

AQUA

DUCTUS

REPORT

Recovering the memory of a river and
an aqueduct

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MASTER'S THESIS 2018

AQUADUCTUS

The reinterpretation of a hydraulic infrastructure for integrating water as an asset in the urban life of La Cascada neighborhood.

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Master's Thesis at Chalmers School of Architecture
Master program Architecture and Planning Beyond Sustainability
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ABSTRACT

Water can be a quality if seen as the origin of life. In spite of this, the problems with water have increased around the world. Water in the shape of rainwater is affecting cities by causing floods. Polluted streets and urban expansion over nature, have lead to polluted and drying rivers. As climate change increases, water from rainfalls becomes unpredictable in quantity and time, and actions ti be taken for an improved management of water in urban areas needs to happen.

This Masters Thesis aims to question the way in which cities deal with rainwater in a context where a crossing of two water networks, in this case an aqueduct and a river, give a hydraulic quality to an area. Nowadays, the periods of rain enhance the division of two Neighborhoods. The project breaks with the idea of the river as a barrier by connecting the social and urban tissues of the site through the recovery of the memory and the importance of water to the site. The project also enhances the resilience and public life of the area in periods with heavy rain.

Those divisions and problems around water place people in the center of attention. Eighty percentage of the world's population live below the poverty line and 54 percent live in cities. But even if urban and economic conditions are different for the inhabitants, people living in cities are more constantly affected by water. Architecture claims to be a profession for people, unfortunately most of it has been directed towards the rich. It is of importance to use Architecture as an opportunity to work against social and environmental crises, to create a platform where nature and humans can coexist. Latin American countries are examples of places where the urban fabrics deplete green and blue areas primarily in poor neighborhoods.

The city of Oaxaca in Mexico is an example of this. At the site which this Masters Thesis investigates, a river acts as a division between the wealthy and the poor but the crossing of an aqueduct, physically unites the areas. This division is enhanced during rainy season where the river can be at its full capacity, affecting the

ACKNOWLEDGMENTS

neighboring constructions. The idea of a line that unites the two areas is expanded towards a series of interlacing lines of water, vegetation and social platforms that open the river to the community to reduce the negative impacts of it.

Moreover, a series of strategies that improve the quality and quantity of water sent to the river respond to specific locations that could be expanded to let natural spaces reclaim areas of the city. In other words, the project serves as an alternative to the current development of cities where an opportunity for turning water into an asset for the people and for the city, is taken.



I would like to take this opportunity to thank to all the people that have been part of this process. First of all, a big thanks to my parents because thanks to them I have reached to this point, thank you for being the warriors that you are, for always pushing me forward and for believing in me. Thanks to my sisters because they are a great inspiration to me.

To the Urban Challenges studio for being supportive in so many ways through all the process, to Kengo for taking his role as a tutor passionately and always giving me more time of advice accompanied by humor. To Joaquim for being that wise mind that took me back to the right path when I needed it.

Thank you to Conacyt in Mexico and Avancez Chalmers because without their financial support I wouldn't had been able to study this Masters. To all the people back in Mexico who helped me with their recommendations for obtaining my scholarships.

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This project resonates around the idea of water in urban contexts. Where water and people can have a space and most importantly, where they can coexist.

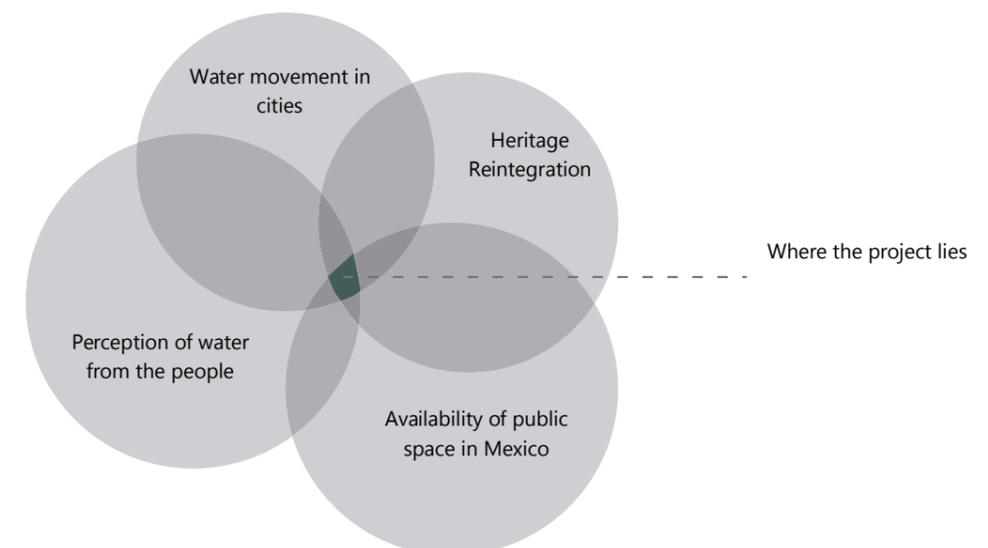
If one wonders what do we know about water, a direct answer will be that it is the source of all life and therefore it is of great importance, but are we good at living with it?, and what is the role of water in cities? moreover, how is the relationship of water and Architecture?

This Master Thesis started with the desire of rescuing an old Aqueduct in a site where the urban mass is consuming everything. Through the process, the aim shifted to look at the role of water nowadays taking as point of departure the intersection of a river and an aqueduct, and from this take the Aqua Ductus (lat. To lead water) ^{E. B. (2018)} idea to act on behalf of the current and future needs of the site.

By trying to answer the questions...

HOW CAN THE CITY DELIVER TO THE PEOPLE A PLACE WHERE WATER BECOMES AN INTEGRATED-ACTIVE PARTICIPANT OF THE SITE?

HOW TO IMPROVE THE RELATIONSHIP BETWEEN PEOPLE AND WATER IN A CONTEXT WHERE A RIVER AND A AN AQUEDUCT ARE IN DECAY?



DISCOURSE

This project deals with issues particularly relevant for the context of Oaxaca, Mexico, but also applicable for other cities around the world, particularly those in developing countries. Mexican cities have followed wrong examples for the development of cities that prioritize the car as the main mode of transportation, leaving the urban conditions for pedestrians deplorable.

The availability of green spaces per inhabitant in Mexico is very low compared to the 10m²-15m² recommended by the World Health Organization ^{CAT-MED 18}, but also very contrasting within the different types of settlements in the country. Wealthy areas could have access to 12.5m² per inhabitant, while impoverished areas only afford 0.6m² per inhabitant.

Water has become a particularly relevant issue since it is scarce nowadays, and a grievance is projected in the future due to the growing population and the reduction in the availability of it. In addition, the effects of climate change and pollution levels also exacerbate problems with water in urban contexts.

In the case of Heritage, the city center of Oaxaca belongs to the World Heritage List of UNESCO but constructions outside that area tend to be left out of restoration projects. The same applies for projects intended to improve urban conditions, most of them are carried on wealthy areas.



BASIS

This project started with the identification of the an Aqueduct, which crosses the denominated *San Felipe-Jalatlaco river*, located in the city of Oaxaca, Mexico. An Aqueduct that was built between 1720 and 1739.

The point of the Aqueduct crossing the river is a node of two water networks intersecting. It is relevant to mention that the river carries water mostly during rainy season, apart from this period, the availability of water was, and still is low. In spite it was surrounded by vast vegetation.

In the case of the aqueduct, this used to carry water taken from the mountains surrounding the valley of Oaxaca in the area of San Felipe, but the urban expansion and construction of roads lead into the segregation of it, remaining now as a monument.

Three sections will be presented along this project, constituting the main elements: Water, urban and monument.

1 BRIEF HISTORY



Image 1. Plan from 1777 of the city of Oaxaca. ²¹

1486

XOCHITL MILI CO B. A. (1989)
 Flow- Field Location

It was founded by Aztec warriors coming from Mexico City who lived in an area with the same name. The name of the neighborhood of *Xochimilco* comes from the Nahuatl dialect.

The aqueduct used to belong to this neighborhood. B. A. (1989)

1519-1521

Spanish conquer Mexico.

1529

An estimate of 80 families living in Oaxaca that did not required a water infrastructure. B. A. (1989)

As the city grew, convents and temples started to be built, and a great amount of water was needed. By that time, water was brought by a natural creek but it needed to be cleaner, reason that motivated the construction of a structure that could bring the water elevated, diminishing the possibilities of it to becoming contaminated. B. A. (1989)

1720-1739

Construction of the arcade and aqueduct. B. A. (1989)

1944-1945

A big section of the Aqueduct was demolished for the construction of the *Carretera internacional 190*. B. A. (1989)

2

LOCATION



Image 2.

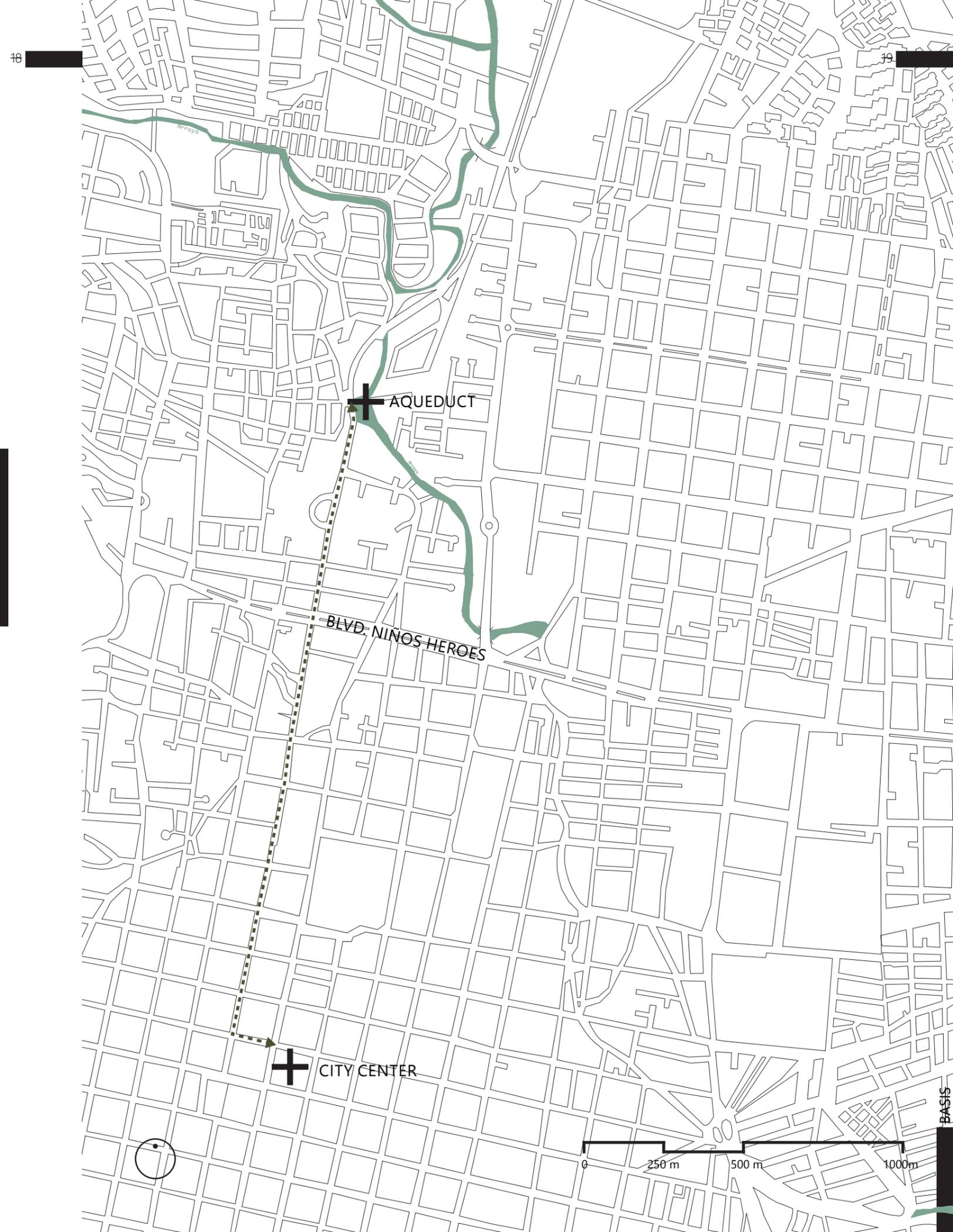


Image 3.

The image 4 (next page) shows the *San Felipe-Jalatlaco* river, now a days surrounded by constructions.

From the plan, an identification of wealthy and less wealthy areas can be made. Those looking more disorganized correspond to the "poor" neighborhoods, visible on the west side of the Aqueduct (*La Cascada neighborhood*). Opposite to this, a more organized squared grid on the east side, corresponds to *Reforma neighborhood*.

The *Aqueduct of Xochimilco* (Img. 3) is located just 2km away from the main plaza, of the city of Oaxaca, *Zócalo*. Along that connection, the amount of visitors and attractive areas gradually diminishes after crossing the *Bldv. Niños Heroes*, and two blocks before the Aqueduct, where tourists are rarely seen.



THE ROLE OF THE AQUEDUCT

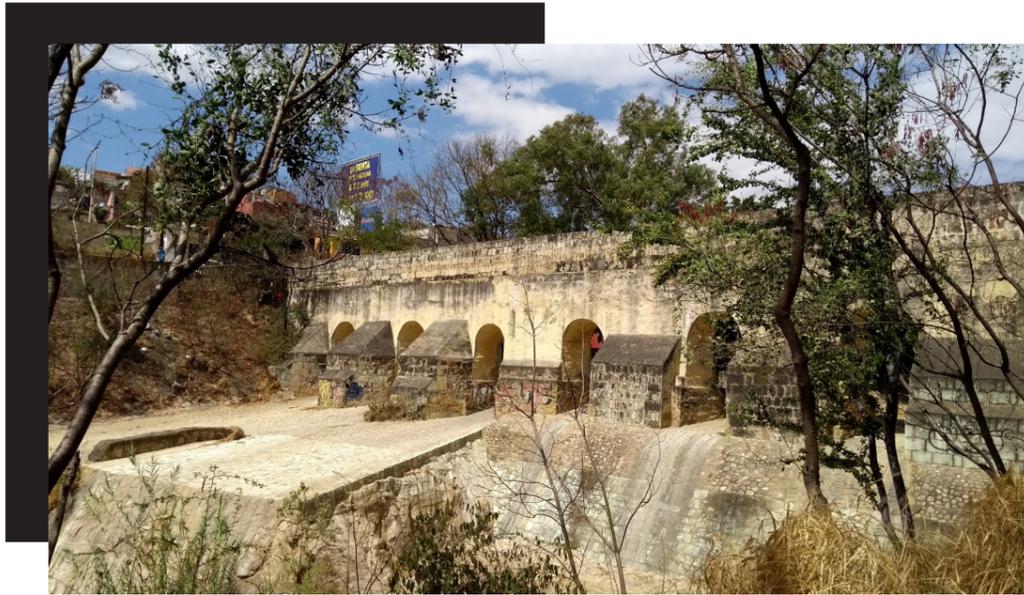
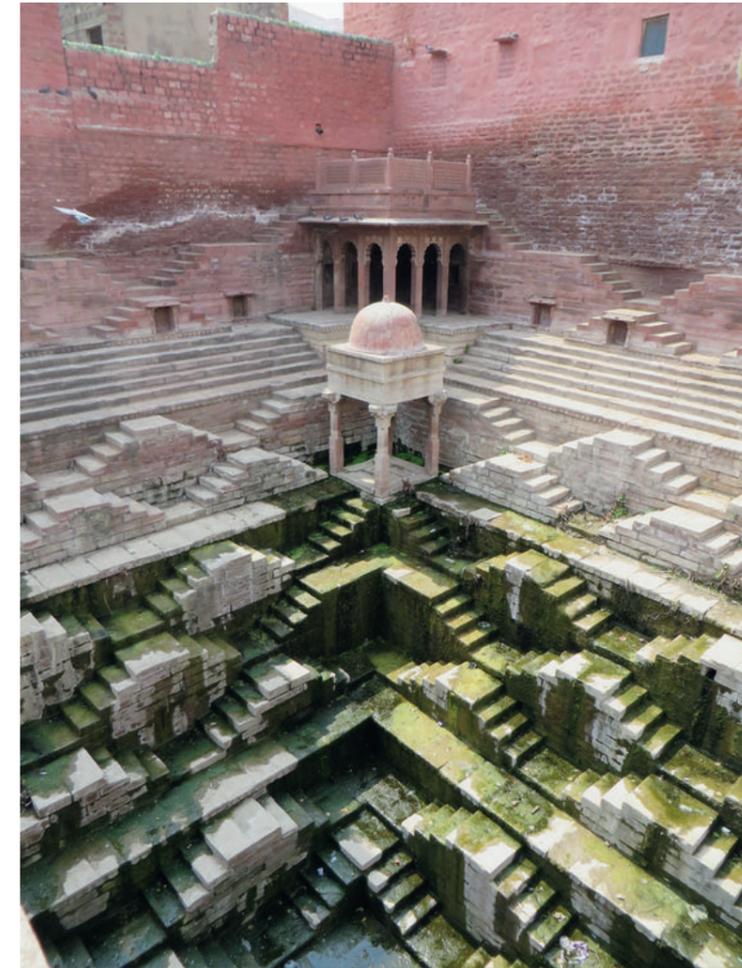


Image 5.

The *Aqueduct of Xochimilco* or *Pozas Arcas* was part of the hydraulic network which provided with water to the inhabitants of the city of Oaxaca. But between 1944 and 1945 the demolitions of sections of it started, leaving remains that are continuously consumed by the urban expansion.

This situation gives an opportunity to think how to recover such construction and to see the possibilities beyond its previous function, by the inclusion and glorification water.

The *Aqueduct of Xochimilco* can be taken as an opportunity to also attach to the history of the site.

Image 6. ©Victoria Lautman ^{2,2}

Inspiration can be taken from historical examples where water was the main element from which the design developed. The step-wells in India were places where women used to gather beyond the mere act of collecting water, social interaction was part of the activity. Even in some situations, temples were built adjacent to these type of constructions, magnifying the importance of them and of the water.^{L.M. (2003)}

But the purpose of most step-wells has shifted towards becoming a tourists attraction, losing its hydraulic function and its connection to the local people. In spite, their beauty persists, where possibilities for reinterpretation may arise.^{L.M. (2003)}



Image 7 © 2000–2018 Friends of the High Line ^{2,3}

The High Lane Park in New York, also represents an infrastructural element but with the purpose of transportation. It is an example for the reintegration of left overs of infrastructure with the aim of providing a park. History, physical connection and citizens are linked through vegetation and public space.

URBAN

Mexico is a country of contrasts where a road or a river can be enough to make a distinction of rich and poor areas. The neighborhood of *La Cascada* and the neighborhood of *Reforma*, divided by the *San Felipe-Jalatlaco* river are different on topography, economy, services, infrastructure and architecture.

Considering that the majority of the population in Mexico is poor and that Architects work for the "rich" sector of the population, it is expected that most projects will happen on areas that already enjoy of amenities as *Reforma*.

A way to support low income areas is from the intervention in the public space, by facilitating their access to basic services as infrastructure and accessibility. La pobreza urbana en México (Rep.), (n.d.).

1 TWO SIDES

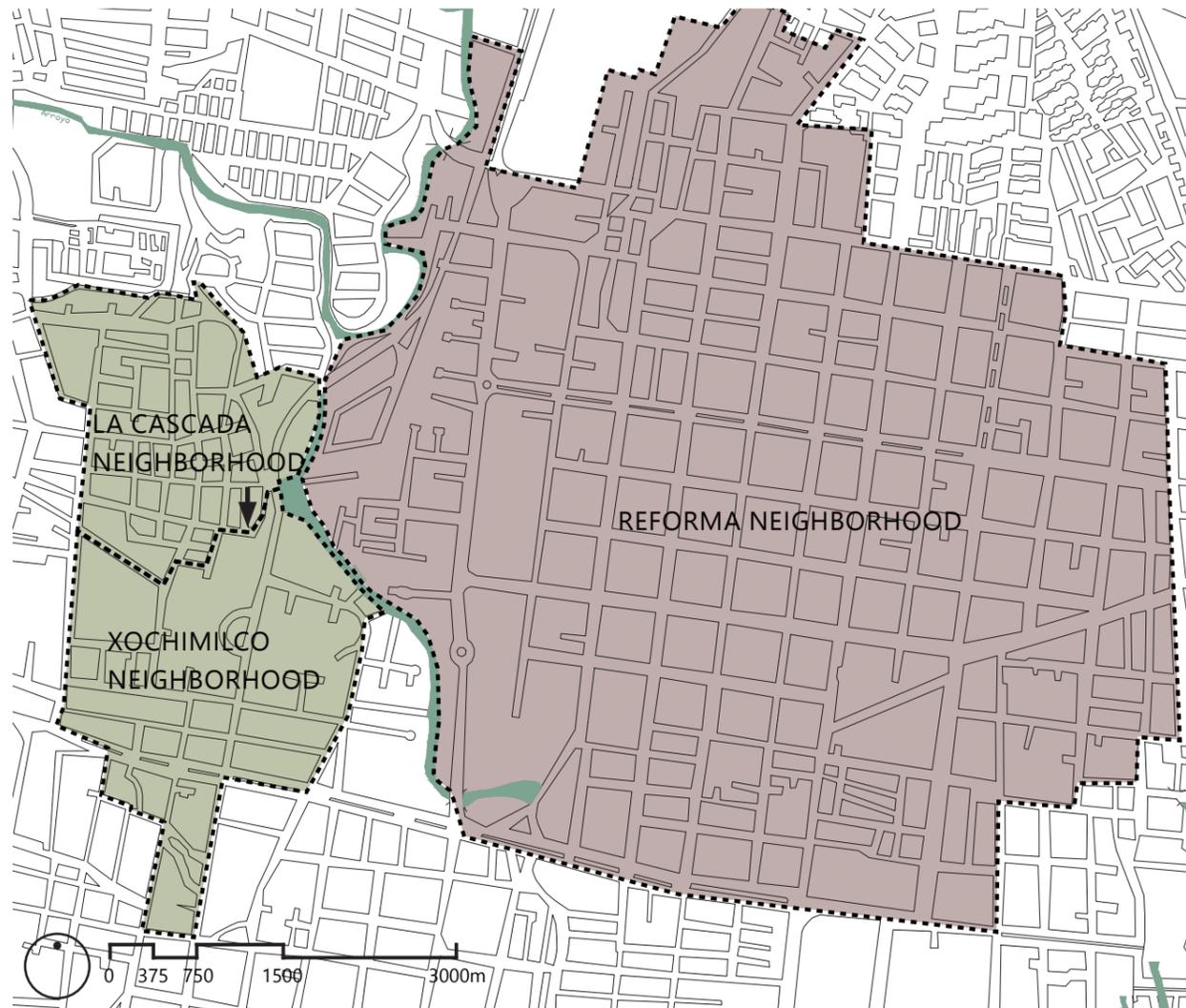


Image 8. Identification of neighborhoods besides the San Felipe-Jalatlaco river.

2 CONNECTIONS

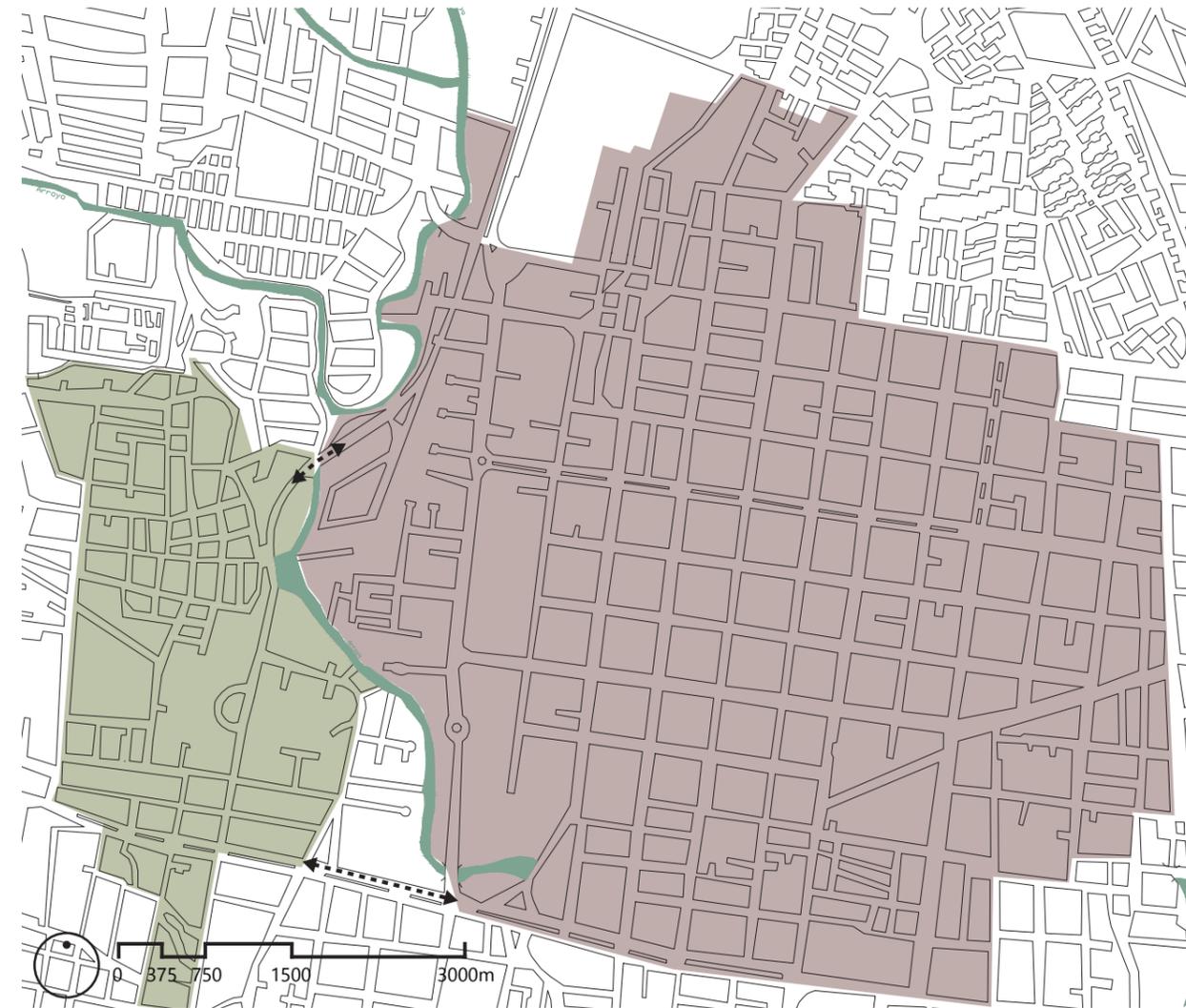


Image 11. Existing connections for the two sides.

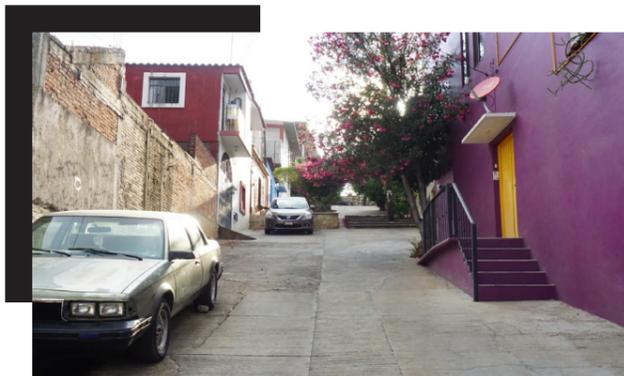


Image 9. Street in La Cascada neighborhood.



Image 10. Street in Reforma neighborhood.

When it is considered that both sides of the river are connected by two streets of 1.4km of distance and that the only point for crossing in between is the river which is polluted, it is understood that interaction between the two areas will be very low.

River - Aqueduct



Roads



Buildings



Image 12,13, 14, 15, 16, 17, 18,19. From top to down and left to right.

The urban conditions of today, in the location of the *Aqueduct of Xochimilco* are explained through a set of layers (img. 20) where the topography represents the base.

The water-natural networks occupy a very small part in the area of analysis but are of high importance.

Roads are the third layer, which will be an important factor considered for the water lead into the river, runoff.

The last layer shows the constructions. This one occupies the majority of the area in the model.

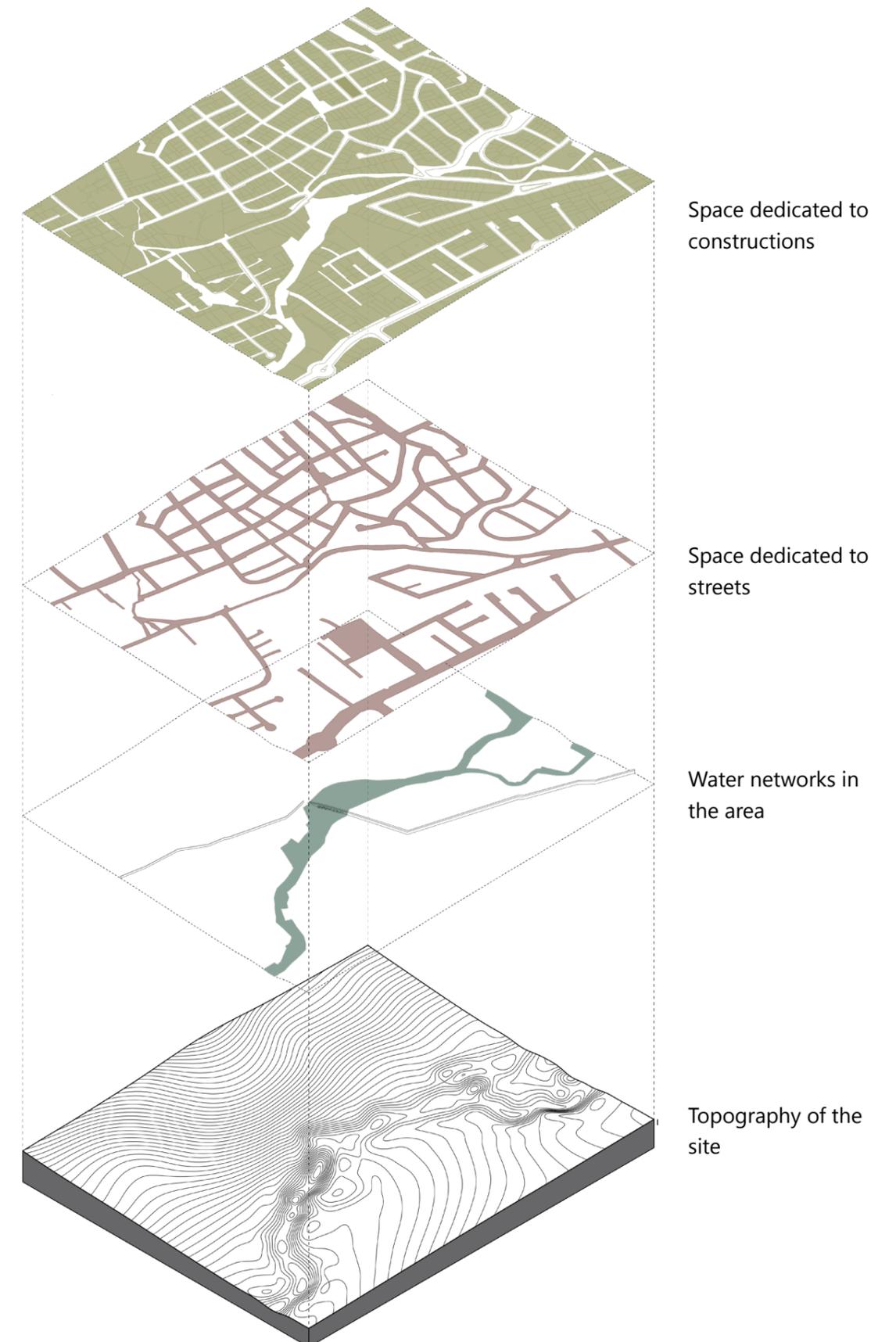
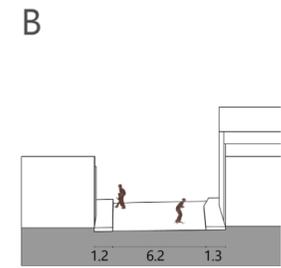


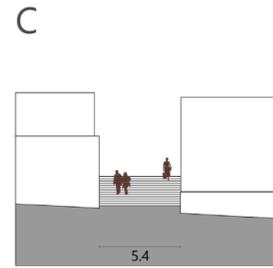
Image 20. Exploded isometric of the current conditions of the site.

4 STREETS

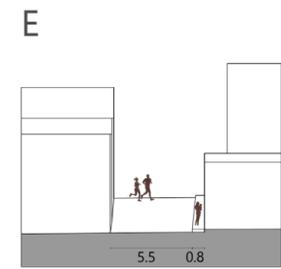
Since runoff water will depend on the urban qualities ^{Surface runoff. (n.d.)} and all cities have different conditions, it is important to look at the case of the *La Cascada neighborhood*, to understand the limitations of space and the reasons for the water to flow on a certain direction. It is no surprise that this situation repeats itself each year, when the streets have very limited vegetation and concrete is the predominant material. The sections presented here show some streets in La Cascada neighborhood.



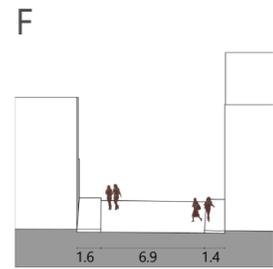
2 cars
2 sidewalks



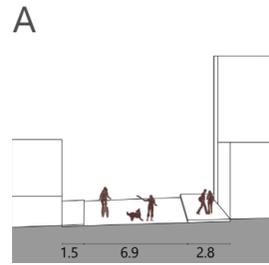
Steps



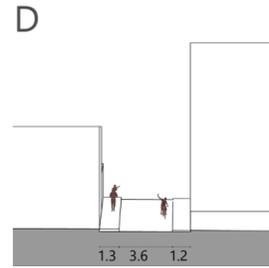
2 cars
1 sidewalk



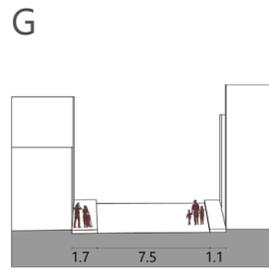
2 cars
2 sidewalks



2 cars
2 sidewalks



1 car
2 sidewalks



2 cars
2 sidewalks

Image 21. A, image 22. B, image 23. C, image 24. D, image 25. E, image 26. F, image 27. G

5 THE CURRENT SITUATION

The diagram presenting the current situation is of importance considering that today, the main problems that urban contexts face related to water are "the lack of access to safe water and sanitation, and increasing water-related disasters such as floods and droughts" ^{UNDESA (2014)}. This is a result of the way in which cities have been mostly built, therefore finding an optimal situation in which water and city can support each other ^(S. T. 2012) is needed, and a way of promoting this is by increasing the permeability of cities, giving a high importance to rainwater by being the main source of water in the site.

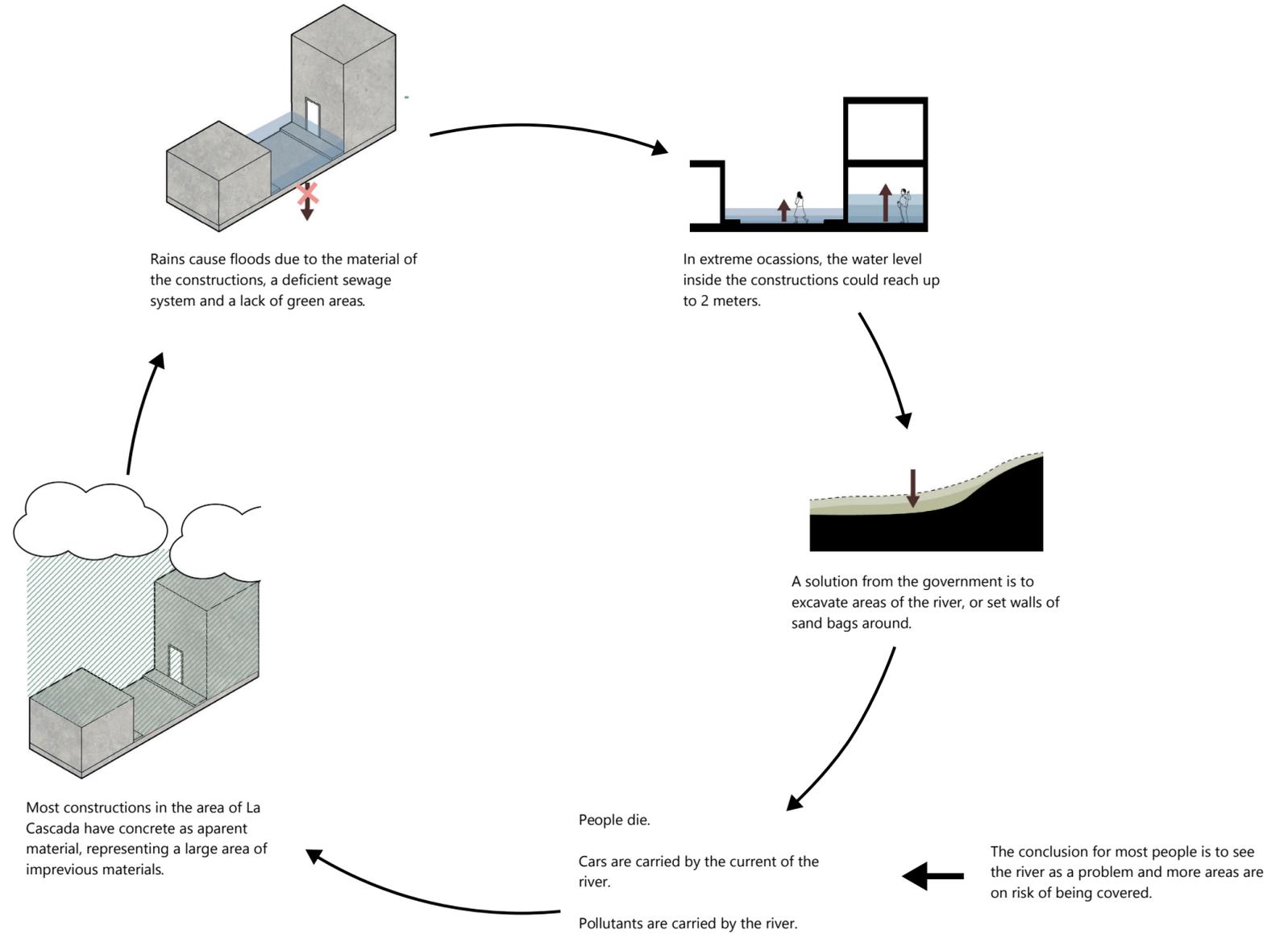


Image 28. Cycle of rain season in La Cascada

6

ACCESSIBILITY TO THE RIVER



Image 29. Top view from the site

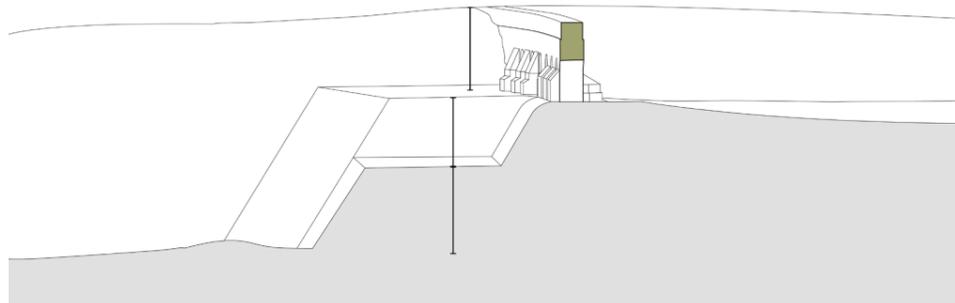


Image 30. Section A-A

It is important to open up the river to the city for reducing the levels of pollution and to limit the actions of vandalism that happen in it. The actual difference in height and the visual blockage of the river from the streets, diminish the motivation for making use of it.



Image 31. The Juan Sanchez Pascuas or La Cascada Park



Image 32. Plan of the current conditions

In spite of the existence of the *Juan Sanchez Pascuas* or *La Cascada* park, and the *Hermandad plaza* which were developed in 1994 with the aim of attracting people to the river and the aqueduct, the projects were unsuccessful, and the space continues to be unused, unvalued and vandalized.



Image 33. The hermandad plaza

WATER

The accessibility of water in Mexico, coming by either pipe, well or rainwater is of 61.68% according to the World Bank. ^{World Bank.} (2018). From 16 Latin American countries from which there is information available, Mexico occupies the 9th place. In the case of specifically urban areas, the accessibility is of around 73%. But this availability has other problems which will be explained further.

In contrast to the usage of water, and as mentioned before, floods represent an important issue to tackle. It becomes relevant to look at the opportunities that water brings to urban areas and propose solutions that take in consideration the potentiality of rainwater.

1

AVERAGE RAIN PER YEAR

Considering that the *San Felipe-Jalatlaco river* has water only during the periods of rain, becomes important to understand the amount of rainwater available on the site. The city of Oaxaca has contrasting situations of rain and dry seasons.

During winter time, there are no rains and the river carries no water, while during spring and summer, rainfalls happen and particularly from June to September, floods occur.

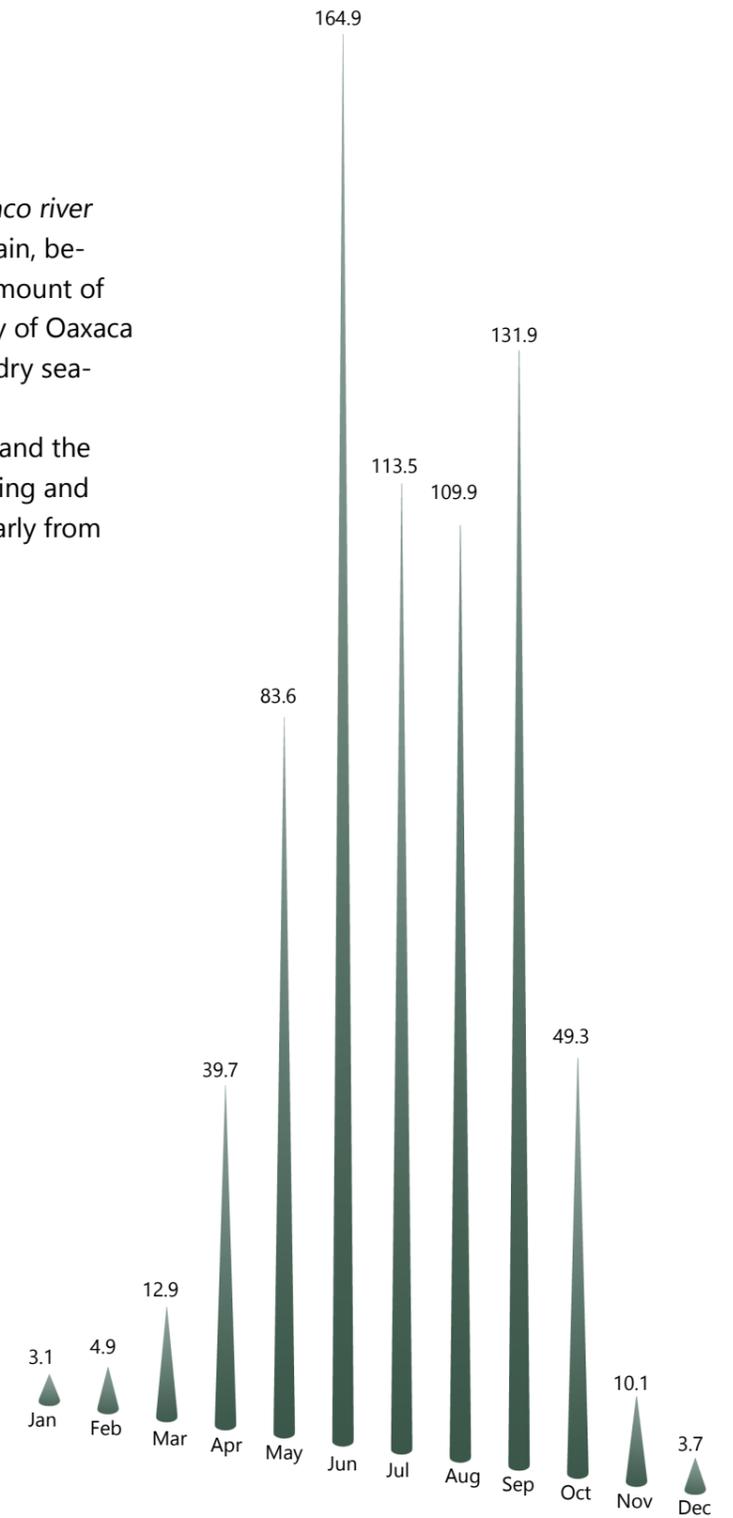


Image 34. Graph of quantity of rain shown in mm.

2 DRY RIVER



Image 35. Picture inside the river.

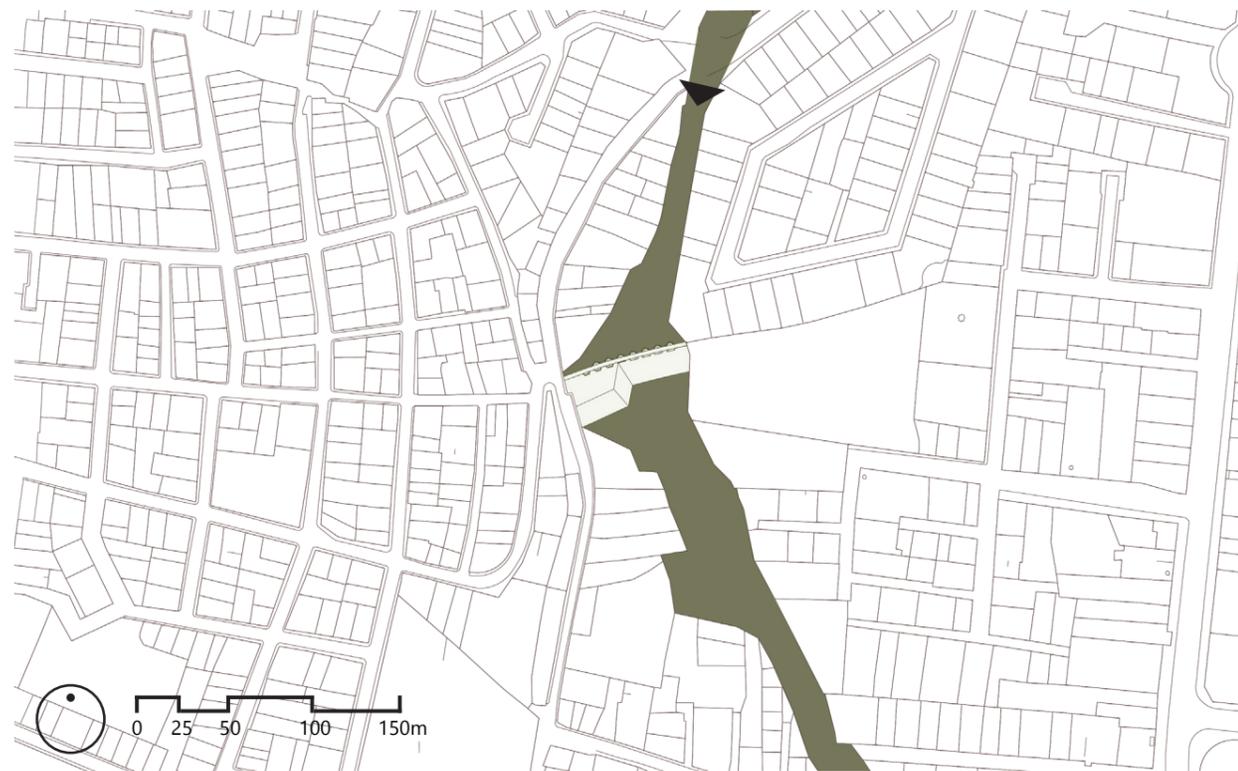


Image 36. Plan of the San Felipe - Jalatlaco river during dry season.

 Dry river

3 ORDINARY FLOW OF THE RIVER

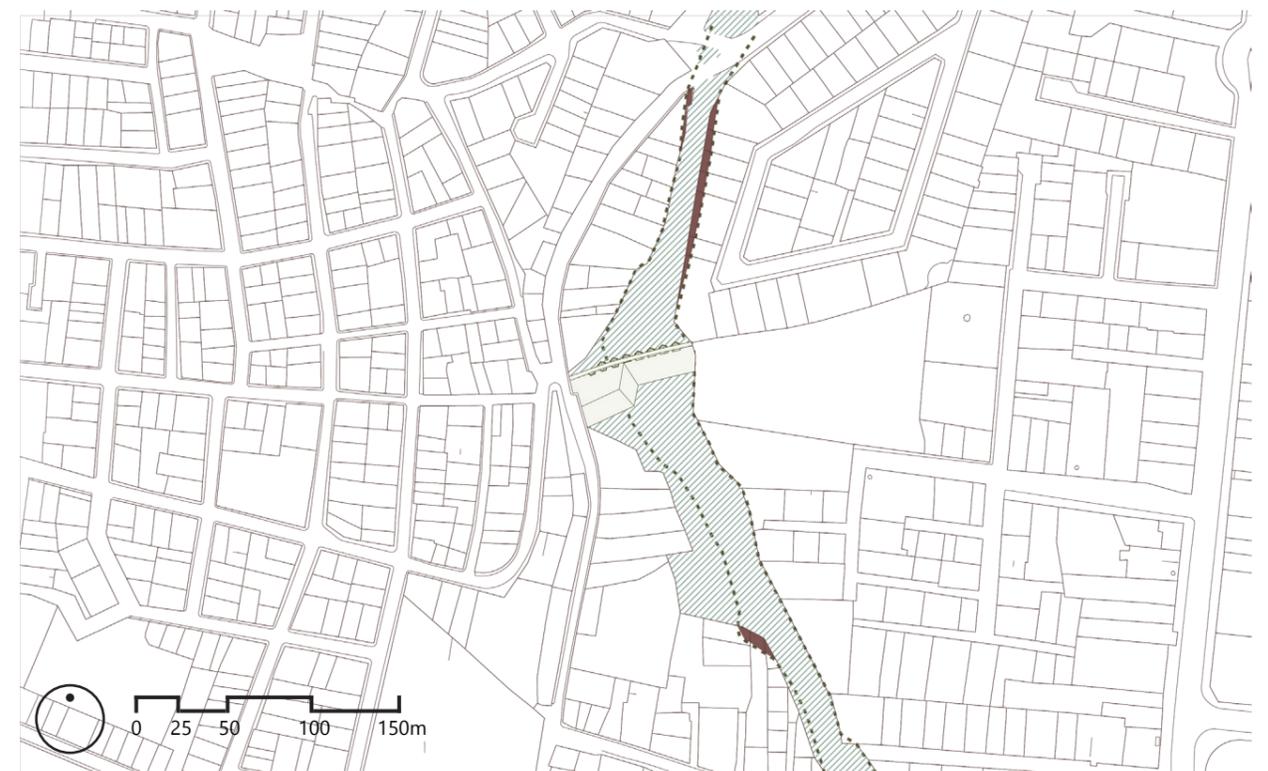


Image 37. Plan of the San Felipe - Jalatlaco river during low rain season.

 Invasion areas
 Ordinary limits of the river

4 EXTRAORDINARY FLOW OF THE RIVER

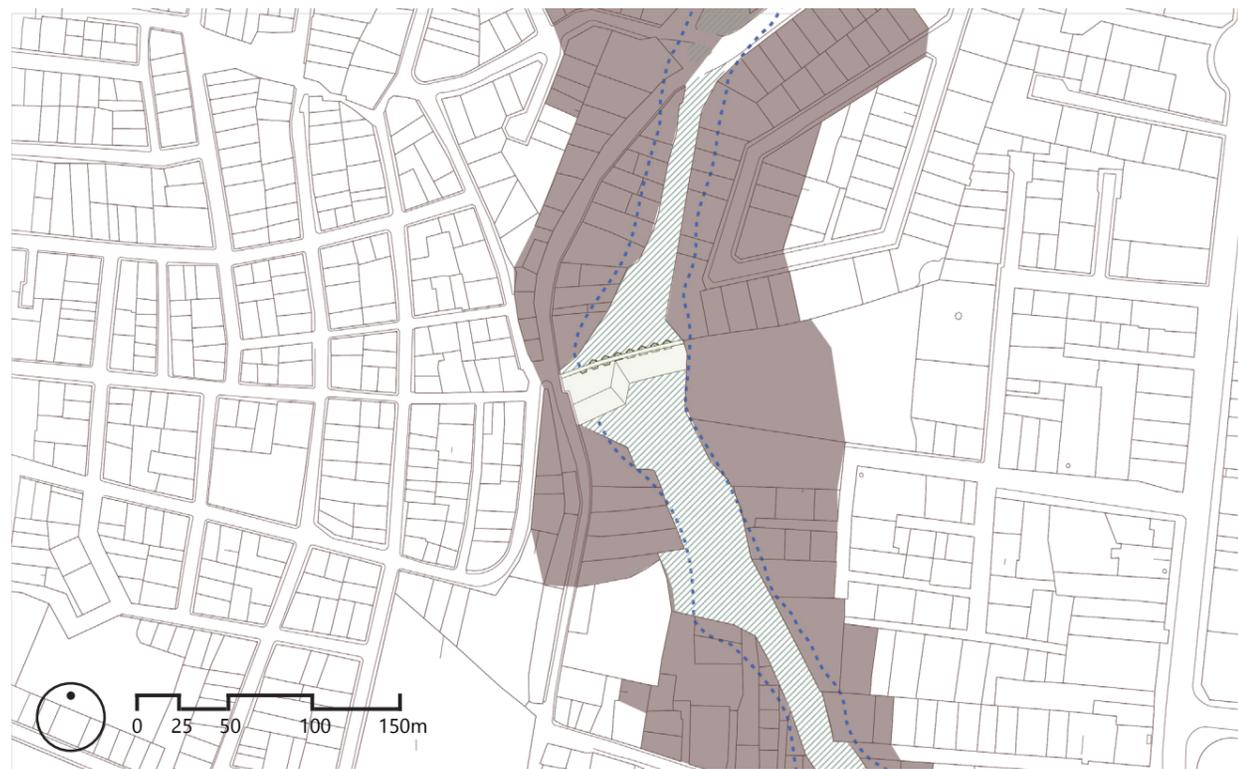


Image 38. Plan of the San Felipe - Jalatlaco river during heavy rain season.

- Vulnerable areas
- Extraordinary limits of the river

5 VOLUME OF WATER DURING RAIN SEASON

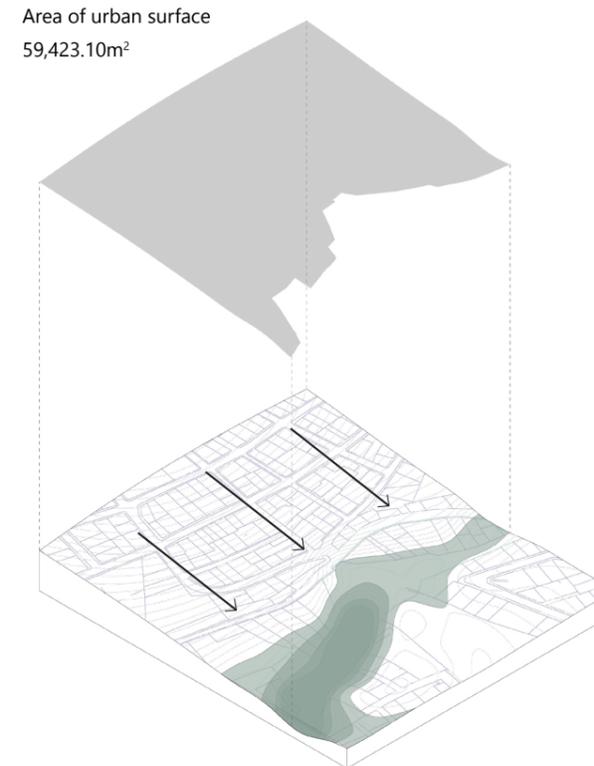


Image 39. Sample area of the west side with square meters

Months	Amount of rainwater	55% of the rainwater
January	0.22 mm	13.20 m ³
February	0.93 mm	55.30 m ³
March	6.52 mm	387.70 m ³
April	31.33 mm	1,861.69 m ³
May	74.52 mm	4,428.47 m ³
June	155.47 mm	9,238.65 m ³
July	104.24 mm	6,194.23 m ³
August	100.66 mm	5,981.33 m ³
September	122.57 mm	7,283.21 m ³
October	40.68 mm	2,417.36 m ³
November	4.30 mm	255.73 m ³
December	0.42 mm	24.70 m ³

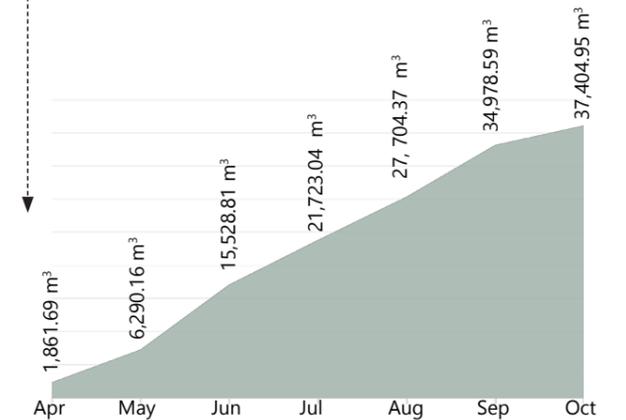


Image 40. Accumulated rainwater from runoff on the west side from April until October.

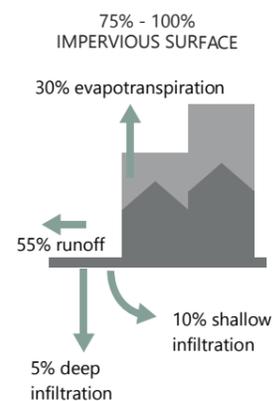


Image 41. Values of evaporation, infiltration and urban runoff according to the 75-100% of impervious surface ²⁷

For a general understanding on the amount of water coming from rain and runoff from the streets, a calculation considering the accumulated values from April to October in cubic meters of water has been made. The calculation considers a predominance of impervious surfaces of 75%-100% where:

- 30% evaporates.
- 5% has a deep infiltration.
- 10% has a shallow infiltration.
- 55% represent the urban runoff.

6 DISPOSAL OF WATER IN LA CASCADA

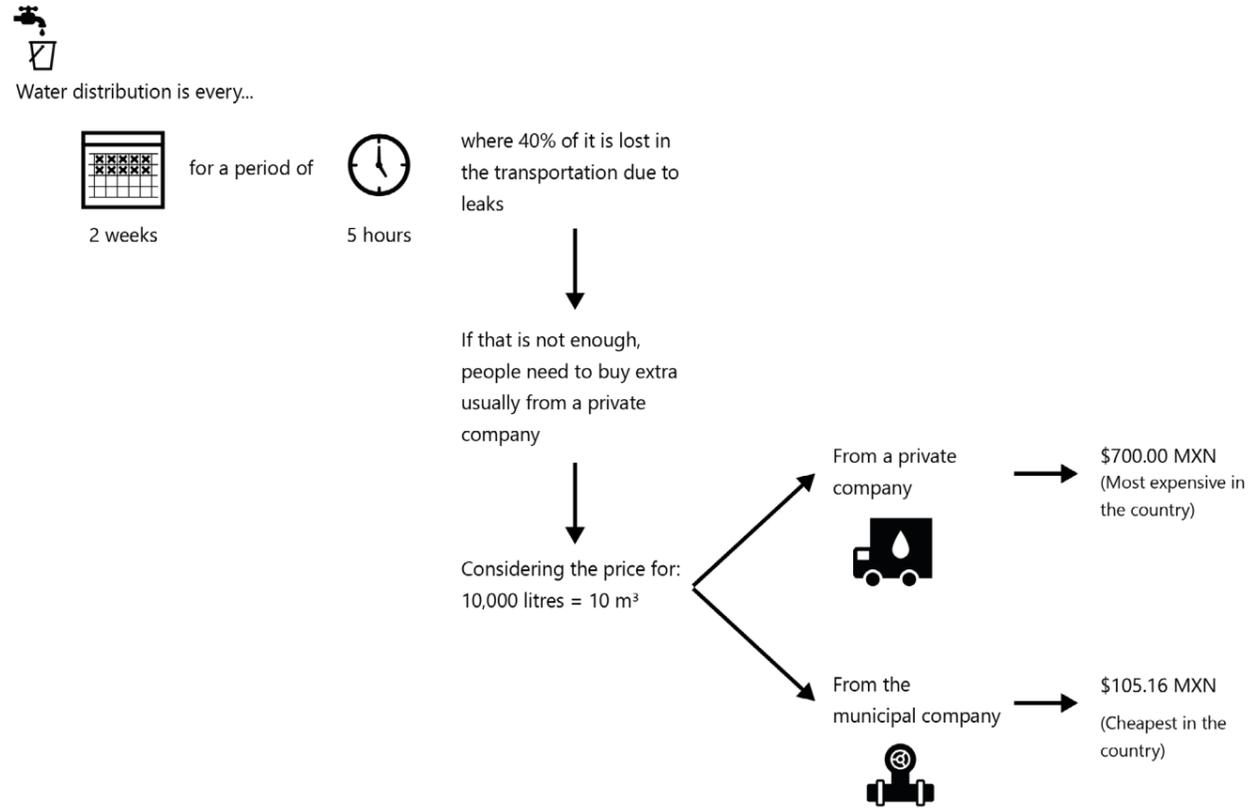


Image 42. Delivery of water in La Cascada neighborhood.

While the previous information corresponds to the availability of rainwater, if this one is not harvested or used, the potentialities of the resource are lost. In the city of Oaxaca, the population relies on the connection to the municipal water company, representing an expense for people. In the case of La Cascada neighborhood, the water coming from the municipality is distributed every 1 or 2 weeks for a period of 5 hours maximum, which means that the citizens can fill their water tanks only during that period. But in a situation where the quantity is not enough, and more water is needed before the next distribution period, an order from a private company must be made, which usually costs 6 times more than the water from the municipality, representing a risk to the economy of the families.

7 RELEVANT DIRECTIONS OF WATER FLOWS THROUGH THE SITE

As the flow of rain in an urban context is very much dependent on the surface materials present in it and the slopping of the terrain, a 3D model has helped to understand the site. Due to the topographical conditions, the streets that go from west to east, turn into channels of water transportation during rainy season. Most water is directed towards a focalized node that coincides to where the aqueduct ends. This point is also where the river opens to the neighborhood of La Cascada.

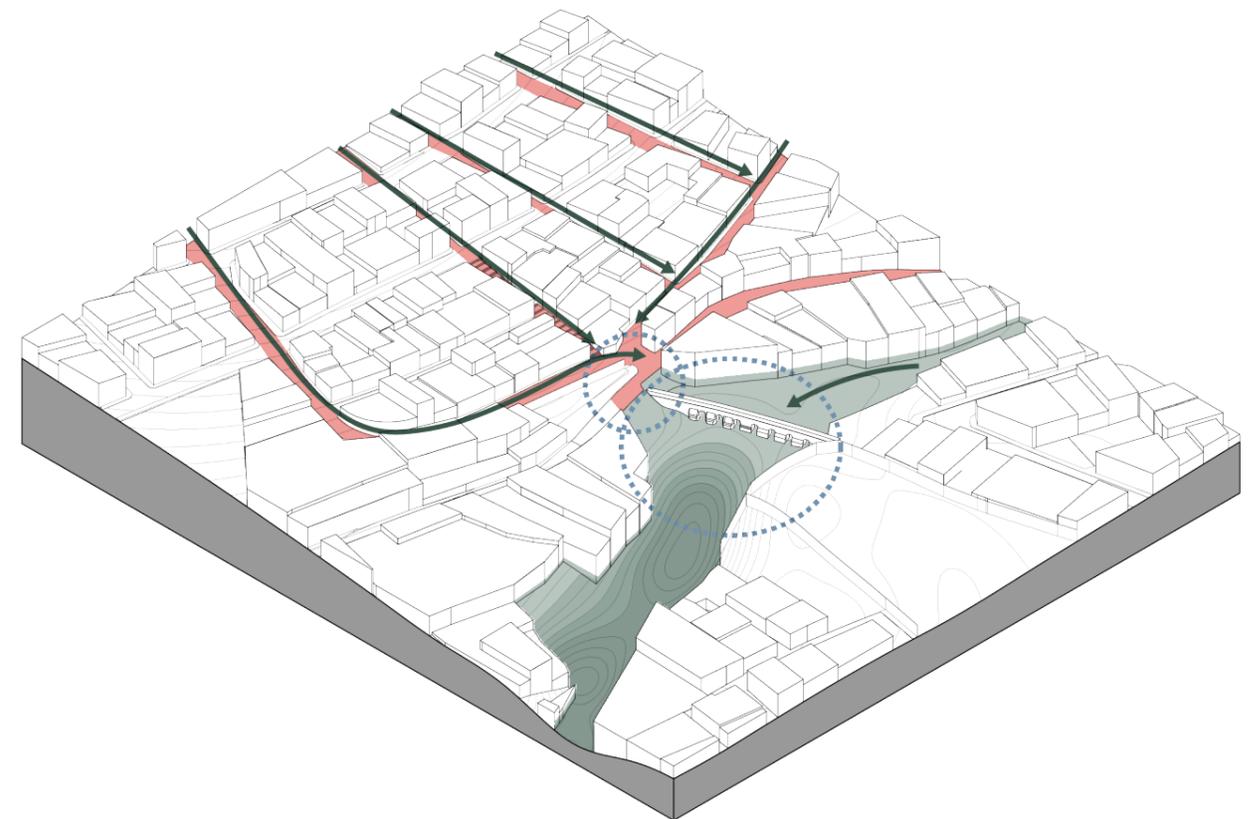


Image 43. Critical points in the area.

8

THE BACK OF THE HOUSE

Contrary to the amount of water that could be collected, the reality is that most of it becomes polluted when in contact with the streets, ending up in the river. The river accumulates the polluted water. In addition, the constructions along the river give their backs to it, increasing the rejection and the ignorance towards the problems with the river and the potentialities of it. As the visibility towards the river is very limited, it becomes a good spot for throwing waste and vandalism. The only areas where the river opens for vision and accessibility, are where roads cross and where the old aqueduct meets La Cascada neighborhood.

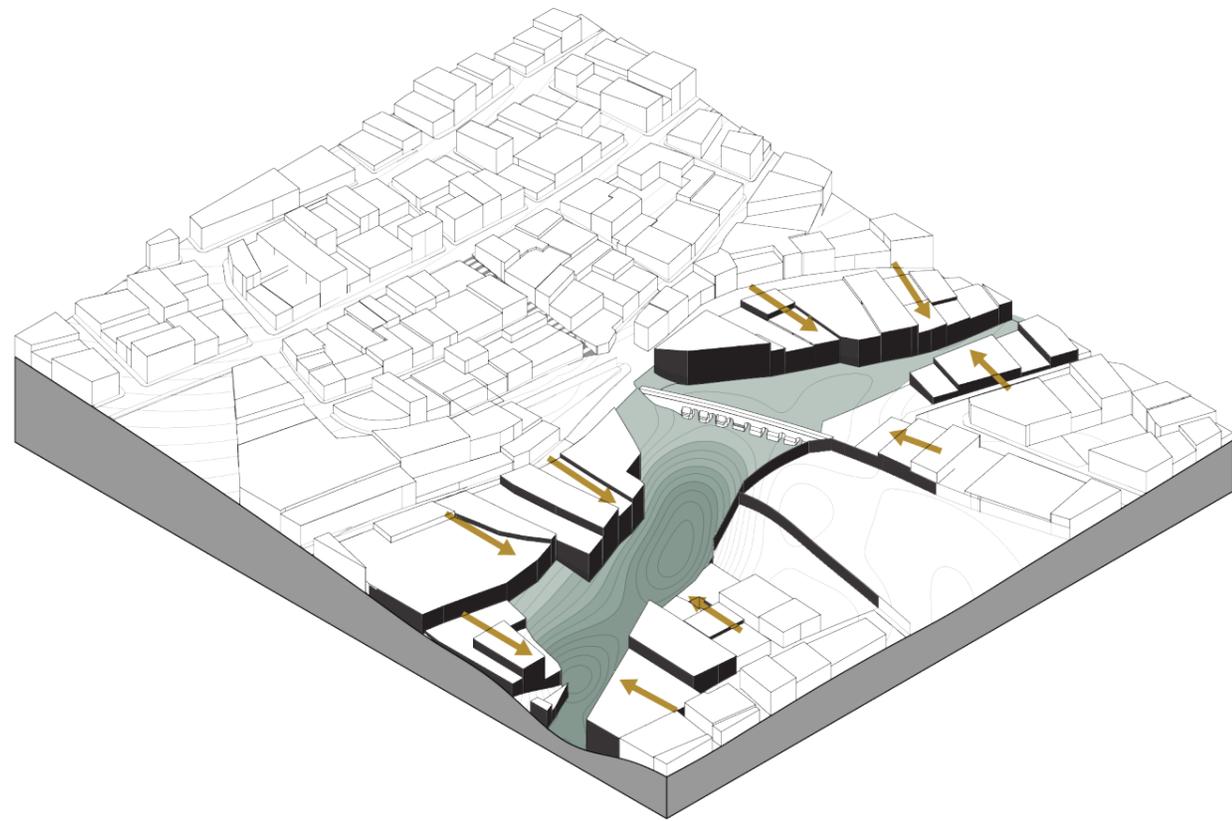


Image 44. Expansion over the river.

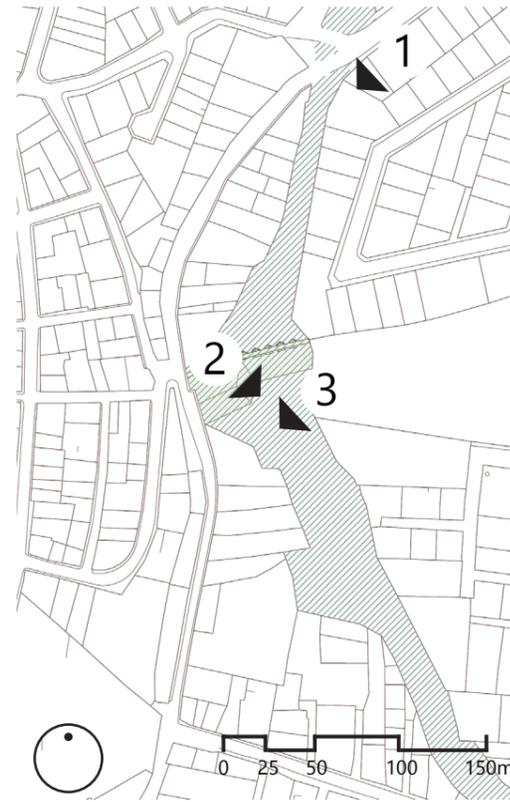


Image 45. on the left, from top to down image 46. 1, image 47. 2. image 48. 3.

9 DRAINAGE



Image 49-50. Pictures of drainage wells inside the river.



Image 51. Plan of the wells inside the water body of the San Felipe - Jalatlaco river.

- Drainage well
- Underground drainage pipe

A drainage pipe is located underground along the river. The drainage is accessed through wells that during periods of heavy rain and large quantities of water, the covers can be lost, freeing the content of the drainage.

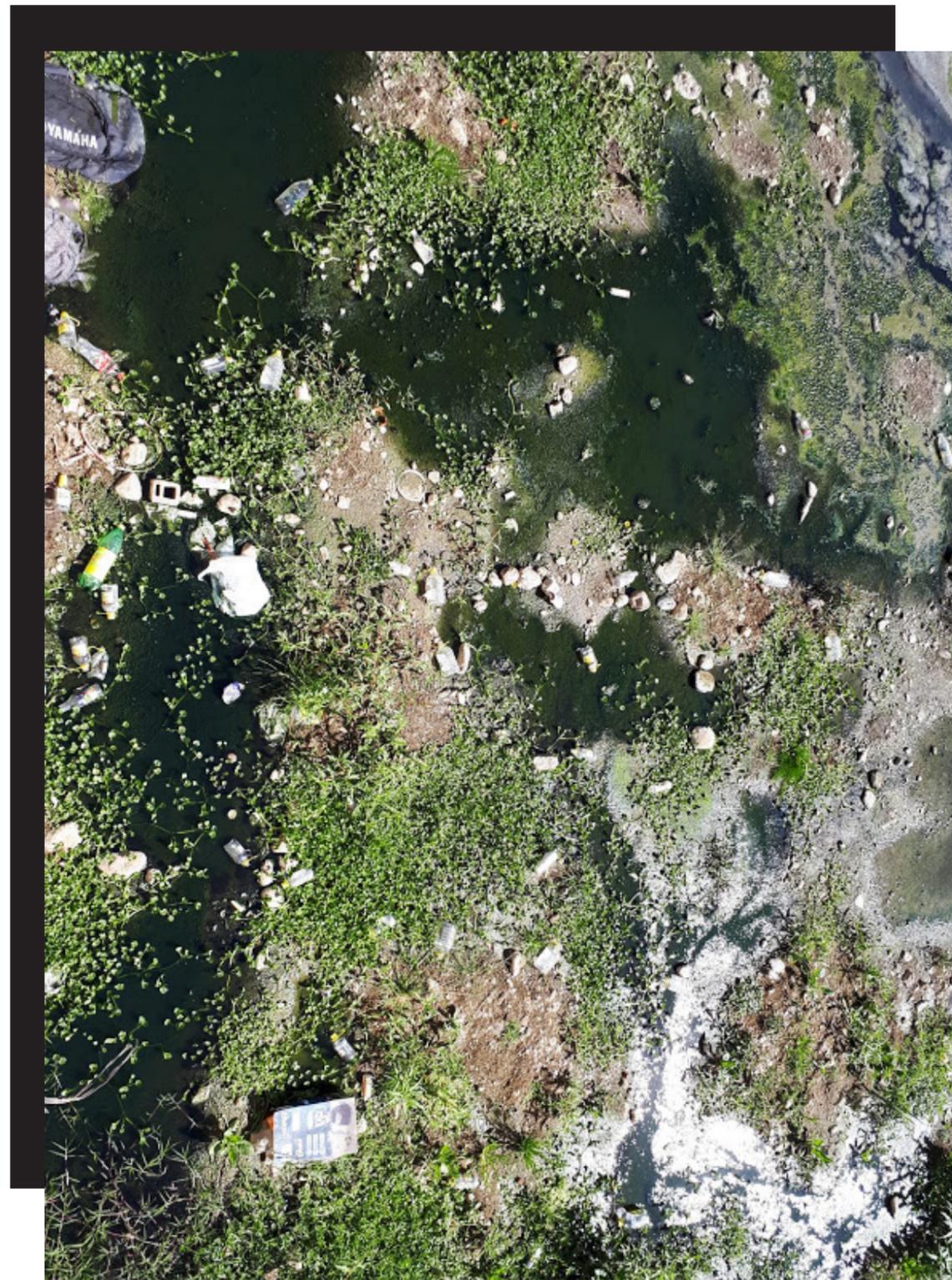


Image 52. Appearance of water in the river

10 WATER - VEGETATION

From water, a direct linkage into vegetation can be made. Plants provide psychological benefits to humans and in some cases, they can be used as food, herbs or natural remedies.

Vegetation in shape of aquatic plants have the potentiality of cleaning water and removing heavy metals present in it.

Some examples of vegetation which can be used in the site of the project with the aim of improving the quality of water, and in supporting the public life are found in the following charts.

AQUATIC PLANTS

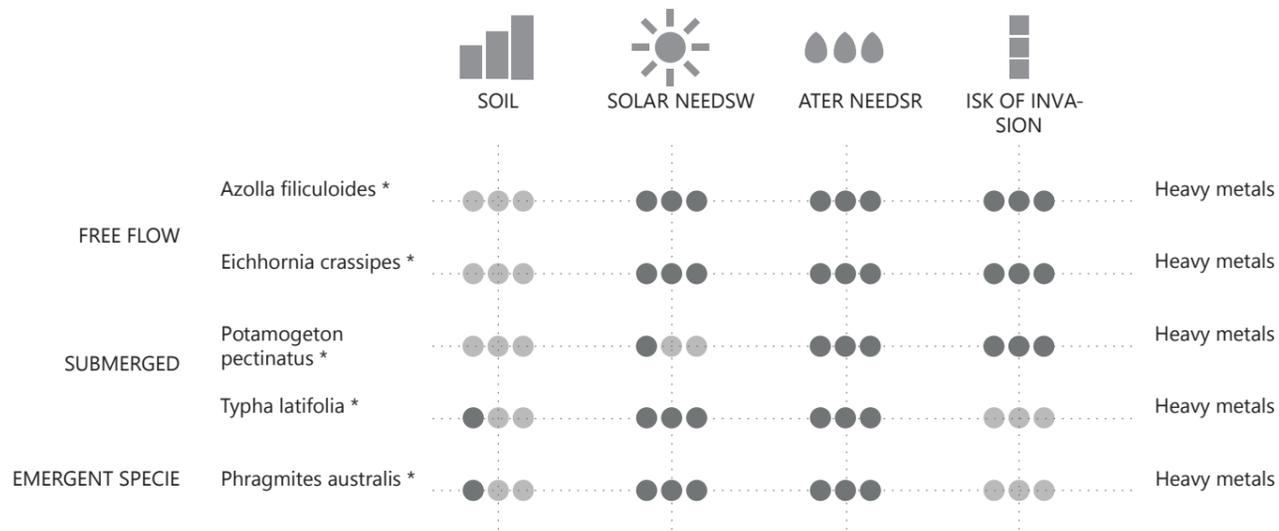


Image 53. Proposal of aquatic plants for the site.

TERRESTRIAL PLANTS

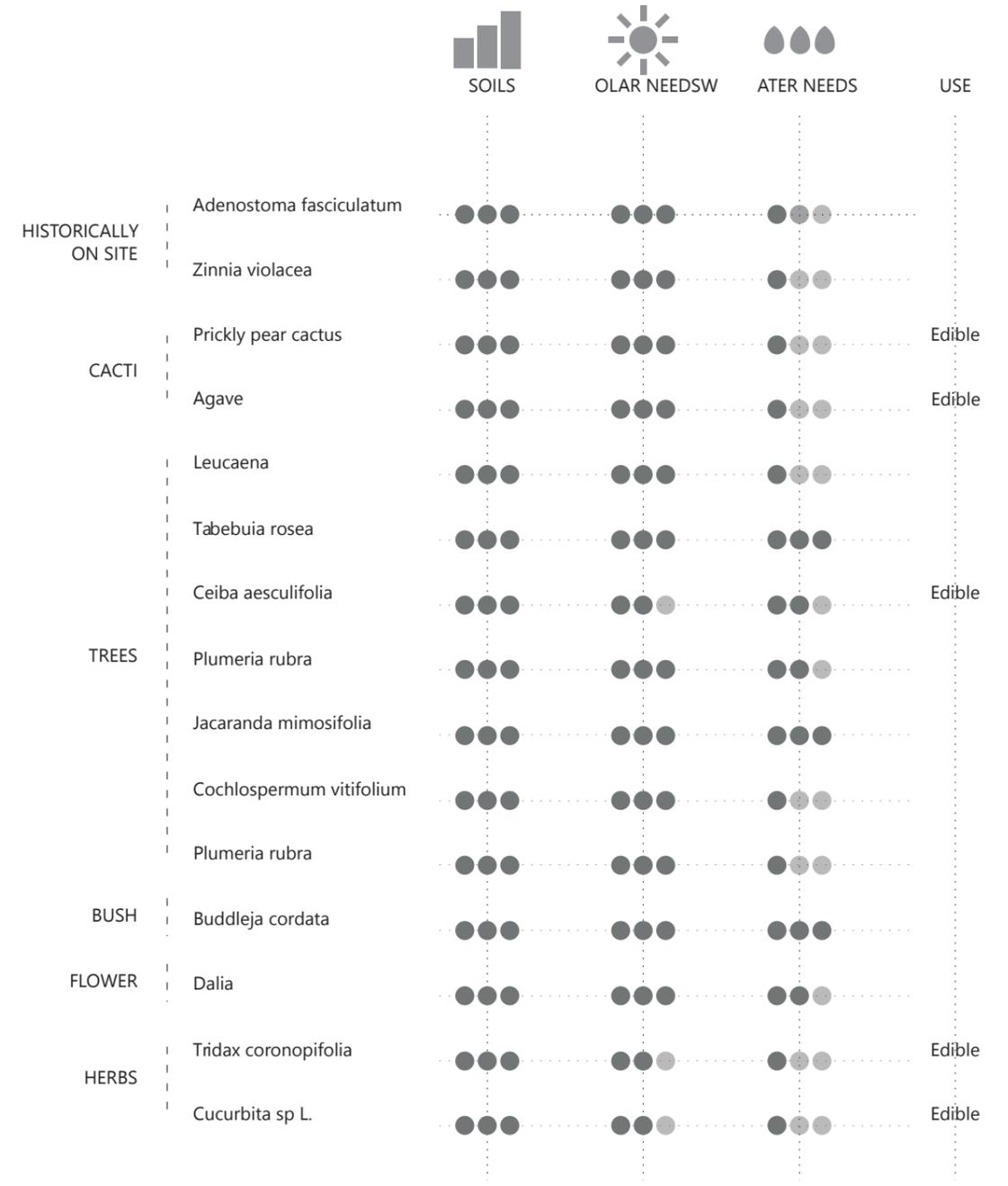
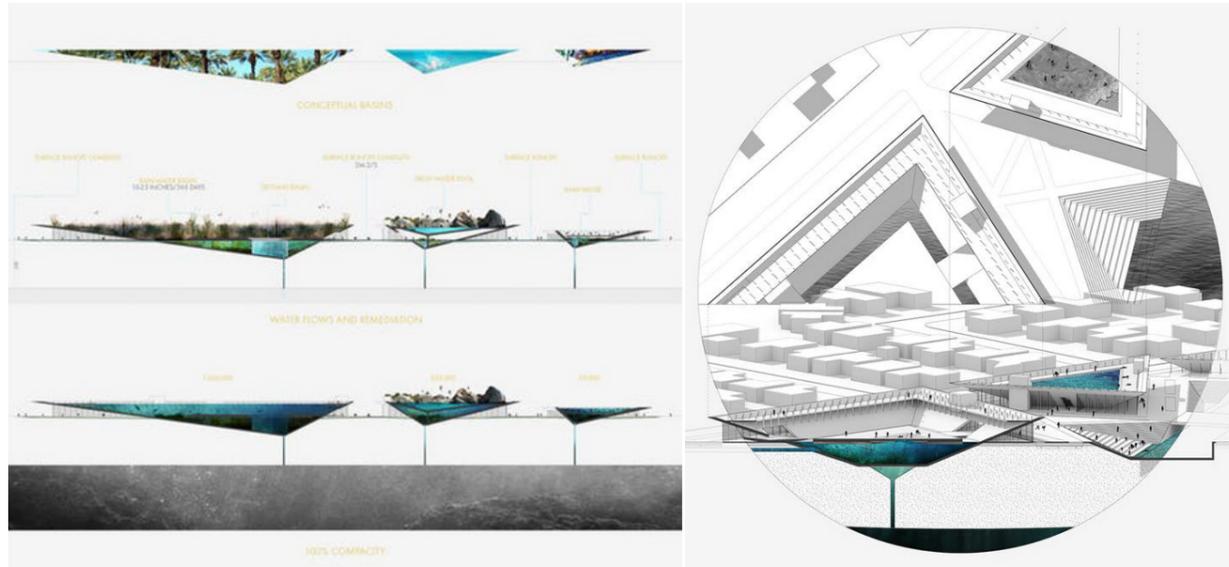


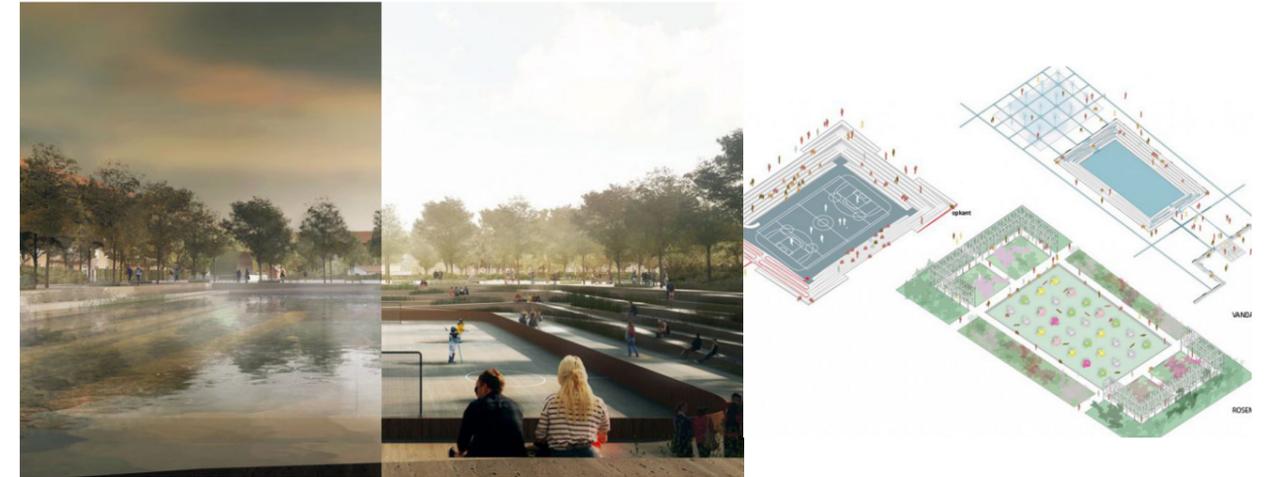
Image 54. Proposal of terrestrial plants for the site.

11 STUDY CASES

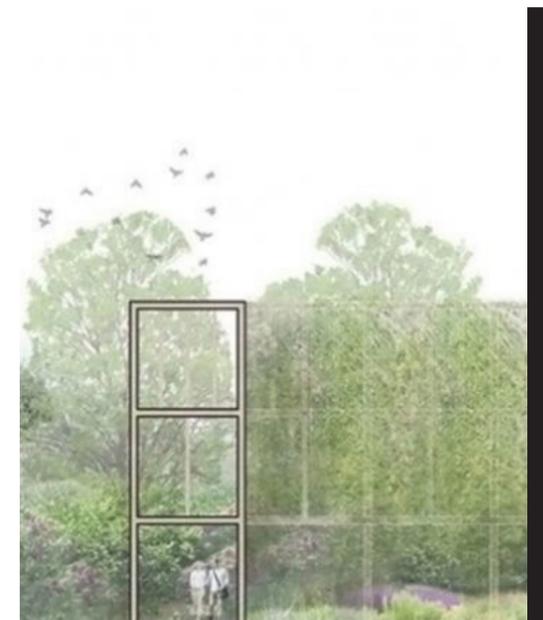
LIQUEFYING AQUIFER by Lujac Desautel



ENGHAVEPARKEN by Tredje Natur



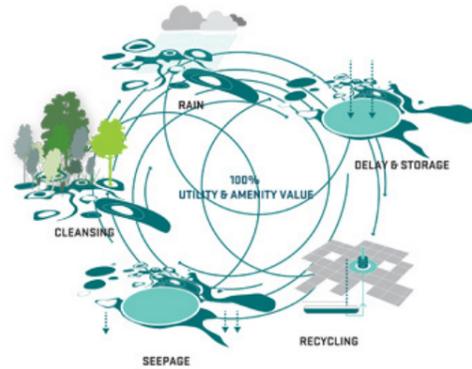
The integration of containment basins in a city aiming at maximum water replenishment back into the aquifers. The project combines edifices with the caption of rainwater, probably water purification and direct access to the aquifers. Water is looked also from a poetic approach, enhancing it with social possibilities.



The project aims at the design of public spaces that are planned to get flooded and contain water during periods of rain. The use of the steps resembles to the step-wells of India, with the same notion of accessibility. The design works on the vertical and the horizontal planes, in the case of the first one, the main function is delaying, while on the second one, is the containment of water.

HANS TAVSENS PARK AND KORSGADE

By SLA



Rainwater management becomes the focal point of this project, aiming at **closing loops** by returning water to nature, integrating it into the urban structure through a way that the **sen-sorial connection** with it is enhanced. When the park extends to streets, the design is based on the typologies that are existing and follows the limitations of the streets, in some cases it sacrifice space destined to cars, but the support of **pedestrians experience is enhanced.**

MONUMENT

When the segregation of the aqueduct happened, the function of it was lost and the standing leftovers shifted their status from hydraulic infrastructure into a monument or a sculpture.

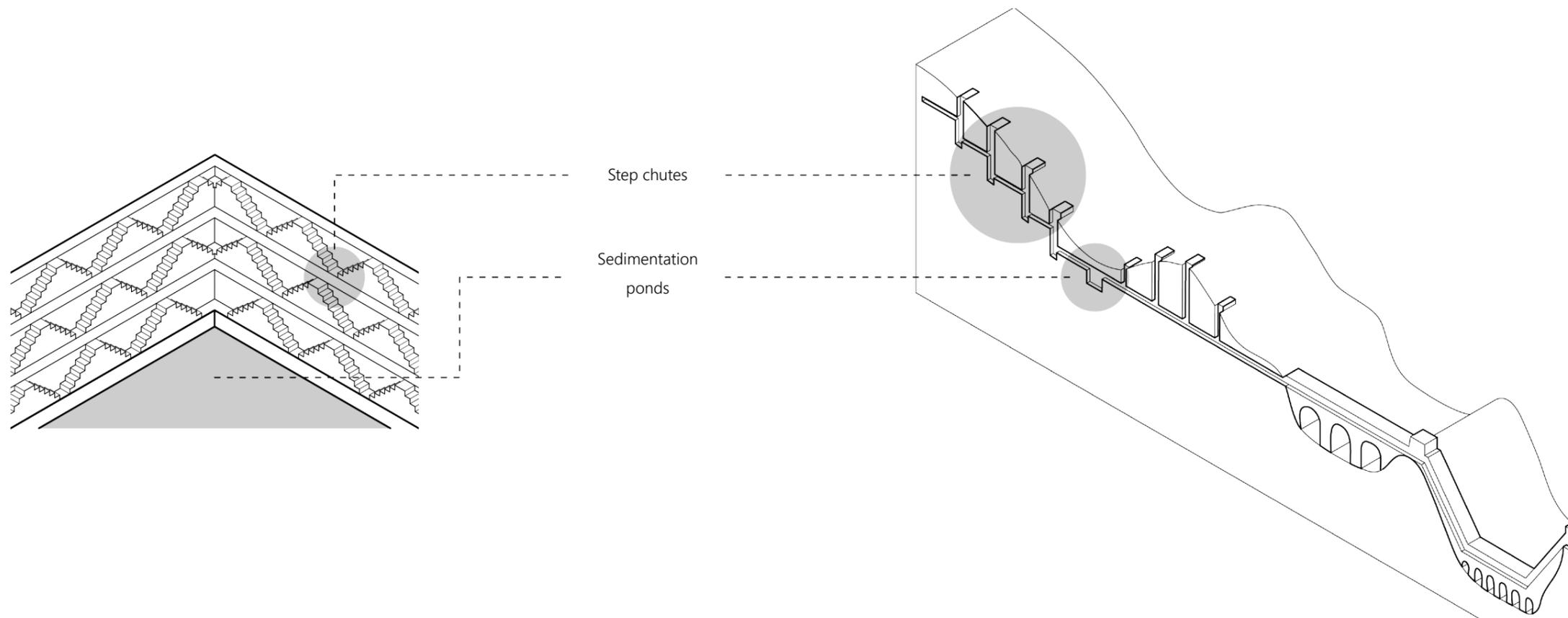
The left piece at the location of the project is a commemorative representation that speaks the past of the site, becoming a sign that shows the importance of water. ^{K,R (1979)}

It is relevant to take advantage of the monumentality of the construction and consider the recovery of the Aqueduct. The recyclability of this abandoned space, will represent an effective and ecological practice that rather than promoting the destruction of spaces, will support the re-birth of them.

The Aqueduct gives an opportunity to revive the water quality from the intersection of two water networks on the site, by reinterpreting a system of water infrastructure with a contemporary solution that is informed of historical values.

1

PASSIVE CLEANNING



It can be learned from the construction of old water infrastructure systems, that there are elements that enhance the quality of water and open the possibilities of public occupancy in them.

Step-wells whose purpose is the collection of water, are an example of a basin that were part of a larger network where these were the last step in the transportation of water.

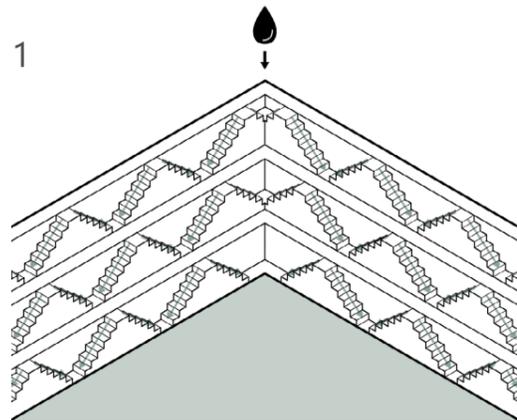
By comparing the elements present on a large network and a part of the network, as an example the step-wells, similarities can be identified that helped in both cases to improve the quality of water.

Two elements which are created by the shaping of the water container or conveyor need to be mentioned:

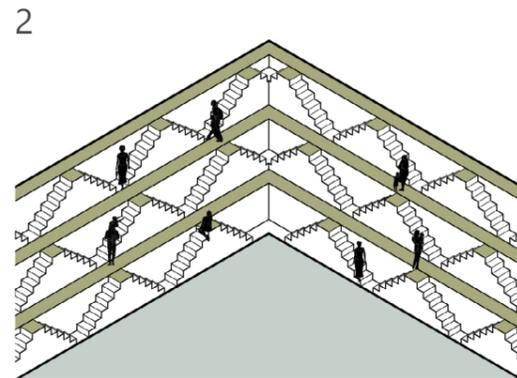
1. Step chutes have been used for decreasing the speed of the water and oxygenize it. This process is important for a good quality of water, and it is a process that could be combined with other methods.
2. Sedimentation ponds help water get rid of particles by capturing coarse sediment and litter.

A possibility seen from the example of the step-wells, is to expand the function of the basin into a level in which this one could become a social platform. A way in which the allowance of people is increased, can be seen from the number of steps that allow a continuous use on the vertical axis and the posterior incorporation of functions in it, such as monasteries.

STEP-WELLS

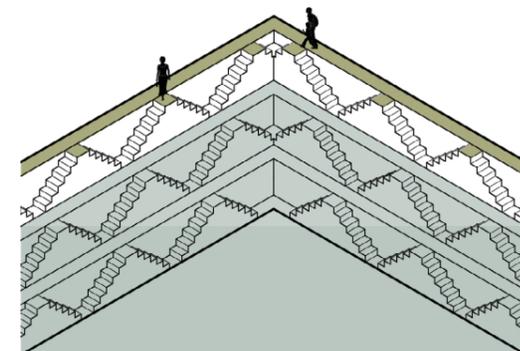
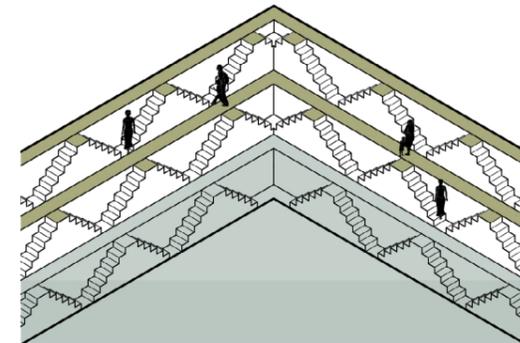
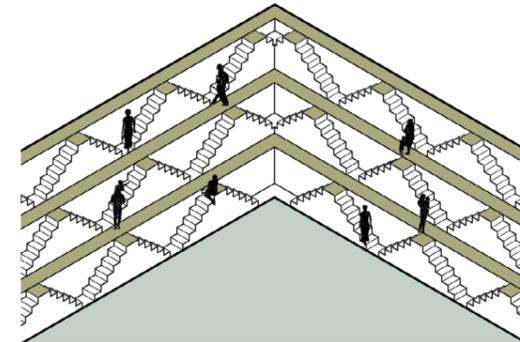


Indian civilizations developed step-wells, which consist of water descending to wells or ponds through a series of steps.



The design of the steps creates spaces that can be used as meeting points at different levels. People have the possibility to move in the vertical and horizontal axes as long as the water allows it.

3



Access to water at different levels, where water sets the limit of movement for people, and therefore the more area of water, the less room for people.

PROPOSAL

The presence of the Aqueduct in the site is an opportunity to use this structure by the reinterpretation of it, taking the idea of leading the water that flows through the site into a way that does not risk those bordering the river. The monumentality of the aqueduct can be taken to enhance its presence and reconnect it with the citizens, seen as a sculpture or a ruin which potentially could turn into a social platform.

The design proposes interventions in three main areas along the river. In the case of the plazas located in each neighbourhood, a different type of approach is desired to allow different type of events to happen in each side and therefore promote the usage and exchange of experiences from people living on both sides.

1

WHERE? AN ENHANCEMENT OF THE EXISTING

The location of the aqueduct has the possibility to become a link for the two neighbourhoods surrounding the river. On the west side, the already existing pedestrian street and the cultural qualities of *Xochimilco* could extend and connect with the business and now partially pedestrian side of *Reforma*.

At the same time, by combining the already existing water structures of the site, the memory of the aqueduct can be brought back to life by the integration of water as a urban quality of the neighbourhood.

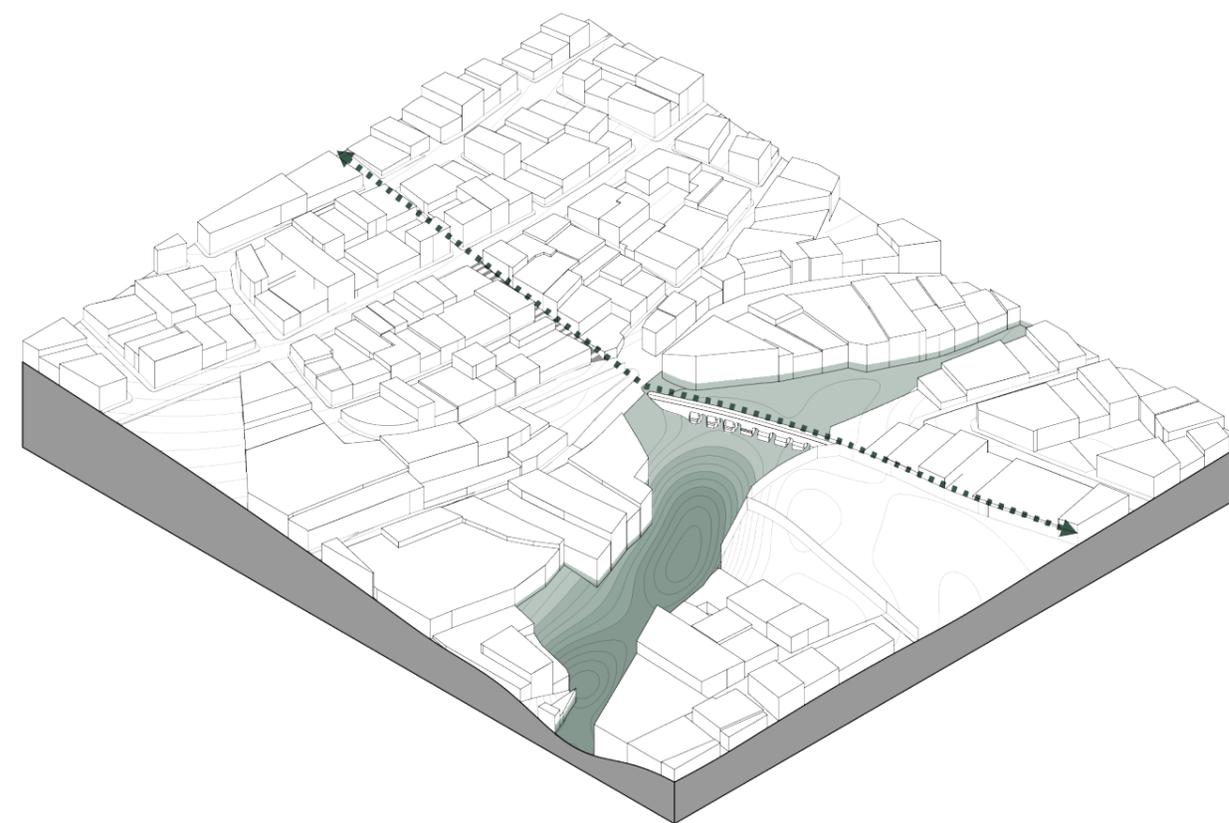


Image 71. A physical link present in the site.

WHAT TO INTERVENE AND WHY?

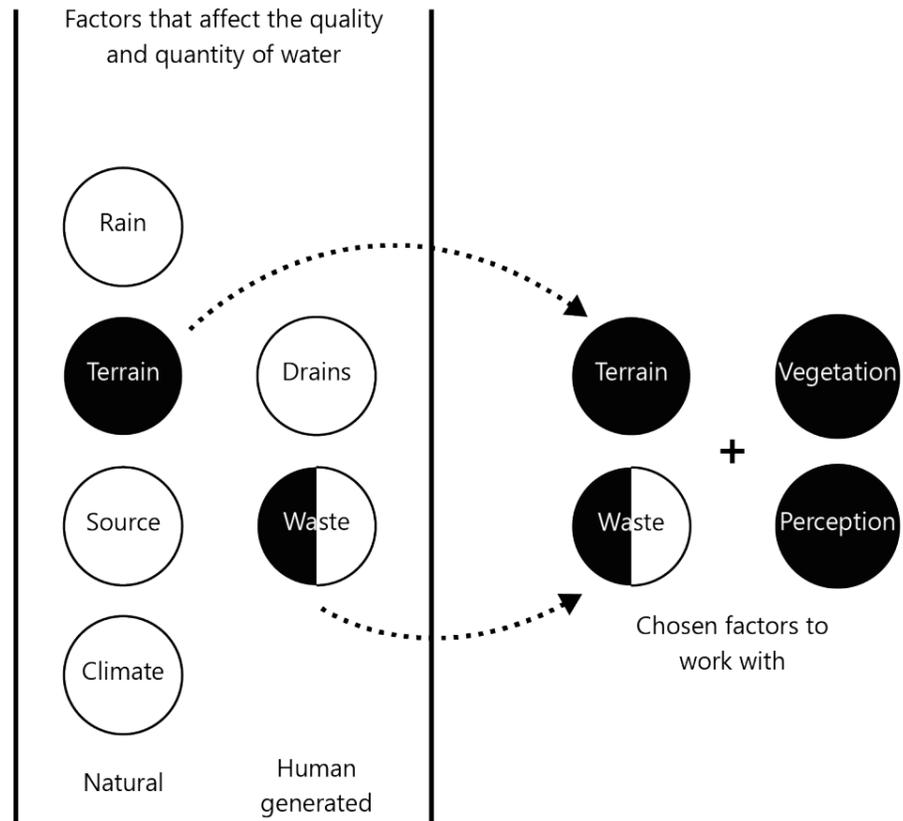


Image 72. Factors affecting the quality and quantity of water.

The diagram shows the elements that determine the quality and quantity of water available on a site.

Considering all the information presented in this document, it is stated that the area to intervene is inside the river and some nearby spots that are underused today.

By intervening the river, it is preferred to not over-design, but rather work with elements that enhance the existing and add values. The chosen ones are topography, a consideration on the polluted water that is being carried during the rainy season, the increase of greenery and the perception of the area, which will follow from the other 3 strategies.

TERRAIN...
WHY?

Shaping the terrain in a different way can soften the feeling of barrier of the river. It allows the creation of a public - green area without domesticating too much the existing natural areas.

WASTE...
WHY?

Waste is considered as the pollution particles that the water carries as it washes the streets. These can be treated by the shaping of the terrain, as seen in the step-wells and aqueducts, and by the inclusion of vegetation

VEGETATION...
WHY?

Simple! There is a lack of permeable surfaces so by increasing the vegetation, less water will flow, plants will clean a bit the water and the roots will transport the water into the soil. The temperature during sunny days will be less of a problem and come on! Who doesn't enjoy some extra vegetation.

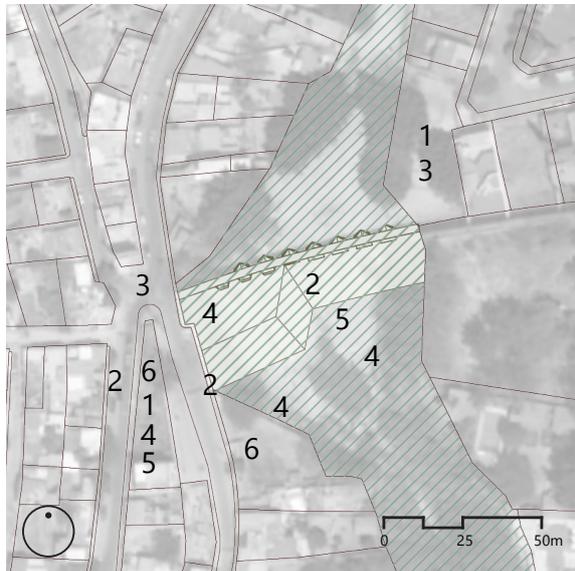
PERCEPTION...
WHY?

If the river is being polluted by the people, the creation of a space that enhances the beauty of the aqueduct and allows a closer contact to the river and the water can reduce the negative ideas that people have from it. A bridge enhances the visibility to the inside of the river, which can diminish the vandalism and enhance the feeling of security.

Oh and trash bins will also be included! (because so you know, there is none now)

3 IDENTIFIED STRATEGIES

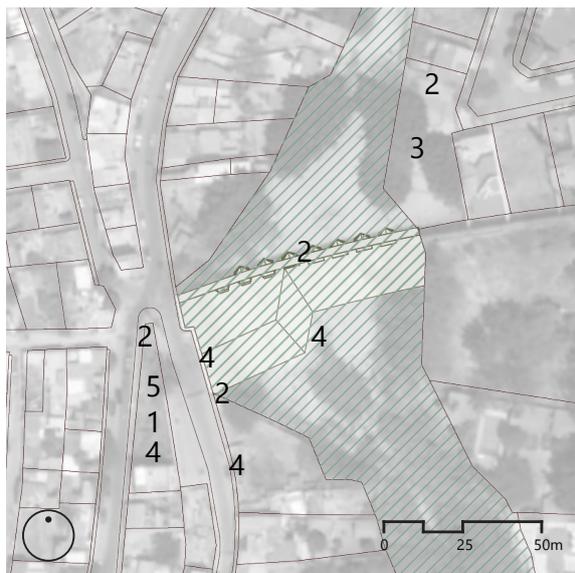
- 1 contain
- 2 direction
- 3 absorb
- 4 purify
- 5 sediment
- 6 irrigate



WATER

The main idea of the water strategies is to reduce the negative impacts on people, therefore water is directed to areas where flooding can happen in a safer way and where it can be absorbed. Purification is preferred as water is being directed, the same applies to sedimentation and irrigation.

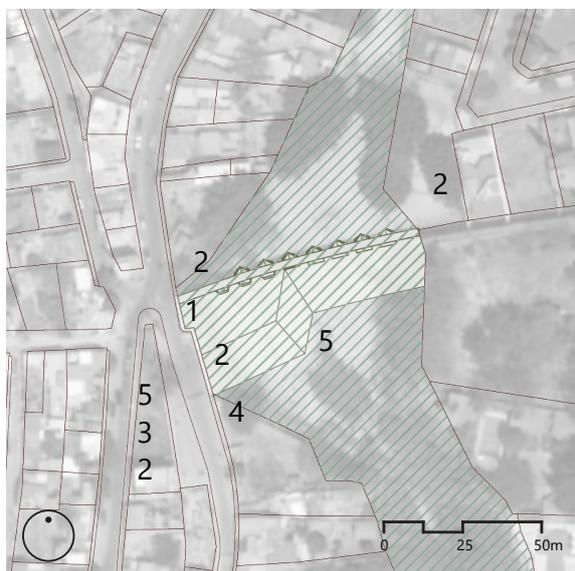
- 1 sunken plaza
- 2 connection
- 3 floodable park
- 4 platforms
- 5 urban farming



SOCIAL

It is necessary to make the river more public in order to create a middle common space for both sides where the level of water does not interfere with the activities through the use of platforms at different levels. Better pedestrian connections between the neighborhoods and the river are proposed. Situations where containment of water is needed, gives space for a park or a plaza where urban farming can happen.

- 1 aquatic plants
- 2 trees
- 3 herbs garden
- 4 cacti
- 5 flowers

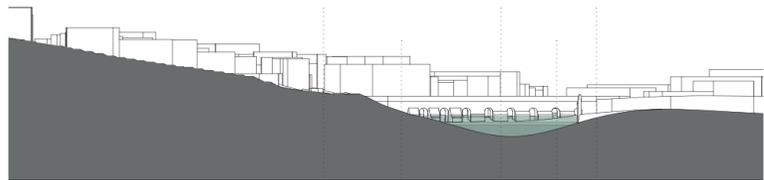


VEGETATION

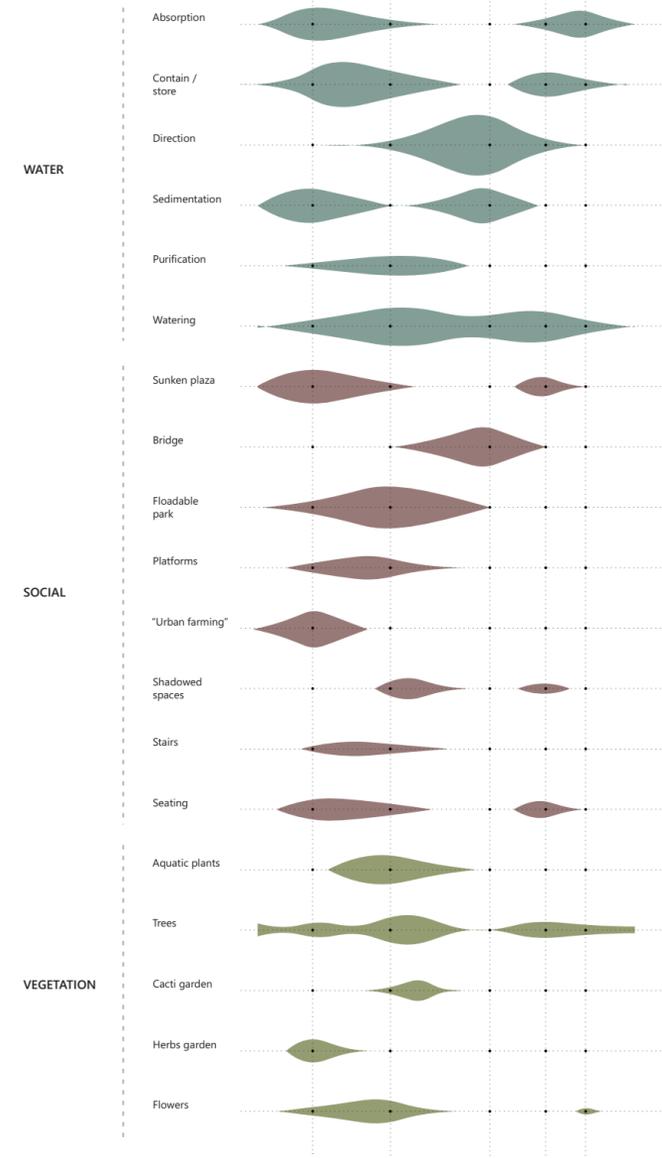
More vegetation is needed to reduce the runoff of water. Trees are a good option for places where there could be a lot of water, since they can be strong and their roots bigger. Herbs and flowers support certain activities and can make an area more attractive. Cacti can stand high temperatures which are present in Oaxaca throughout the year. Aquatic plants help to clean the water.

Image 73, 74, 75 from top to down.

LA CASCADA SAN FELIPE-JALATLACO RIVER REFORMA



1:500



The strategies according to each area are distributed along the site depending on the specific requirements in *La Cascada*, the *San Felipe-Jalatlaco river* and *Reforma*. Spaces that include water, a social requirement and certain types of vegetation are linked to give birth to the proposal.

PROPOSAL PROPOSAL

Image 76. Matrix of the hydraulic, social and vegetative requirements along the site



The floorplan gives a clear idea of how the lines of people, water and vegetation are connected through the site. An ideal future will be to expand these also to the streets, for creating a city of green corridors.

Image 77. Plan of the design.

5 SECTION



SUNKEN PLAZA
Serves for containment of water during rain season, the collected water can be used for irrigating the herbs garden.

CHANNELS
Help to store water, delaying the process of reaching the river and giving it more time to penetrate in the soil.

JACARANDA
Tree found historically on site

GREEN CORRIDOR
Absorbs the water from the street, in case it overflows, a channel to the right directs the water.

EXIT CHANNEL
Directs the water to the cleaning ponds, to provide a deeper cleaning process.

EXIT OPENINGS
Let the water flow from the cleaning ponds to river in the shape of a cascade.

PERFORATED CORTEN STEEL
The walls for containing the vegetation in the river are made out of perforated corten steel, which allows the free movement of water into the area where vegetation can be found.

CONNECTING FLOORS
Allow for people to move inside the river when the level of water allows for it.

TEXTURED SLOPE
The step chutes idea is applied along the channels that allow the water to oxygenate.

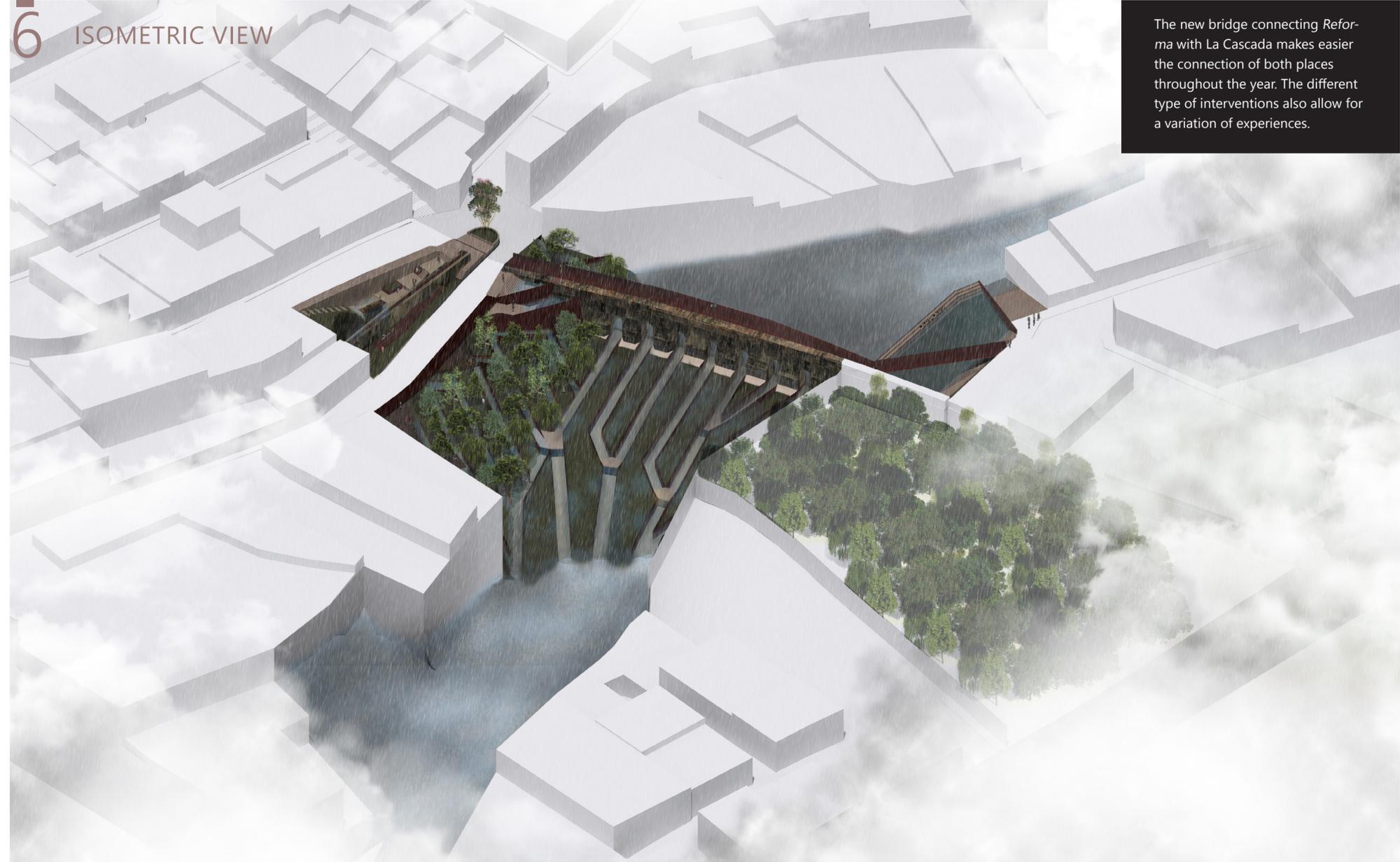
SEDIMENTATION PONDS
Help the water to get rid of small particles and medium size elements.

Along the river, it is desired for nature to take over the space and let it be more wild. At this area vegetation plays a key role on the absorption of water to the soil and in reducing the amount of water being sent to the river.

0 5m 10m 20m

Image 78. Section of the proposal

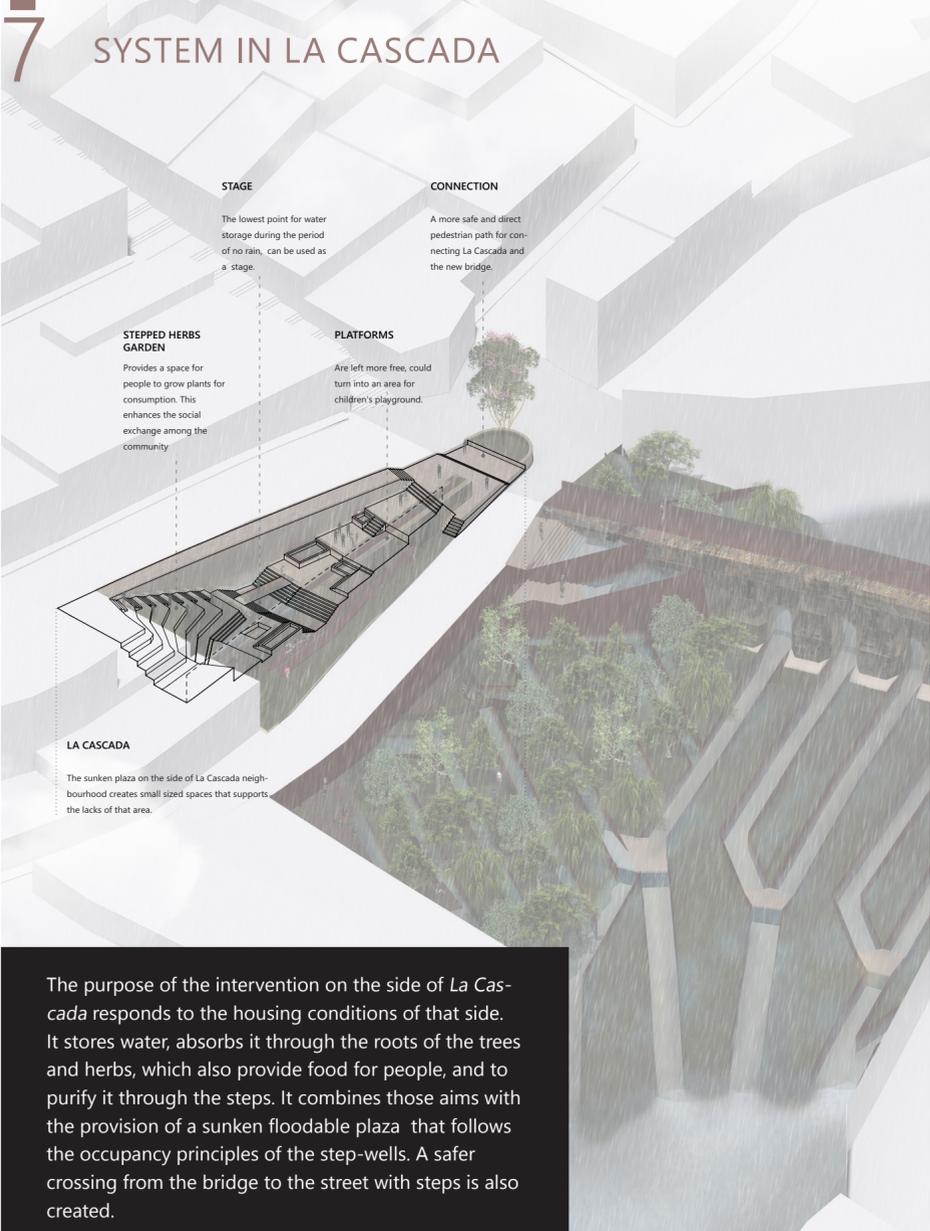
6 ISOMETRIC VIEW



The new bridge connecting *Reforma* with *La Cascada* makes easier the connection of both places throughout the year. The different type of interventions also allow for a variation of experiences.

Image 79. Isometric SE view.

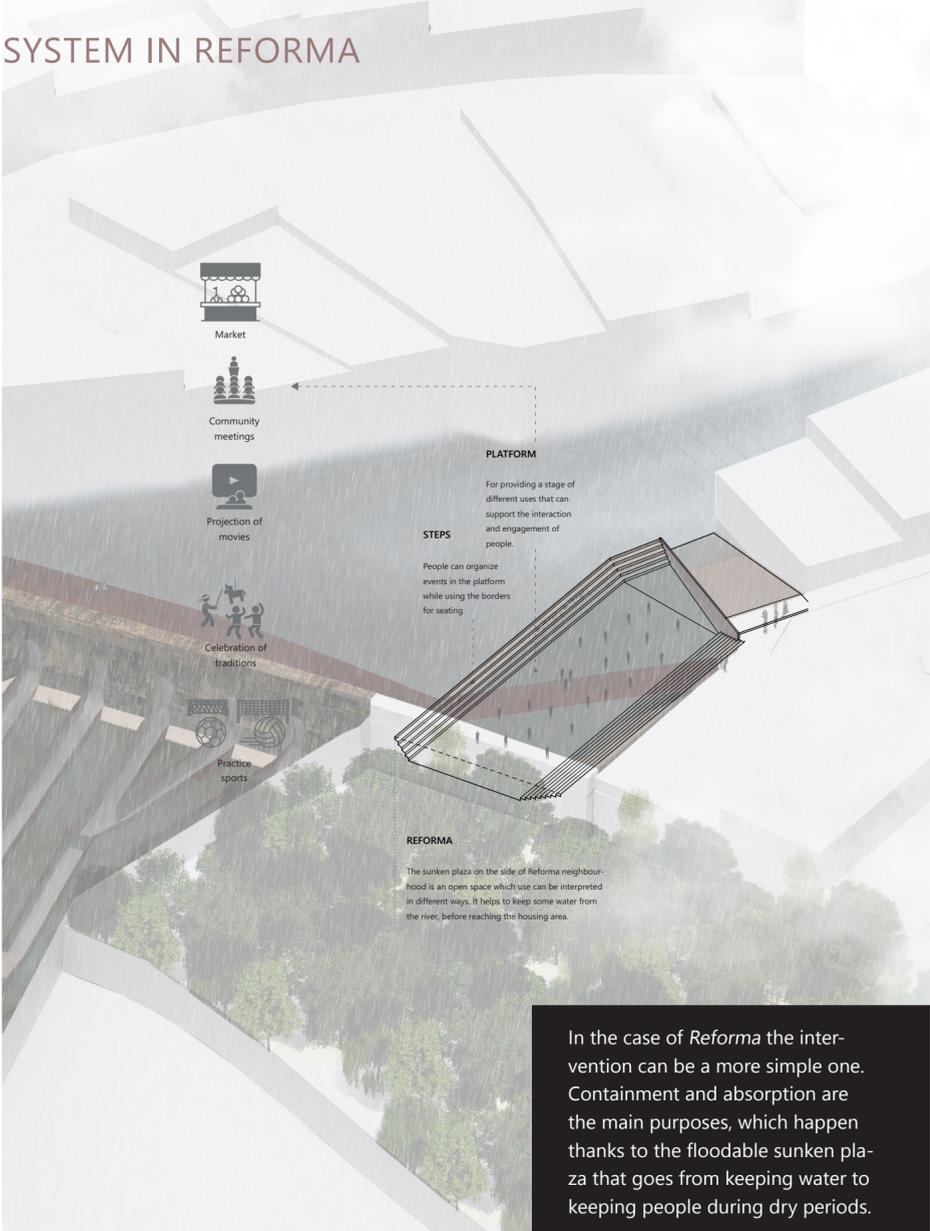
7 SYSTEM IN LA CASCADA



The purpose of the intervention on the side of *La Cascada* responds to the housing conditions of that side. It stores water, absorbs it through the roots of the trees and herbs, which also provide food for people, and to purify it through the steps. It combines those aims with the provision of a sunken floodable plaza that follows the occupancy principles of the step-wells. A safer crossing from the bridge to the street with steps is also created.

Image 80. Perspective with the system in La Cascada.

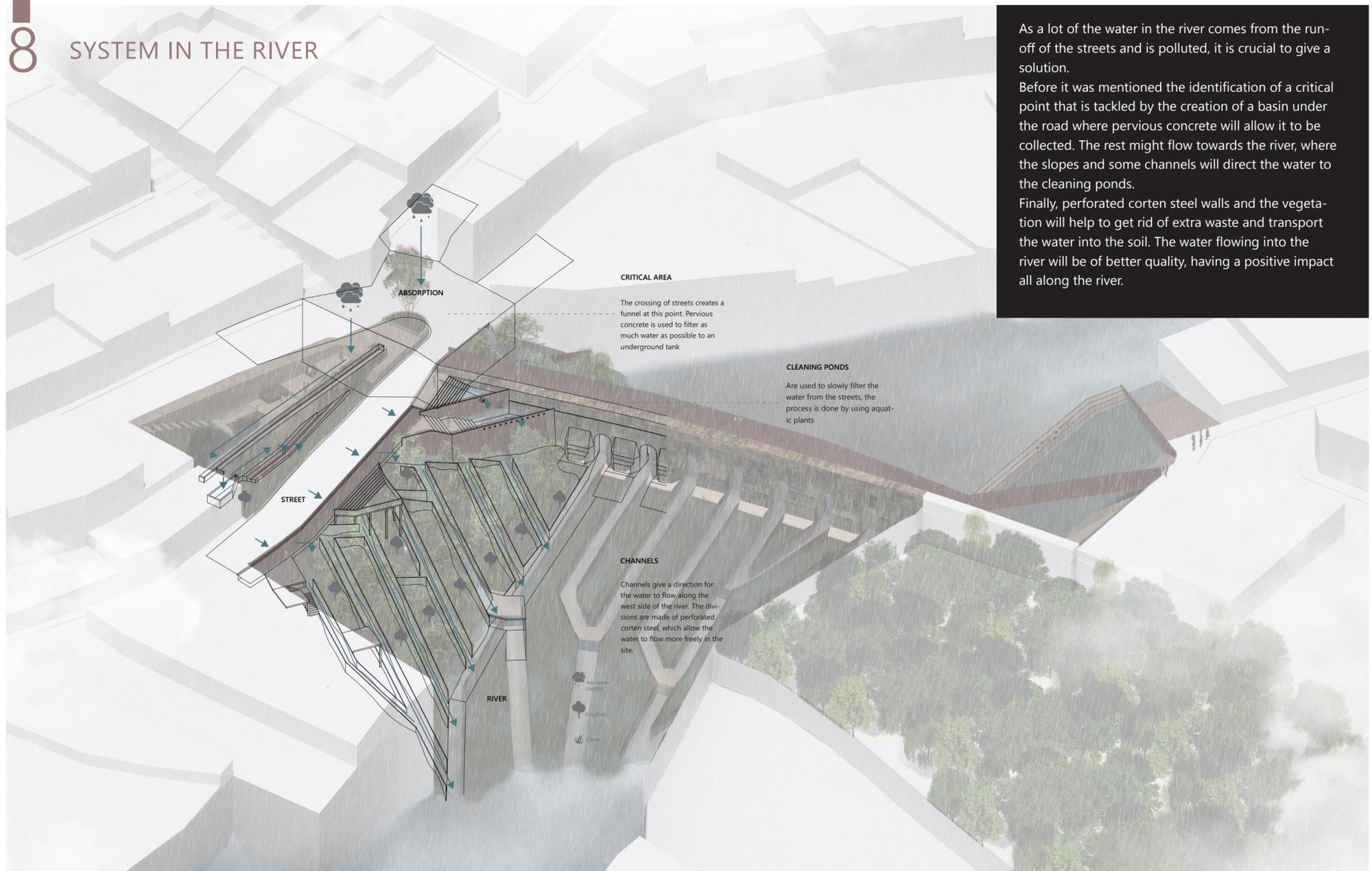
SYSTEM IN REFORMA



In the case of *Reforma* the intervention can be a more simple one. Containment and absorption are the main purposes, which happen thanks to the floodable sunken plaza that goes from keeping water to keeping people during dry periods.

Image 81. Perspective with the system in Reforma.

8 SYSTEM IN THE RIVER



As a lot of the water in the river comes from the run-off of the streets and is polluted, it is crucial to give a solution. Before it was mentioned the identification of a critical point that is tackled by the creation of a basin under the road where pervious concrete will allow it to be collected. The rest might flow towards the river, where the slopes and some channels will direct the water to the cleaning ponds. Finally, perforated corten steel walls and the vegetation will help to get rid of extra waste and transport the water into the soil. The water flowing into the river will be of better quality, having a positive impact all along the river.

Image 82. Perspective with the system inside the river.

9 PERSPECTIVE VIEW



Opening more the river and making it more accessible to the citizens is one of the crucial aspects that will improve the perception of it. A connection between the two areas is also very important to fight against the mental barrier that divides the neighborhoods.

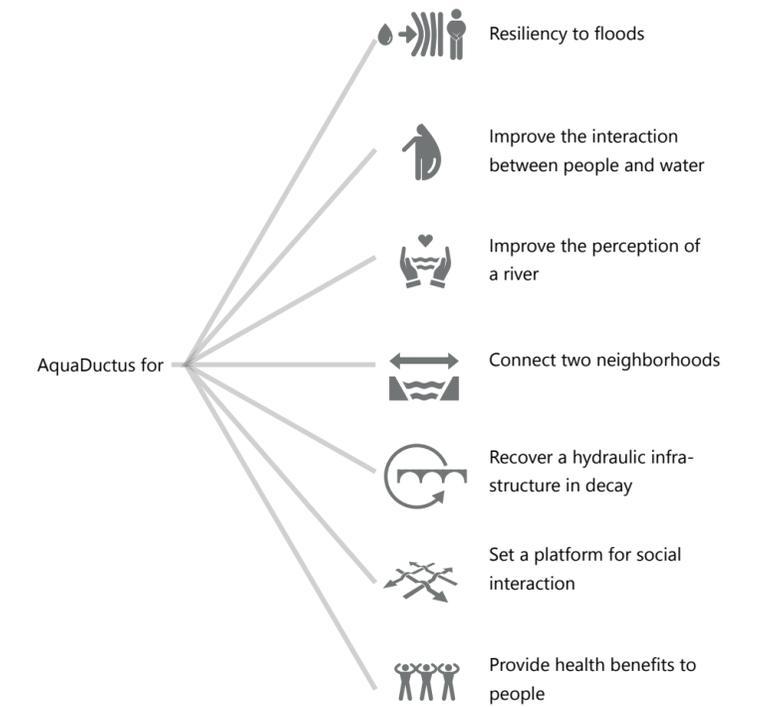
Image 83. Birdeye view over the side of La Cascada and inside the river.

10 PERSPECTIVE VIEW



It is of great importance that the design responds to the changing levels of water that are experienced in Oaxaca by applying strategies that respond to situations in specific locations. More vegetation and steps will be needed in areas where water is prevented to flow over the circulation of people.

CONCLUSION



This project started with the desire of just rescuing the Aqueduct through the improvement of the topography, but all the information and problematics of the site lead into a kind of infrastructure that bond people and water.

AquaDuctus reduces the quality of barrier from the river by creating a smoother transition of urban-natural and turning the negative aspects of heavy rain into a quality that can enhance and promote the urban life of the river and the neighborhoods.

The project sets a platform for a stronger connection between the two sides of the river and with the river in itself, serving its function when there is rain, but also when there is no rain. It promotes the interaction between people and their connection with water finalizing into a series of benefits that go beyond the planned ones.

This project is just a small contribution to this larger discourse of inclusion of water in cities, where there are still a lot to learn about and if climate change worsens, maybe more problems will raise and will need to be addressed.

It is true that a change is needed but how far will we go in taking actions not just for necessity but for coexisting?

Image 84. View of the floodable plaza in Reforma neighborhood.

Image 85. AquaDuctus benefits

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AQUA DUCTUS

This project resonates around the idea of water in urban contexts. Where water and people can have a space and most importantly, where they can coexist.

If one wonders what do we know about water, a direct answer will be that it is the source of all life and therefore it is of great importance, but are we good at living with it?, and what is the role of water in cities? moreover, how is the relationship of water and Architecture?

This Master Thesis started with the desire of rescuing an old Aqueduct in a site where the urban mass is consuming everything. Through the process, the aim shifted to look at the role of water nowadays taking as point of departure the intersection of a river and an aqueduct, and from this take the Aqua Ductus (lat. To lead water) ^{E. B. (2018)} idea to act on behalf of the current and future needs of the site.

By trying to answer the questions...

HOW CAN THE CITY DELIVER TO THE PEOPLE A PLACE WHERE WATER BECOMES AN INTEGRATED-ACTIVE PARTICIPANT OF THE SITE?

HOW TO IMPROVE THE RELATIONSHIP BETWEEN PEOPLE AND WATER IN A CONTEXT WHERE A RIVER AND AN AQUEDUCT ARE IN DECAY?