

WATER, INFRASTRUCTURE AND PUBLIC SPACE IN LISBON

Rethinking public space along the aqueduct in Lisbon

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RESUMO

No século XXI, a questão de como definir uma boa cidade é tudo menos clara. Por muito diversas que sejam as necessidades da sociedade moderna, por muito numerosas que pareçam ser as respostas, não se pode chegar a um resultado universalmente válido que sirva todos os registos. O tema central desta investigação é o espaço público. O espaço de vida entre edifícios é considerado decisivo para o desenvolvimento social de uma cidade. Resulta de sistemas de diferentes escalas, territoriais, infra-estruturais, bem como culturais. Como e onde as pessoas se reúnem numa cidade define-a. Nesta dissertação, o espaço público é considerado a partir de todas estas leituras. Os conceitos de espaço público e de infra-estrutura servem de leitmotif, centrando-se na interacção infra-estrutural entre aqueduto e espaço público na cidade de Lisboa. O trabalho está dividido em três escalas de tamanho e tempo diferentes. Primeiro, o próprio conceito de infra-estrutura é explorado a fim de esclarecer a dialéctica em que a modernidade, a infra-estrutura e o espaço público se confrontam. Com base em fontes primárias, mas também em textos fundamentais, será feita uma introdução à história da engenharia hidráulica pós-medieval nas cidades europeias. Em seguida, utilizando o exemplo da cidade de Lisboa, que foi abastecida por um aqueduto durante quase dois séculos, a partir do século XVIII, será analisado como uma infra-estrutura tão grande produziu espaços públicos que ainda hoje estão presentes na paisagem da cidade. Finalmente, o fruto destas reflexões é uma proposta para a conversão de um reservatório em Lisboa. O discurso terá como base o facto dos exemplos históricos poderem servir de inspiração para a utilização, conversão e expansão dos espaços públicos ao longo do aqueduto e fornecer impulsos para o desenvolvimento de novas tipologias.

ABSTRACT

In the 21st century, the question of how to define a good city is anything but clear-cut. As diverse as the needs of modern society are, as numerous seem to be the answers to them, and yet one cannot arrive at a universally valid answer that serves all registers. The central subject of this investigation always leads back to public space. The living space between buildings is considered decisive for social developments in a city. It results from systems of different scales, territorial, infrastructural as well as cultural. How and where people come together in a city defines it. In the following work, public space is considered in terms of these different scales. The concepts of public space and infrastructure serve as leitmotifs, focusing on the infrastructural interaction between aqueduct and public space in the city of Lisbon. The work is divided into three scales of different size and time. First, the concept of infrastructure itself is explored in order to understand the dialectic in which modernity, infrastructure and public space confront each other. Based on primary sources and texts, an introduction to the history of post-medieval hydraulic engineering in European cities will be given. Then, using the example of the city of Lisbon, which was supplied by an aqueduct for almost two centuries from the 18th century onwards, it will be examined how such a large infrastructure produced public spaces that are still very present in the cityscape today. Finally, the fruit of these reflections is a proposal for the conversion of a reservoir in Lisbon. The discourse will address how historical examples can serve as inspiration for the use, conversion and expansion of public spaces along the aqueduct and provide impulses for the development of new typologies.

ABSTRAKT

Im 21. Jahrhundert ist die Frage, wie man eine gute Stadt definiert, alles andere als eindeutig. So vielfältig die Bedürfnisse der modernen Gesellschaft sind, so zahlreich scheinen die Antworten darauf zu sein, und doch kann man nicht zu einer allgemeingültigen Antwort kommen, die allen Registern gerecht wird. Das zentrale Thema dieser Untersuchung führt immer wieder auf den öffentlichen Raum zurück. Der Lebensraum zwischen den Gebäuden gilt als entscheidend für die sozialen Entwicklungen in einer Stadt. Er ergibt sich aus Systemen unterschiedlicher Maßstäbe, territorialer, infrastruktureller wie auch kultureller Art. Wie und wo Menschen in einer Stadt zusammenkommen, definiert sie. In der folgenden Arbeit wird der öffentliche Raum im Hinblick auf diese verschiedenen Maßstäbe betrachtet. Die Konzepte des öffentlichen Raums und der Infrastruktur dienen als Leitmotive, wobei der Schwerpunkt auf der infrastrukturellen Interaktion zwischen Aquädukt und öffentlichem Raum in der Stadt Lissabon liegt. Die Arbeit gliedert sich in drei Maßstäbe unterschiedlicher Größe und Zeit. Zunächst wird das Konzept der Infrastruktur selbst untersucht, um die Dialektik zu verstehen, in der Modernität, Infrastruktur und öffentlicher Raum einander gegenüberstehen. Auf der Grundlage von Primärquellen und Texten wird eine Einführung in die Geschichte des nachmittelalterlichen Wasserbaus in europäischen Städten gegeben. Dann wird am Beispiel der Stadt Lissabon, die ab dem 18. Jahrhundert fast zwei Jahrhunderte lang durch ein Aquädukt versorgt wurde, untersucht, wie eine so große Infrastruktur öffentliche Räume hervorbrachte, die noch heute im Stadtbild sehr präsent sind. Das Ergebnis dieser Überlegungen ist schließlich ein Vorschlag für die Umgestaltung eines Reservoirs in Lissabon. Der Diskurs wird sich damit befassen, wie historische Beispiele als Inspiration für die Nutzung, den Umbau und die Erweiterung öffentlicher Räume entlang des Aquädukts dienen und Impulse für die Entwicklung neuer Typologien geben können.

INDEX

ABSTRACT

INTRODUCTIONp.11

CHAPTER I p.25

Lisbon’s Urban development from the perspective of its water supply
The history of Lisbon’s water supply since the city’s beginnings under Portuguese rule
The 18th and 19th century

On the history of Lisbon’s water supply since the city’s beginning	
under Portuguese rule	p.27
The 18th and 19th century	p.28

CHAPTER II p.37

The old and the new: public space in changing times
Historical case studies in Lisbon

Mãe d’Água das Amoreiras	p.45
Jardim das Amoreiras and Chafariz do Rato	p.51
The reservatório da Patriarcal and Praça do Príncipe Real	p.55
The neighbourhood of Campo de Ourique in the end of the 19th century	
and the Reservatório de Campo de Ourique	p.59

CHAPTER III p.71

„Um reservatório de espaços“
A hypothesis

Strategy: City and infrastructure	p.72
Infrastructure and public space	p.74
The grid	p.74
Territorial sections	p.80
The platform and gallery	p.84
The higher buildings	p.94
Flexibility	p.120
A green oasis	p.130
How will we come together?	p.134

CONCLUSIONp.134

How will we come together in the future? p.134

Bibliography	p.141
Sitography	p.142
Index of images	p.143



01

INTRODUCTION

What makes a good city? Can beauty in a city be planned? Is there a recipe for the artistic, the seemingly spontaneous in a city, or is it time that produces such outcomes? Central to this question seems to be the public space. The better it functions in a city, the better the public life there, one would think. Already towards the end of the 19th century, the Austrian urban planning theorist Camillo Sitte asked himself this question. With a chagrin about modernised cities in which all poetry gave way to increasingly formalistic urban planning, Sitte set out to record his theses for a “significant city” in his work “Der Städtebau nach seinen künstlerischen Grundsätzen”¹. His critics countered that he was ignoring the complexity of the modern city.² Again and again, architects and urban planners are faced with the task of rethinking the city according to its time and meeting new demands of a physical as well as programmatic nature. A look ahead seems just as important as a look into the past in order to master the difficult balancing act between considerate and visionary design. Especially in the post-industrial age, cities have become multi-layered compositions of different systems. They have to do one thing above all: function.

In recent centuries, we have experienced technological progress that has made cities in their current form possible in the first place. The city as we know it today can only be regulated in its spatial scope by highly complex infrastructures. The forms of public life such as squares, promenades, fountains, parks and railway stations that accompany us every day are inextricably linked to these infrastructures and were often brought into being by them. In his article “Constructing Landscape by engineering water” Antoine Picon describes cities as “complex hydraulic systems, a series of watersheds that must be managed with the greatest care”³, highlighting the fundamental importance of the role that water takes in the design of cities. He claims that in modern times despite a multitude of technological answers towards technological problems i.e. the accessibility of water, the designers in charge are often missing a clear global vision on how to address the issue at hand. By carefully observing the role that water

Figure 01
Ponte Vecchio, Florence, 2020.

1. SITTE, Camillo, *Der Städtebau nach seinen künstlerischen Grundsätzen*. Reprint of the 4th edition of 1909, first edition published in 1889, Basel, Boston, Berlin: Birkhäuser, 2001, p. 12 (free translation by the author).

2. CHOAY, Françoise, *The Modern City: Planning in the 19th Century*. New York: George Braziller, Inc., 1969, p. 106.

3. PICON, Antoine, “Constructing landscape by engineering water”, in *Landscape Architecture in Mutation: Essays on Urban Landscapes*, Institute for Landscape Architecture, ETH Zurich, Zürich: gta Verlag, 2005, pp. 257-266.

and hydraulic engineering have taken in the development of European cities over the past centuries, Picon asks how these past developments can be taken as a starting point for present and future urban developments in an increasingly technological age. The following discourse will provide an insight to the history of post-medieval hydraulic engineering in European cities, breaking down the term of infrastructure itself in order to understand the dialectic in which modernity, infrastructure and public space confront each other.

The development from rural to urban space has taken place successively over the last centuries. As late as the Middle Ages, European cities were nothing more than loose human settlements on natural space, enclosed by fortifications at strategic points. Natural elements such as forests and water were still a big part of the urban appearance, and water in the form of many rivers and canals was a major feature of the mediaeval city. This also meant that the relationship to water was a very direct one: people gathered right by the river to make use of the vital resource. Clean drinking water was scarce, as running waters were used for any kind of disposal, and water from wells also came from the same water table of sewage. Water procurement was thus one of the main tasks that had to be addressed in the course of urban modernisation. In the age of industrialisation, both the access to and the removal of water were regulated. Rivers were replaced by underground water pipes and sewerage systems, which largely changed the urban landscapes both in appearance and structure⁴.

Historically, water served as a primary source for transport and energy production until more recent centuries. This meant that urban and rural planning could not be approached without considering the prevailing water situation. Major infrastructures were connected to or built on water from the ground up. If one looks at the depiction of medieval European cities, they all once resembled Venice or Amsterdam before the canals were gradually filled in and replaced by roads or sewage systems.⁵ Canals and rivers were mainly used in an utilitarian sense, before they entered the sphere of being viewed as aesthetically stimulating elements of landscape. This changed in the 18th century, when in cities such

Figure 02
Bird's-eye view of Venice, 1559.

⁴ *ibid*, pp. 257-260.

⁵ *ibid*, p. 258.





as Paris, walls were built along the water, leading to a re-alignment of the urban layout towards the waterfront. Facades were facing the river, and the river became the view. Water, the river, the canals were stripped of their physical use and became a visual object.

In the 18th century, the natural canals and rivers became obsolete in their original form and were subsequently being replaced by artificial man made infrastructures, invisible to the public and laid underground.⁶ The cities “dried out” and the canals, which originally served as main arteries for transportation, were gradually replaced by roads, while at the same time representative fountains and wells emerged, marking the new era of industrialisation and political representation. This represents a spatial contrast. If one looks at old maps and depictions of cities in the Middle Ages, they are criss-crossed by diverse waterways. In the age of industrialisation, these disappear from the map and underground pipes and sewage systems take their place. Simultaneously, public places with fountains and wells appear in a very visible and representative decorative function, from which the water, once flowing organically in the cityscape, now gushes out in bundles. It is collected and “spat out”. Something similar could be said about other infrastructures such as the metro: instead of water, people are transported here and let out at strategic points.

Picon goes on to describe the role of water in the 18th century with four key points: water as “inhabited utilitarian milieu”, water as “urban landscape”, as “technological and invisible infrastructure” and as “monumental element in the city”⁷. The juxtaposition of these different characteristics can be seen in the example of Paris, where the Seine took on a representative function while the Canal St. Martin continued to maintain an utilitarian aspect. In the meantime, the underground network of infrastructural water pipes was increasingly expanded. Interestingly, the viewing and knowledge of these infrastructures was reserved for a certain elite, and only evident to the public in the form of fountains and wells. What went on underground was kept from the public.⁸ This reinforces the idea that public space was focused on precisely those venues around the fountains, and did not go beyond, or

Figure 03
Paris, Plan De Méraïn 1615.

⁶ *ibid*, pp. 259-260.

⁷ *ibid*, p. 260.

⁸ *ibid*, p. 260.

Figure 04
La Plage à Trouville, Claude Monet, 1870.

Figure 05
Swimming in the Rhine in Basel, ca 1980.

⁹ *ibid*, p. 261.

¹⁰ *ibid*, pp. 261-262.

rather, below. As far as current challenges are concerned, Picon points out three main points. Firstly he mentions the fact that urban space is increasingly expanding, so that territorial boundaries between city and countryside are blurring. The main difference between the traditional and the modern city is that a traditional city has rivers flowing through it, whereas the modern city is built on a complex hydraulic system. As a result, urban water issues are no longer just aesthetic or water supply issues, but reach an all-encompassing environmental dimension.

As modern problems, Picon continues to name, in addition to a series of technical water procurement problems, the increasing need for water as an integral part of everyday life in an urbanised society in both public and private contexts, which went beyond the pure entertainment factor of water in the 19th century, when the bourgeoisie was content to take the occasional trip to the sea. The desire in the modern age for proximity to water, especially in cities, far exceeds this dimension. The real estate market is increasingly focusing on waterfront areas and the public and private spaces along rivers are in high demand⁹. Paradoxically, the very rivers and canals with a former utilitarian nature that fell victim to technologisation in the 18th century are now seen as places with a high quality of stay. In the 18th century, the natural watercourses were filled in and artificial access to the water (in the form of fountains) was created for the public. Today, despite the still popular use of these fountains in public places with recreational value, a reversal is taking place and any place with natural water access in a city is welcomed. Hence, the ecosystem is endangered by the growing demand to be and build close to the water. Lastly, due to the expansion of peripheral cities, more and more sealed surfaces can be found on the outskirts of cities, which is why rainwater can no longer run off naturally and large catchment areas have to be created.¹⁰



04



05



06

Concluding from these reflections, he refers to Bruno Latours “Politiques de la nature”, stating that instead of imposing technology upon nature, an adaptation towards nature is necessary when wanting to adequately react to these challenges. He mentions the term “techno-nature”, meaning that today the lines between technology and nature are no longer clearly defined, but blurred. When in the past the artificial and the natural were clearly distinct, they are nowadays merging.¹¹

At this point it can be stated that a characteristic feature of modernisation from the 18th century onwards is the transition from nature to infrastructure. The term “infrastructure” also stems from this period, first appearing in the second half of the 18th century and initially referring in French to a substructure (French: “infrastructure”), i.e. all earthworks to reclaim the land and levelling in railway construction.¹² Infrastructural facilities emerged in the 19th century as a concomitant of industrialisation and urbanisation. In this process, infrastructure and urbanisation were in constant competition with each other in their development. In the case of the construction of canals and railways, infrastructure preceded urbanisation processes; in the case of water supply and sewerage in cities, infrastructure lagged behind the growth of cities. Rapid urbanisation led to hygiene problems and a lack of water supply, especially in poorer neighbourhoods.¹³ A regulated water supply was to provide a remedy. This is how the “bacteriological city” came into being.

Matthew Gandy first coined the term “Bacteriological City” and describes it as a phenomenon that developed between the 19th and 20th centuries. He describes the modernisation of cities as a transition from the private to the public city, in which a centralised administration oversaw and uniformly regulated local problems. This process was charged by a conflict of interests that lay between the new and the old capital, i.e. the aristocracy and the new lobby of industrialists. At the beginning of the 18th

Figure 06
Paul Cézanne, “La Tranchée du chemin de fer”, 1870.

¹¹ *ibid*, p. 262.

¹² Wikipedia, The Free Encyclopedia, s.v. “Infrastruktur”. Available at: <https://de.wikipedia.org/wiki/Infrastruktur> (accessed September 6, 2021).

¹³ VAN LAAK, Dirk, “Eine kurze (Alltags-) Geschichte der Infrastruktur - Essay” (April 11, 2017). Available at: <https://www.bpb.de/apuz/246420/eine-kurze-alltags-geschichte-der-infrastruktur#footnode3-3> (accessed September 6, 2021).

century, the first centralised water systems were introduced in several major European cities: in Paris in 1802, in London in 1808, in Berlin in 1856. With this turn of events, traditional forms of water supply such as wells, individual water sellers and others were replaced. The city administration was confronted with a political and technical dilemma concerning the contrast between water supply and water disposal. The improved water supply, which was quite easy to produce, led to a huge increase in water consumption, which in turn overloaded the pre-industrial sanitation systems.¹⁴ However, a new system of water disposal posed a technical and financial problem, as the underground sewerage system had to be completely rebuilt. These new technologised sewerage systems provoked a heated conflict between 19th century engineers, as not all were in favour of the change from organic to technological. To give an example, the loss of human waste, which could now no longer be disposed of organically and used as fertiliser, was considered uneconomic from an agricultural point of view. This dilemma highlights the tensions already present in the 19th century, which resulted from the question of how the modern city should be structured. In this context, nature and society stood in opposition to each other.¹⁵ Furthermore, infrastructures shortened spatial distances and restructured cities. By uniting cities and regions and creating new boundaries, they were instrumental in shaping the everyday life of an entire society and formed the basis for today's globalisation. Already in the 18th and 19th centuries, extensive improvements, river straightening and canals proved to reshape the landscape in a technocratic sense. With the prospect of efficiency, rivers, lakes and seas were connected to shorten transport distances. These serious interventions in nature were registered by artists such as Paul Cézanne and captured, for example, in his painting "The Railway Crossing" in 1870 (Fig. 06). Above all, roads, canals and railways have created long-term pathways and partly irreversible path dependencies.¹⁶ Today, the consequences of these sacrifices in favour of efficiency are palpable, and an ecological understanding of counteracting environmental damage is coming to the fore more than ever. The human conquest of nature with the help of infrastructure is viewed critically today. More than ever, ecological considerations have become

14. GANDY, Matthew, "The Fabric of Space: Water, Modernity, and the Urban Imagination" in *Leviathan*. Berlin: Nomos Verlagsgesellschaft mbH. ISSN: 03400425. Vol. 33, No. 4 (December 2005), pp. 522-543. German Translation by Maren Harnack.

15. *ibid*, pp. 524-528.

16. VAN LAAK, Dirk, *op. cit.*

a priority in the design of urban spaces. With this moral change of heart, aesthetic sensibilities have also changed: the inclusion of nature and landscape in urban planning has become very important. Given the socio-political and spatial weight that the introduction of infrastructures into the urban fabric has had over the last three centuries, the connection between large-scale functionality and small-scale design of public space becomes clear. What we see in detail on the surface is only a visible fragment of a large underground system. Against the background of Europe's infrastructural development, especially in the field of hydraulic engineering, it becomes clear that a city is a function-dependent construct. A city in the modern sense is a human superstructure based on sub- or infrastructures. Thus, over time, public places that are designed around or result from a function at their core emerge.

In the research presented here, the city of Lisbon is used as a case study, where the interplay between infrastructure in the hydrological field and public places is broken down historically. In this city, an aqueduct fed a network of wells for almost 200 years until it no longer met the requirements of water supply in an industrial city and, finally, became obsolete. The large structure, which still exists as such, leaves a clear footprint in the cityscape to this day. The city has grown over time around the fountains, which can be found here and there but no longer serve as water sources. In some places, the original structure of an old road can still be found, which created access to water for livestock and people. The fountains are a grateful respite in the city, an oasis between the hustle and bustle of traffic and big city buildings, and one cannot help but wonder what the city would be without them. Any modern fountain could hardly produce the same effect as the 19th century fountain in the Praça do Príncipe Real or the impressive building of the Mãe d'Água das Amoreiras reservoir, which forms the artistic end of the arches of the aqueduct around the Amoreiras Garden. Although in their simplicity these fountains could no longer supply a large city, they have helped shape the development of Lisbon's public space, and it is no coincidence that many of the green spaces, parks, gardens or squares are located near them.

Figure 07
Chafariz no Largo do Carmo, 25 de Abril 1974.

Figure 08
Largo do Carmo (former Largo do Chafariz), 2022.

The correlation of the superordinate infrastructural system and the public places it generates is also familiar to us from other, more recent infrastructures. Railway networks in large cities are comparable to the aqueduct: underground channels that serve for transport, and at points of tension (train stations, fountains) let out what needs to be transported. Naturally, public centres in the city develop over time at such functionally charged places, because where a function is fulfilled, people will be found.

The direct connection between function and physical point of attraction for people is being challenged in the age of the pandemic, where everything has been converted to delivery service, home office and remote work. What does the city of the future look like and what does public space mean today in the face of a city that can increasingly be experienced from one's desk? To what extent will social changes make today's public spaces and infrastructures obsolete in the future, just as in the case of the aqueduct?



07



08

CHAPTER I

Lisbon

Lisbon's Urban development from the perspective of its water supply



The history of Lisbon's water supply since the city's beginnings under Portuguese rule

Among the great European cities, Lisbon stands out not only for its morphological peculiarities and its location at the estuary of the Tagus, its gateway to the world, but also for its history of water supply. The known historical facts on Lisbon's water supply before the foundation of the monarchy are rather thin, but point to traces of an aqueduct from Portugal's times as a Roman province. This aqueduct was probably underground and was intended to bring water to Lisbon from various sources, including the Águas Livres spring. Under Arab rule, these infrastructural remains were probably used to collect water in a basin in Carenques, near Amadora, for agricultural purposes.¹⁷ When Lisbon was conquered by D. Afonso Henriques in 1147, the city counted around 15,000 inhabitants. However, population growth was slow, which may, amongst other factors, have been due to the poor water supply. Against this background, it becomes clear that the drinking water supply of the city of Lisbon had always been a problem. During Portugal's period of conquest in the 16th century, the problem of poor drinking water quality became all the more apparent as expeditors could not be supplied with sufficiently good water for their expeditions. The monarch of the time, D. Manuel, recognised the urgency of solving this problem and commissioned Francisco de Holanda to draw up a plan to supply the capital with much-needed water, as well as a project for a large fountain in Rossio, but nothing came of the plans and Lisbon was to remain without an acceptable water supply for another century.¹⁸

During this period, the majority of the population fetched their water from the Chafariz d'el Rei, few public fountains spread around the city, and private wells. Who drew water from where was subject to strict hierarchical rules. This can be seen in a painting of the Chafariz d'El Rei in Alfama (Fig.12), which is considered the mother of all fountains: each water tap was assigned to a social class or ethnicity, white women and girls, mixed-race men, black women, slaves and so on.¹⁹ The painting depicts an everyday scene in which figures of different social and ethnic affiliations gather around the Chafariz d'El Rei and go about their activities. Because of the diversity depicted, the painting is often described as an example of globalisation during the Renaissance era.²⁰ Another example of everyday life of

Figure 09
Perspective of the Ageduto das Águas livres, circa 1800.

Figure 10
Siege of Lisbon, Roque Gameiro, 1917.

17. LARCHER, Cap. Jorge das Neves, *Memória Histórica sobre o abastecimento de Água a Lisboa até ao reinado de D. João V*. Lisboa: suplemento do Boletim da Comissão de Fiscalização das Obras de Abastecimento de Água à Cidade de Lisboa, 1937, p. 4.

18. FERREIRA, Maria Dolores, "O abastecimento de água à cidade de Lisboa nos Séculos XVIII e XIX" in *Revista Finisterra*. Lisboa: Finisterra, 1981. No. 31, p. 123. Available at: <https://doi.org/10.18055/Finis2193> (accessed 2021).

19. FERREIRA, Maria Dolores, op. cit., p. 124.

20. CEMBALEST, Robin, "From Kongo to Othello to Tango to Museum Shows", in *ARTnews* (October 25, 2012). Available at: <https://www.artnews.com/art-news/news/image-of-africans-in-western-art-2119/> (Accessed February 1, 2021).

Figure 11
Rua Nova dos Mercadores, séc. XVI.

Figure 12
Chafariz d’El-Rey, circa 1580.

21. FERREIRA, Maria Dolores, op. cit., p. 124.

22. “Eu el-rei faço saber a quantos este alvará virem, que, havendo-se intentado remediar a falta d’água que experimentar os moradores d’estas cidades (...) conduzir-se a fonte da Água-livre com outras que se podiam recolher, no aqueduto que estava traçado (...) hei por bem e mando que o superintendente que nomear para a mesma obra, ordene logo (...) que a dita obra se faça (...) e poderá (...) tomar todas as fonts que se puderem ajuntar e agregar à dita água (...) E não parará a dita obra por nenhum caso que seja”. CASEIRO, Carlos; PENA, Américo; VITAL, Raul, “Histórias e outras memórias do Aqueduto das Águas livres”, Lisboa: EPAL, 1999, p.38.

23. EPAL, s.v. “Aqueduto das Águas Livres”. Available at: <https://www.epal.pt/EPAL/menu/museu-da-água/exposição-permanente-património-associado/aqueduto-das-águas-livres> (accessed January 24, 2022).

24. FERREIRA, Maria Dolores, op.cit., p. 132.

Lisbon in the 16th century is the painting Rua Nova dos Mercadores, 1570-1590, which depicts one of the most important commercial entrepôts in Europe, where caravels and carriages from all parts of the world were anchored daily. The importance of water was such that places like the Chafariz D’el Rey and other fountains immediately became the main venues of the social and economic life of the city and its inhabitants.

The 18th and 19th century

At the beginning of the 18th century, under the reign of Joao V, Lisbon experienced a period of prosperity with monumental buildings such as churches, convents and palaces. However, the most important project with the greatest public impact was by far the construction of the Aqueduto das Águas Livres. By the middle of the 18th century, Lisbon counted about 80.000 inhabitants and only had a daily water supply of 560 m3, i.e. about 8 litres per person²¹ (in comparison, a person in a European household nowadays consumes about 150 l per day). To solve this urgent problem, construction was to begin on the large infrastructure of the aqueduct). To fund the monumental project, the city solicitor Cláudio Gorgel do Amaral created a new tax in 1731 called “Imposto Real de Água” on basic products such as meat, salt and wine.²² The aqueduct transported water over a distance of 18 km (today almost 60 km) from the Águas Livres spring north of Caneças to the “Casa das Águas” in Amoreiras, spanning the Alcântara Valley in an impressive series of 35 stone arches, the largest of which is 65m high.²³ Once the water had bridged the Alcântara Valley, it crossed Campo de Ourique, passing through the “Arco das Amoreiras”, arriving at the Reservatório Casa das Águas das Amoreiras . From here, it was distributed to the West, East and South via three main canals: Galeria das Necessidades towards the West, Galeria da Esperança towards the South, and Galeria do Loreto towards the East.²⁴ From 1748



11



12

Figure 13

Valley of Alcântara and the Aqueduto das Águas Livres, circa 1790.

Figure 14

Aguadeiros in „Chafariz de Dentro”, Alfama, 1907.

25. MARAT-MENDES, Teresa (coord.); MOURÃO, Joana; BENTO D'ALMEIDA, Patrícia; NIZA, Samuel, “Water and Agriculture Atlas: Lisbon Region 1900-1940”. Lisboa: ISCTE-IUL, 2015, p. 22-23. DOI: 10.15847/pm.2015.001. Available at: <https://repositorio.iscte-iul.pt/handle/10071/8985> (accessed 2021).

26. FERREIRA, Maria Dolores, op.cit., p. 130.

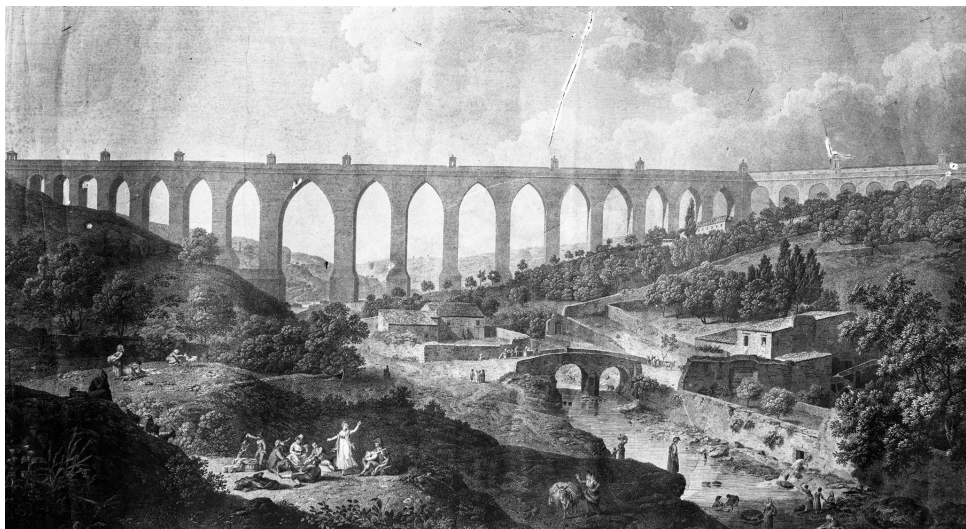
27. ALMEIDA MAIA, Susana Pais de; CORREIA DINIZ, Silva, “O bairro de Campo de Ourique: projectos e actuações (1878-1958)”, Dissertação de Mestrado em História da Arte Contemporânea, Lisboa: UNL, 2013, p.14. Available at: <https://run.unl.pt/handle/10362/13691> (accessed 2021).

28. FERREIRA, Maria Dolores, op.cit., p. 130.

29. *ibid.*, p. 131-134.

to 1880, Lisbon was supplied solely by the Aqueduto das Águas Livres. Most of the population fetched water from wells and fountains closest to their homes. Access to water was free, and those who could afford it had it fetched by watermen (aguadeiros) and brought to their households in 25-litre buckets at a cost of 20 reis each.²⁵ In addition, rich households could afford a private water access, a “pena de agua”, which supplied an amount of around 3308 l of water per day.²⁶

In the 19th century, Lisbon flourished economically. With the modernisation of water supply and other urban infrastructures, the city experienced population growth and was faced with new challenges. The expanded water supply infrastructures led to an increased use of public space, especially through fairs, where municipal services were installed. Streets inherited from earlier centuries became obsolete and had to be repaved or widened. The existing sanitation system was overburdened with the rapidly growing number of inhabitants, and diseases such as cholera took root.²⁷ Streets were considered one of the main sources of infection, as both human and animal waste was disposed of here. All this led to a government modernisation program being set in motion from the middle of the 19th century, which addressed three different areas: the water supply by a private company, the extension and improvement of the old sewerage network, and urban planning that would allow for better traffic and hygiene conditions. In the course of this, the company “Empresa das Águas Livres de Lisboa” was founded in 1858 and obliged by the state to provide 11,300 m³ of water every day for industrial and domestic purposes.²⁸ The company commissioned engineer M. Mary to study the terrain of Lisbon in order to expand the water network. Lisbon’s topography required an elaborate construction of water pipes and water depots at different levels, and planning errors eventually led to faults in the construction. During the reparation works in 1864, a new solution was sought as quickly as possible, and it was finally decided to draw water from the East from Canal do Alviela via another canal. The Reservatório de Campo de Ourique acted as a reserve, receiving water from both the Canal do Alviela and the Aqueduto das Águas Livres.²⁹ In 1868, there were 26 fountains in Lisbon with a total of 97 water outlets, some for



13



14

fetching water by the Aguadeiros and others for private use. The entire city was supplied by a total of 6 public and 1200 private fountains.³⁰ In 1884, along with other important urbanisation plans, a new plan for a sewage system was being prepared and presented. The polluted water from wells or households was used for agricultural purposes. The water supply and use in Lisbon at that time was strongly linked to the agricultural activity of the population.³¹ Parallel to the hydrological developments, industrial development brought with it an improvement in infrastructure, with new roads and streets being built and the railway line to Sintra inaugurated in 1887. Along with this, construction activity was concentrated mainly in the urban and suburban cores adjacent to the railway line.³² In 1894, a total of 12,808 buildings in Lisbon were supplied with piped water. At the time, the population used various springs located in central squares and fountains sited in public squares or in nearby private properties.³³ In Sintra, due to its morphological position on a slope on a high mountain, wells were rarer. Apart from being used for the evermore present issues such as street cleaning and sewerage, the water served as well as for agricultural, industrial and domestic purposes. In 1940, Lisbon counted around a million of inhabitants.³⁴ The water supply was still provided by private and public wells, furnished by the Aqueduto das Águas Livres (1748) and the Aqueduto Avieia (1880), a system which could no longer sufficiently meet the needs of the growing population. This led to a contractual agreement between the engineer Duarte Pacheco, the Companhia das Águas Livres and the Minister of Public Works, in which it was decided that the Canal do Alviela and the water distribution network to Lisbon would have to be improved and the total water volume per day increased to 800,000 m³. The latter was to be done with the help of a water catchment tank in Zezere.³⁵ In 1935, construction of the Tejo Aqueduct began, and the improved water supply also made it possible to provide water to the neighbouring regions of Oeiras and Paço de Arcos. The construction and improvement of additional fountains was commissioned as part of a government improvement programme that the city embarked on thanks to an economic boom.³⁶ Furthermore, investments were made in hydroelectric power plants and the

30. MARAT-MENDES, Teresa, op. cit., p.23.

31. *ibid*, p.24.

32. BENALI, Karim Cunha, “O Aqueduto das Águas Livres como elemento dinamizador e regenerador do eixo Lisboa-Sintra”, Dissertação para obtenção do grau de Mestre em Arquitectura, Lisboa: FAUL 2016, p.31. Available at: <http://hdl.handle.net/10400.5/12049> (accessed 2021)

33. MARAT-MENDES, Teresa, op.cit., p.22-23.

34. *ibid*, p.107.

35. *ibid*., p.108.

36. *ibid*.

regularisation of water bodies, and each municipality was now served by its own water supply system as well as sewage system.³⁷ Such improvements were intended to prevent diseases caused by contaminated water, which continued to be a problem. Urban growth gradually displaced the agricultural land in the city and surrounding communities.³⁸ The aqueduct's large drinking water supply structure, which included public fountains, supply to farms, public institutions and private homes, functioned for barely 150 years and eventually could no longer respond to the rapid urban growth, so that it was eventually decommissioned.³⁹ The public fountains belonging to the aqueduct, which were used to supply drinking water during this period, created places of gathering for more than 150 years and marked a concise structure in public places in the city that is still visible today. The existence of the Reservatório da Mãe d'Água das Amoreiras next to Largo do Rato enhanced in this area of the city a new organisation and restructuring of the entire space and surrounding areas. The water supply through the aqueduct was an essential step in the modernisation of Lisbon. By building such a large infrastructure, comparable to the construction of a railway line, the cityscape changed and became increasingly urbanised. Streets became social arteries where people went to access fountains. Fountains and wells developed into new centres and social arenas. New solutions had to be found for the problems that accompanied the modernisation of the city. The capital developed into the only urban centre in Portugal and was thus competitive with other European cities. In the case of the railway, the aim is to shorten transport routes. The railway network is therefore strategically designed, partly in harmony with above-ground transport routes and main transport hubs. The path of the aqueduct is also strategic, responding to the morphology on the one hand, and on the other hand tangent to axes and centres of the city, which once served the simple purpose of good accessibility. Over the decades, however, these centres have shifted, and what was once an important hub is now no longer a centre in urban planning terms and is disappearing into the density of the modern city. In order to understand the relationship between public space and the aqueduct, it is essential to look at the history and previous events of the place under study and to examine elements such as water reservoirs and fountains, taking into account their historical context, to pose new questions for public uses in the future.

Figure 15
Chafariz D'El Rey, Alfama, 1907.

Figure 16
Aquaduto das Águas Livres, Lisboa, 1912.

Figure 17
Aguadeiros in „Chafariz da Esperança“, 1907.

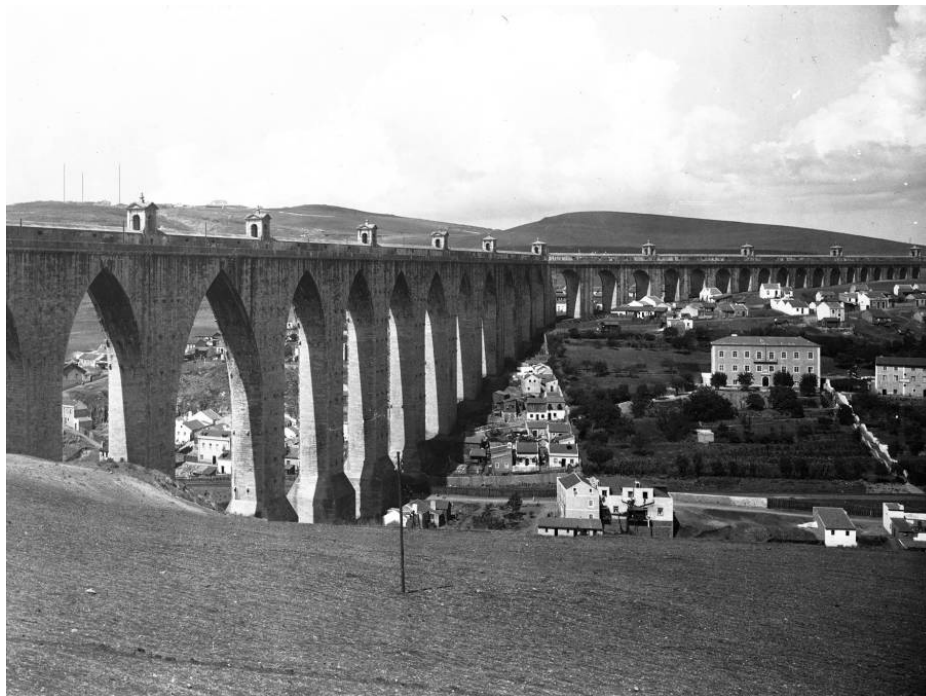
37. *ibid.*

38. *ibid.*, p.109.

39. BENALI, Karim Cunha, op. cit., p.31.



15



16



17

CHAPTER II

The old and the new: public space in changing times

Historical case studies in Lisbon



18



19

The old and the new: public space in changing times

Thus each of these places has its significance, its history, and one now understands why fountains and monuments are not located in the main axes of traffic, not in the centre of squares...

Camillo Sitte, 1889

With Lisbon's hydrological development in mind, a look at the representative elements of the aqueduct, such as the fountains, helps to trace its path in the urban fabric.

While the infrastructure of the aqueduct is largely underground, the various water outlets in the city of Lisbon are a key design feature and, as in many of its European counterparts, are an integral part of the cityscape. Considering the early industrial history of the city's water supply, it seems not surprising that an interplay of socio-political and technical developments also has a great influence on the overall image of a city. Fountains and wells developed into hubs of public life in parallel to the development of infrastructure: a fountain with ornamentation, a public square with amenity qualities, sometimes an entire garden or park that provided additional shade in combination with the refreshing fountain. The significance that those fountains had at the time of their original use, the water supply, changed over time. Stripped of their function as mere water givers, these places continue to exist today and shape the cityscape. They are often located at strategic points, manifest themselves through good accessibility and are visibly and representatively designed.

The reflections on the transformation of public places were already recorded by Camillo Sitte in "Der Städtebau nach seinen künstlerischen Grundsätzen". His work raises fundamental questions that are still relevant today. Sitte cites Italy first and foremost as an example of a well-functioning interaction between urban space and quality of life. According to him, the architectural principles on which Italian cities are built are so timeless, humane and insightful that they still lend themselves to modern considerations of urban planning. Public places are the hearts of a city, the paths leading to them urban arteries. Life takes place on the street, at the fountain, in front of the town hall. Thus, over the centuries, many different typologies of public places have emerged that once served a function and eventually outgrew it, while their spatiality still remains. Even if no one reads out announcements in the town hall square

Figure 18
Piazza della Signoria, Florence by Giuseppe Zocchi, 1744.

Figure 19
Piazza della Signoria, Florence, 2010.

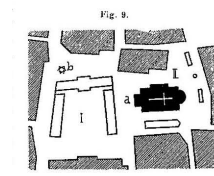
Figure 20
Schemes from Camillo Sitte - City Planning According to
Artistic Principles (1889).

40. SITTE, Camillo, op.cit, p. 13 et sqq.

41. *ibid*, p. 26.

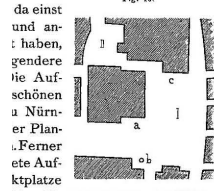
anymore, and the square around the fountains is no longer used for fetching water, these places are still centres of public life and signposts for finding one's way around a city, while conurbations of metropolitan density have grown up around them. Camillo Sitte's work was published at the end of the 19th century and thus written at a time of radical modernisation of cities. The work introduces the term urban planning into the discussion for the first time and continues to provide an impetus for thinking about the qualitative losses that modern urban planning entails. Sitte contrasts the artistic possibilities of urban planning with the pragmatic, mechanised and standardised features of the modern era.⁴⁰ He advocates certain principles for the design of public squares, colonnades, gardens, organically winding streets and many other public typologies. For him, it is above all the irregular that gives a city quality. In the case of Lisbon and the following examples under study, this reference becomes relevant when comparing the pre-modern reservoirs (Amoreiras, Príncipe Real) with those that follow the development of industrialisation (Reservatorio de Campo de Ourique), where the pure function of water storage comes to the fore, without ornamentation or quality of stay playing a role anymore.

In his chapter "Keeping the Centre Free", Sitte sets out his reflections on the placement of fountains. Fountains are witnesses of the times; their placement provides information about the historical context in which they were placed. Here, he gives an analogy to so-called "island-squares": he refers to old city maps of the Middle Ages and Renaissance, in which the squares would be crude and unpaved, as in the countryside, criss-crossed by paths.⁴¹ Fountains would be placed on the free "islands" between the naturally formed traffic routes. Thus, in a main square, a fountain would not be placed purely formally in the geometric centre of the square, but rather next to the road leading to the square, which may have originally served to provide water for the draught animals and in this respect had a purely practical and less formal reason. Sitte emphasises this spontaneity from which, in his view, urban beauty would be born, as remarkable, since each fountain has its own individual history and does not follow any formal pattern in its positioning. If it was once placed in an unpaved, traffic-free zone, it still stands there today,

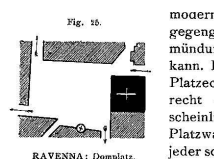


NÜRNBERG.
I. Marktplatz. II. Frauenplatz. a. Marienkirche. b. Der schöne Brunnen.

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ten unsymmetrisch auf solchen
zwar gewöhnlich neben einer
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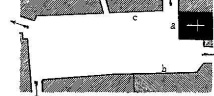


ROTHENBURG a. d. TAUBER.
I. Marktplatz. II. Brunn. a. Rathaus. b. Trinkenbr.



PADUA: S. Giordano.

auen der Kirche an
eachtenswerte Platz-
nunmehr in Unter-
iedenen Einbautungen
an einer Seite ange-
rei Seiten S. Antonio
in eineinhalb Seiten.
regelmäßig.



VERONA: Domplatz.

stellung hat aber nur Nachteile
Für das Bauwerk ist diese
weil der Effekt sich nirgends



VERONA: S. Fermo Maggiore.

schiedenen Bedingungen
in diesem
adition, be-
Enge der
ohrsbedürf-
Hilfe ihnen
währt sich
am glän-
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legen. Der
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aus der Häusermasse ein
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LUCCA: S. Michele.

en und Tischlern schon
in raffiniertester Weise
im handelte, Stein- oder
ch möglichst wenig auf-



FLORENZ: S. Croce.

Fig. 16. Plan of the market square in Brescia, showing the layout of the square and surrounding buildings.

BRESCIA: San Giovanni.

Fig. 17. Plan of the market square in Parma, showing the layout of the square and surrounding buildings.

PARMA: Pal. del Comune.

a. Pal. del Comune. b. Madonna della Steccata. c. Pal. della Podesteria. d. Piazza d. Steccata. e. Piazza Grande.

Fig. 18. Plan of the market square in Mantua, showing the layout of the square and surrounding buildings.

MANTUA: Piazza S. Pietro.

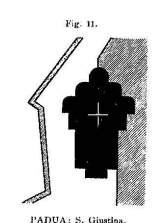
a. S. Pietro. b. Pal. Reale. c. F. Vincoville.

Fig. 19. Plan of the market square in Palermo, showing the layout of the square and surrounding buildings.

PALERMO: I. Piazza del Duomo.

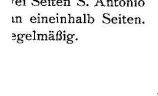
Fig. 20. Plan of the market square in Brescia, showing the layout of the square and surrounding buildings.

BRESCIA: Domplatz mit altem und neuem Dom.



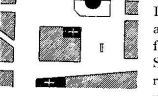
PADUA: S. Giordano.

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Fig. 18. Plan of the market square in Mantua, showing the layout of the square and surrounding buildings.

MANTUA: Piazza S. Pietro.

a. S. Pietro. b. Pal. Reale. c. F. Vincoville.

Fig. 19. Plan of the market square in Palermo, showing the layout of the square and surrounding buildings.

PALERMO: I. Piazza del Duomo.

Fig. 20. Plan of the market square in Brescia, showing the layout of the square and surrounding buildings.

BRESCIA: Domplatz mit altem und neuem Dom.

Fig. 21. Plan of the market square in Brescia, showing the layout of the square and surrounding buildings.

BRESCIA: Domplatz mit altem und neuem Dom.

Fig. 22. Plan of the market square in Brescia, showing the layout of the square and surrounding buildings.

BRESCIA: Domplatz mit altem und neuem Dom.

Fig. 23. Plan of the market square in Brescia, showing the layout of the square and surrounding buildings.

BRESCIA: Domplatz mit altem und neuem Dom.

Fig. 24. Plan of the market square in Brescia, showing the layout of the square and surrounding buildings.

BRESCIA: Domplatz mit altem und neuem Dom.

Fig. 25. Plan of the market square in Brescia, showing the layout of the square and surrounding buildings.

BRESCIA: Domplatz mit altem und neuem Dom.

even if the city has densified all around it. This means that every city has an individual arrangement of fountains and monuments, as every city has its own history. The younger the fountains, the more symmetrically placed, the older the more asymmetrical.⁴² Returning to an Italian example, he cites the fountain in front of the Palazzo Vecchio on the Signoria in Florence (Fig. 18+19) and the fountain on the Piazza Farnese in Rome, where the fountain is placed asymmetrically and not centrally aligned with its surroundings. His observations lead him to the following conclusion: “To the ancient rule of placing the monuments around the edges of the squares is thus added another genuinely medieval and more Nordic one: to place monuments, but especially market fountains, on the dead points of the square traffic”.⁴³

The following are examples of reservoirs and fountains in Lisbon that are linked to the aqueduct and still characterise the city today. Public places have developed around them, so that one could speak of their own typology, composed of reservoir and park. The focus will be on the two oldest and most significant ensembles of this kind, the Mãe d’Água das Amoreiras and the Reservatório do Patriarcal. Based on primary sources such as maps, images and texts, a description of the sites as well as a historical classification will be undertaken. The cartographic comparison is based on a map from 1807, in which Lisbon still consisted largely of farmland, and from 1911, in which the urban structure of the metropole as we know it today can already be seen. Sitte’s reflections serve as a starting point for thinking, on the one hand to trace the dialogue-like development of urban planning parameters of streets and fountains, as well as reservoirs in this case, and on the other hand to make a comparison of pre-industrial plazas (Jardim das Amoreiras) with those from more recent times (Reservatório de Campo de Ourique).

Figure 21
Chafariz do Rato, circa 1905.

⁴² *ibid*, p. 27.

⁴³ *ibid*, p. 28.



21



22



23

Historical case studies in Lisbon

Mãe d'Água das Amoreiras

Mãe d'Água das Amoreiras, also known as Arca de Água, Casa da Água ou Castelo de Água, is the main water reservoir that received water from the Aqueduto das Águas Livres in central Lisbon from the beginning. It is the second nucleus of the Museu da Água. The building was designed in 1746 by the Hungarian architect Carlos Mardel and was not completed until 1834, after his death. It was used to collect and distribute water from the Aqueduto das Águas Livres and is located near Largo do Rato.⁴⁴ Carlos Mardel was responsible for the design and construction of the Mãe d'Água das Amoreiras, and the construction of four monumental fountains, including the Chafariz do Rato and Chafariz da Esperança, and the fountain on Rua Formosa, which were integrated into the network of twenty-four fountains in the centre of Lisbon. He was thus instrumental in the design of public places along the aqueduct. Although Lisbon received its first water from the Carenque Valley in 1748, it took until 1867, almost one hundred and thirty years later, to complete the entire system, including its subordinate and emitting aqueducts.⁴⁵ In October 1744, the water from the aqueduct flowed for the first time into an improvised tank in Amoreiras. In 1746, construction work began on the arches of Amoreiras next to the reservoir. In 1748, with the completion of the 100th arch of the aqueduct, the Arch of Amoreiras, the distribution of water in the city began.

The Mãe d'Água reservoir is laid out along the longitudinal axis created by the preceding arch. In the vertical of this axis is the facade of the building. The Mãe d'Água building receives the water from the top of the triumphal arch, with a waterfall built from stones from the Águas Livres spring inside, and throws it into a basin placed centrally in the space of the building. Via a footbridge one can walk around this 7.5m deep water tank, which has a capacity of 5500 m³. A staircase on the right side of the waterfall leads to the roof with a view over Lisbon. The roof terrace overlooks the Tagus, the Basilica

Figure 22

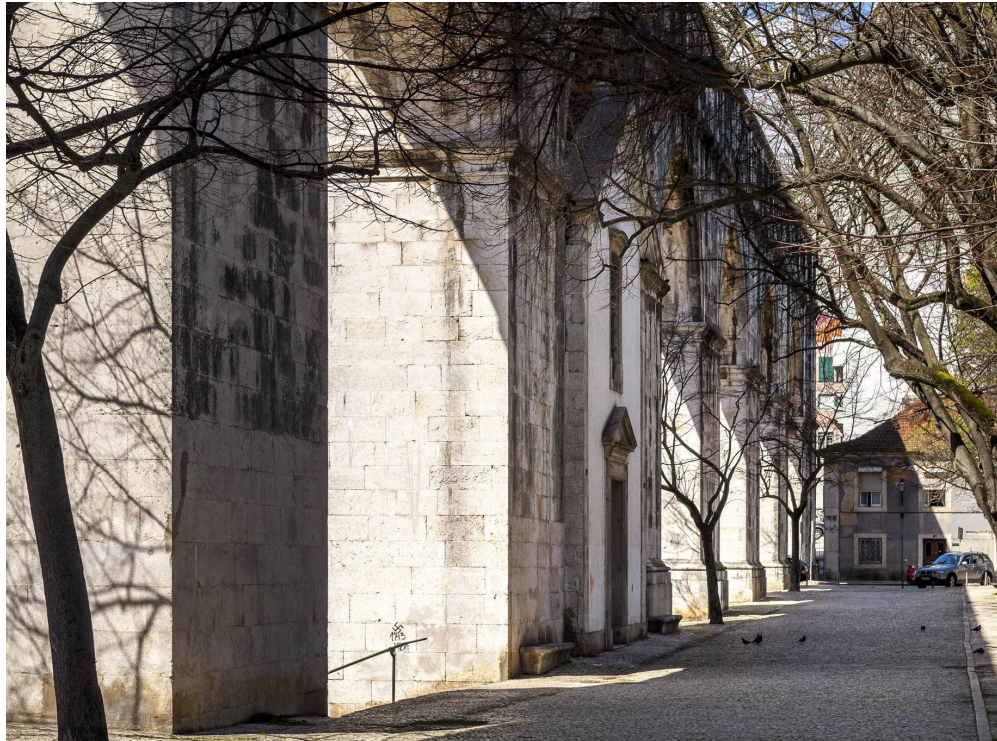
Arches of the aqueduct along the „Jardim das Amoreiras“, 1914.

Figure 23

Bird eye view of Mãe de Água das Amoreiras, 1930.

⁴⁴ Sistema de Informação para o Património Arquitectónico. Available at: http://www.monumentos.gov.pt/site/app_page-suser/SIPA.aspx?id=25486 (accessed May 2, 2021).

⁴⁵ FERREIRA, Maria Dolores, op. cit., p. 132.



24

da Estrela and the Igreja de Santa Isabel. To the South, one looks towards Largo de Rato. The Chafariz do Rato was also designed by Carlos Mardel and was supplied by the Galeria do Loreto.⁴⁶

Attached to the Mãe d'Água building is another smaller building, the Casa do Registo, from which two of the main galleries of the Águas Livres aqueduct emanate: Galeria do Loreto and Galeria da Esperança, as well as a smaller one that serves the Chafariz of Rato. The water transported by the Águas Livres aqueduct, when it arrived in Lisbon, was channelled through a network of five large galleries, most of them underground, with a length of about 12 kilometres, whose function was to ensure the supply of fountains and some public facilities: Chafariz do Campo de Santana, Chafariz das Necessidades, Chafariz do Loreto, Chafariz da Esperança and Chafariz do Rato. The Galeria do Loreto was built in 1746 and is 2998 metres long.⁴⁷ Today it can be visited from the Casa do Registo (Mãe d'Água das Amoreiras) on Rua das Amoreiras southwards to Príncipe Real (Reservatório do Patriarcal) and further on Rua do Século to Miradouro de São Pedro de Alcântara. It supplied the following fountains: Chafariz da Rua Formosa (1762), Chafariz de São Paulo (1848), Chafariz da Mãe d'Água (1840), Chafariz do Passeio Público (1771, dismantled), Chafariz do Carmo (1771), Chafariz do Loreto (1771, dismantled).⁴⁸

In 1856, a project for a new water distribution network was implemented in Lisbon, which was realised with the construction of new reservoirs between 1869 and 1864, eventually making the function of the Mãe d'Água obsolete. From 1867, the distribution of piped water to some houses in Lisbon began, and from 1880, with the construction of the Canal do Alviela, this distribution network for households became increasingly larger. The Galeria da Esperança also starts from Mãe d'Água das Amoreiras and runs parallel to Rua de São Bento and Avenida D. Carlos I to the Conde Barão area with a total length of 1425 m. It includes the São Bento Arch (1758, dismantled, rebuilt in Praça Espanha) and the following fountains: Chafariz da Rua do Arco (1805), Chafariz do Arco de São Bento (1805, dismantled), Chafariz da Esperança (1768), Chafariz do Cais do Tojo (1784).⁴⁹

Figure 24
„Jardim das Amoreiras”, 2022.

Figure 25-27
„Jardim das Amoreiras”, 1930.

46. BENALI, Karim Cunha, op. cit., p. 26-27.

47. Wikipedia, The Free Encyclopedia, s.v. “Galeria do Loreto”. Available at: https://pt.wikipedia.org/wiki/Galeria_do_Loreto (accessed February 10, 2022).

48. *ibid.*

49. ANDRADE, Velloso de; SERGIO, José, Memoria sobre chafarizes, bicas, fontes, e poços públicos de Lisboa, Belem e muitos logares do termo : offerecida á ex.ma camara municipal de Lisboa. Lisboa: Silviana, 1851, p. 4-6. Available at: <https://archive.org/details/memoriasobrechaf00vell/page/263/mode/thumb> (accessed 2021).



25



26



27

Jardim das Amoreiras and Chafariz do Rato

The Jardim das Amoreiras, officially called Jardim Marcelino Mesquita, is a garden located on the Praça das Amoreiras. It was designed by Marquês de Pombal and inaugurated in 1759. It owes its name to the 331 mulberry trees that Marquês de Pombal planned to plant there for silk production. Longitudinally, its entrance is bordered to the southwest by the arches of the aqueduct, which flow into the Mãe d'Água das Amoreiras. On the fifth arch is the chapel of Nossa Senhora de Monserrate (1768). Towards the northeast, it borders a former silk factory and several 18th century houses once built for the silk factory workers. The garden is six thousand square metres in size, with a round fountain in its centre.⁵⁰ Primary sources such as illustrations and maps can be used to trace the development of the garden in the urban fabric. As late as 1807, the area to the northeast of the Jardim das Amoreiras (parish of Santo Antonio) was largely agricultural land, while the only development in the area was concentrated around the garden itself and between Mãe d'Água das Amoreiras and Chafariz do Rato. The Jardim das Amoreiras is the only structured garden in the Santo Antonio neighbourhood at this time. The interaction between public space and water collection points seems clear even from this early mapping: the Reservatório da Mãe d'Água and the Jardim das Amoreiras form an urban ensemble that will manifest itself in the same place in the city more than 200 years later. The 1807 map also shows that the density of buildings around the Jardim das Amoreiras is significantly higher than around the neighbouring agricultural fields. In the 1807 map, six streets run towards the Praça do Rato, where the Chafariz do Rato is located. Buildings are mainly oriented along the roads, and wells are again located along roads or at their intersections, as it was necessary to ensure the easiest possible access to water for livestock and people. The Chafariz do Rato fountain is located in the immediate vicinity south of the Mãe d'Água. It is fed by a single branch of the Mãe d'Água das Amoreiras. In 1752, the fountain was designed by Carlos Mardel, which explains its uniform architectural style with the Casa das Águas. The

Figure 28
Map with Jardim das Amoreiras, Mãe de Água and Largo do Rato, Lisbon, 1857.

50. Wikipedia, The Free Encyclopedia, s.v. "Jardim das Amoreiras". Available at: https://pt.wikipedia.org/wiki/Jardim_das_Amoreiras (accessed February 15, 2022).

Figure 29
Map of Lisbon, Duarte Fava, 1807.

Figure 30
Map of Lisbon, Silva Pinto, 1911.

51. RODRIGUES, Joana Mafalda Pimenta, “Caminho de vida: Aqueduto das Águas Livres : património hidráulico português”, Dissertação de Mestrado em Arquitectura, Lisboa: Universidade Lusíada, 2017, p.79. Available at: <http://hdl.handle.net/11067/3326> (accessed 2022).

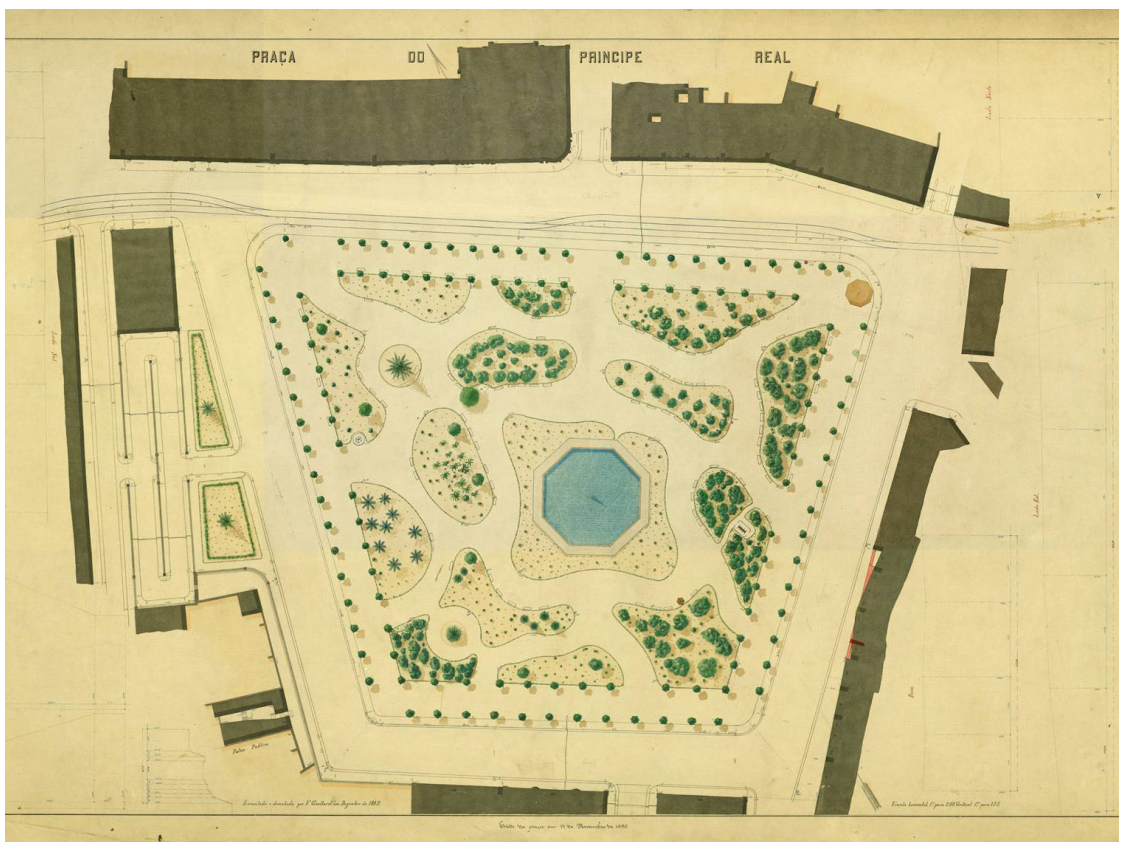
trapezoidal building is divided into two levels, which are connected by a staircase at the side. The lower floor consists of a basin that was used for cattle to drink. The upper floor, a basin lined by a back wall, was for the people.⁵¹ If one compares the historical map of 1807 by Duarte Fava with a map of 1911 by Silva Pinto, done about a century later, some conspicuous urban changes become clear: in almost parallel alignment to the longitudinal axis of the Jardim das Amoreiras, the Avenida da Liberdade has been laid out to the east with its mouth in the Praça Marquês de Pombal. The agricultural areas have given way to Parque Eduardo VII, whose outlines are already visible, but which is still under construction. To the west, the geometry of the Reservoir de Campo de Ourique is parallel to the axis of the Amoreiras Garden. Rudiments of the grid in Campo de Ourique already hint at the future urban densification of the neighbourhood. To the southeast and southwest of the Jardim das Amoreiras, two crucial parks have been added: Praça do Príncipe Real to the southeast, whose reservoir is connected to Galeria do Loreto, and Jardim da Estrela to the southwest, which was fed by Galeria das Necessidades. In the urban densification over the centuries, the gardens and parks with their fountains crystallise as timeless oases in the city. The inseparable interplay of water and public (green) space seems to become clear once again from the historical maps and developments of the above-mentioned examples.



29



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31

The Reservatório da Patriarcal and Praça do Príncipe Real

The Reservatório da Patriarcal is the third nucleus of the Museu da Água. It was designed in 1856 by the French engineer Louis-Charles Mary and built between 1860 and 1864 to supply the downtown area of the city. It is located underground in the Jardim do Príncipe Real, under a lake with a fountain whose iron railing matches the octagonal shape of the reservoir. The reservoir has a total capacity of 884 m³ of water and was built to regulate the pressure between the Reservatório do Arco and the network of pipes in the lower part of the city. It was originally supplied by the Aqueduto das Águas Livres and from 1833 by the Alviela system. The cistern is made up of 31 columns, each 9.25 m high, which support the stone arches that support the vaults. On top of the vaults is the basin (lake), with a fountain. Both the lake and the fountain served to aerate the water before it was fed into the tank. The drained water entered the tank through four openings at the bottom of the basin, which were fitted with pipes that reached the surface of the water and served as drains. Three underground galleries emanate from this reservoir: the first, which breaks out on the east wall, is connected to the Loreto gallery and was used to transport the water from the Arco reservoir. The second ends at Rua da Alegria and the third, which begins on the west wall to Rua de São Marçal, supplies the western part of Lisbon. The Reservatório da Patriarcal was shut down in the middle of the 20th century and later integrated into the Museu da Água.⁵²

The Praça do Príncipe Real received its present name in 1855, was renamed Praça de Rio de Janeiro in 1910 and was given the name Praça do Príncipe Real, in honour of Queen Maria II's first son, again in 1949. In 1853 the first plans for the garden were drawn and in 1869 planting began, mainly with the majestic cedars, araucarias and elms that can still be seen today. The garden consists of flowerbeds and paved paths that cut through them. In the midst of the organic structure stands the octagonal tank

Figure 31
Jardim do Príncipe Real, Levantamento topográfico de
Francisco Goullard, 1890.

52. EPAL, s.v. “Reservatório da Patriarcal”. Available at: <https://www.epal.pt/EPAL/menu/museu-da-agua/exposicao-permanente-patrimonio-associado/reservatorio-da-patriarcal> (accessed January 3, 2022).

Figure 32
„Biblioteca no Jardim do Principe Real“, circa 1935.

Figure 33
„Jardim do Pricipe Real“, 1930.

53. Sistema de Informação para o Património Arquitectónico, s.v. “Jardim do Príncipe Real”. Available at: http://www.monumentos.gov.pt/Site/APP_PagesUser/SIPA.aspx?id=6998(accessed January 3, 2022).

already described. The organic flowerbeds, together with the trees, form the outer physical boundaries of the garden.⁵³ The relationship to the outside is open, occasionally the trees provide a visual shelter to the inside. If one compares the urban situation on the basis of the map of 1807 and 1911, a decisive difference to the case of the Jardim das Amoreiras emerges. While in the early nineteenth century the Jardim das Amoreiras with its adjacent buildings bordered on predominantly rural areas and fields, the area of Príncipe Real was already a dense urban fabric with an open space in the middle, where the Reservatório da Patriarcal and garden would be built about half a century later. One can only guess how the city would have densified if a water reservoir with a park had not been built on this site. Today, however, when walking through the area around the Jardim do Príncipe Real, the presence of the reservoir and the exotic planting are key features of the area’s quality of stay. Complimentary amenities such as kiosks, play tables, a children’s playground, an esplanade and drinking fountains enliven the square today and build on the almost unchanged substance of the original garden, whose timeless design has become an almost untouchable Lisbon landmark. This example also reveals the relationship between the aqueduct, which provides water, and the resulting lively environment of a park. Quite naturally, this ensemble of water and public space seems to have become an organic unity, and the water, which is a necessity, and in this case piped into the city via an underground canal instead of a natural spring as in pre-industrial times, produces a green space in the midst of urban density. As in the example of the Jardim das Amoreiras, which follows the same typological logic of a reservoir and park ensemble, the Príncipe Real garden is still an essential public space with a high quality of stay, whose reach shapes the entire Príncipe Real neighbourhood beyond its boundaries.



31



32

The neighbourhood of Campo de Ourique in the end of the 19th century and the Reservatório de Campo de Ourique

The modernisation program in Lisbon was also intended to respond to the increasing housing shortage, and to develop a strategy for the expansion of Lisbon's city limits.

A development project for Campo de Ourique was one of the first attempts to densify the city. Campo de Ourique is a plateau located between two valleys, which in the 17th century was a rural landscape covered with olive trees, fruit trees, fields and mills, (Campo= field). Wheat was grown here to supply the city's bakers. Until the 18 century, the current district was mainly home to convents, some palaces, large estates and farms. After the construction of the Aqueduct (completed in 1748), but especially after the earthquake of 1755, which spared the area, the site experienced a first phase of occupation and construction. By the end of the 19th century (from 1879), a real urban project gave birth to the Campo de Ourique neighbourhood, transforming it into a residential area of Lisbon with well-designed streets, new houses and modern urban architecture, thus extending the perimeter of the capital. At the time of the construction of the Reservoir, Campo de Ourique was a rural area, located northwest of the city centre Rossio. In 1884, the Commission of Urban Works and Improvements announced the intention to extend the road network to increase the size of the neighbourhood. To the east, the neighbourhood was opened up along the street Rua Ferreira Borges, as new plots of land were acquired, and it was extended to the west by opening two new parallel streets: Rua Tenente Ferreira Durão and Rua Azedo Gneco.⁵⁴ Due to the change in the alignment, a triangular block was formed to the north of the road network. In the course of the planning, there were a number of expropriations of farm owners to implement urban development plans.⁵⁵ The presence of a new neighbourhood with new residents and demands was increasingly felt, and the architectural response was to develop a proportional block

Figure 34

„Planta de Campo de Ourique (ante da construção do Reservatório)“, 1857.

54. ALMEIDA MAIA, Susana Pais de; CORREIA DINIZ, Silva, op. cit., p. 65.

55. *ibid*, p. 66.

Figure 35

„Vista aérea das zonas de Campo de Ourique e Amoreiras em Lisboa vendo-se o reservatório de Campo de Ourique“, 1950.

Figure 36

„Reservatório de Campo de Ourique“, 1904.

56. *ibid*, pp. 73-79.

57. Sistema de Informação para o Património Arquitectónico, s.v. “Reservatório de Campo de Ourique”. Available at: http://www.monumentos.gov.pt/Site/APP_PagesUser/SIPA.aspx?id=26936 (accessed February 6, 2021).

58. ALMEIDA MAIA, Susana Pais de; CORREIA DINIZ, Silva, op. cit., p.73-79.

system. This orthogonal system required straightening and rationalisation of the boundary streets to facilitate access. The neighbourhood became more and more important and towards 1887 attempts were made to open up Campo de Ourique to the surrounding areas and the city centre.

The inhabitants of Campo de Ourique felt isolated and demanded further measures to connect the neighbourhood with the city. Among other things, a wall separating Rua de Campo de Ourique from Estrada da Circunvalação was to be demolished. The construction work for the Reservatório de Campo de Ourique also clashed with the wishes of the residents, as this would prevent an extension of the Rua de Infantaria and thus a connection to the city centre. However, the morphological characteristics of the Campo de Ourique plateau proved ideal for the construction of a reservoir. Such a large functional structure required as large and undeveloped space as possible.⁵⁶ The Reservatório de Campo de Ourique was connected to both the Aqueduto das Águas Livres and the Canal do Alviela. In 1880, construction work began. The reservoir was built with a capacity for 120.000 m³ of water to reinforce the water supply in summer or in case of a break in the Canal do Alviela. In 1890-1892, Portland cement was imported directly from France for the construction, with a total quantity of 2281 tons. The reservoir covers a total area of 26.136 m² and is held up by a cross vault.⁵⁷

The second planning phase for the Campo de Ourique neighbourhood was mainly dedicated to the improvement and installation of infrastructural fixtures such as latrines, wells and washing facilities in Rua Ferreira Borges. The Campo de Ourique project served less to promote the expansion of the city and more to provide building land for housing. In the context of urban planning at the time, Lisbon was not seen as a unified city, but as a collection of several independent settlements with their own character. Campo de Ourique remained a secondary project in the course of these plans due to its external location.⁵⁸

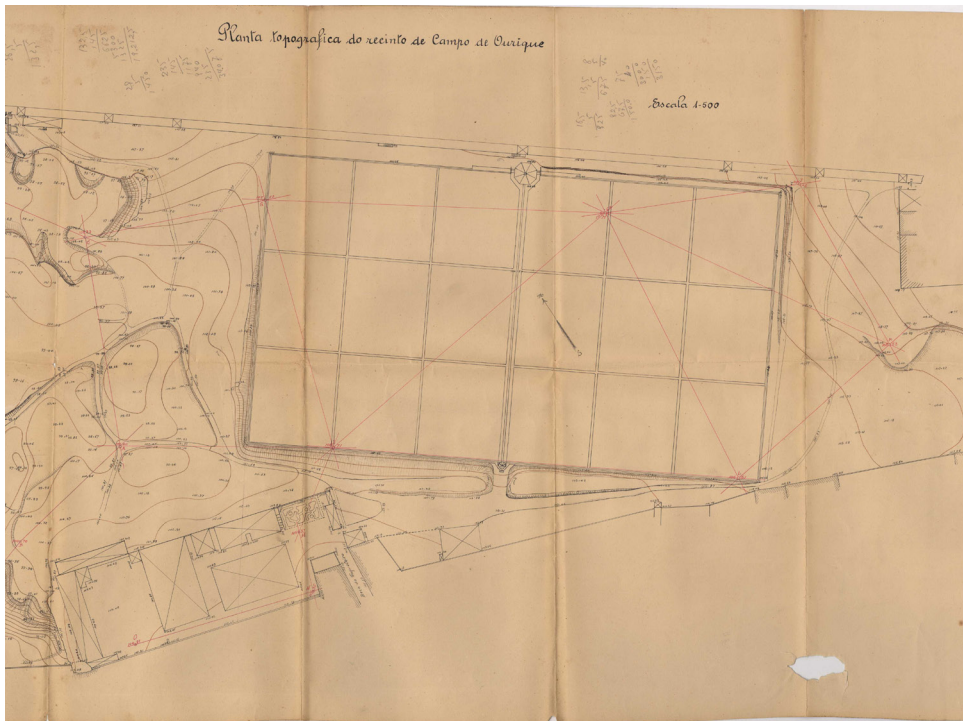
In terms of urban planning nowadays, the Reservatório, which is currently covered by a lawn and inaccessible to the public, is located in a challenging node: it is bordered to the southwest by the gridded



35



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38

and well-functioning residential neighbourhood Campo de Ourique, and to the northeast it is within walking distance of the Jardim das Amoreiras. Also to the northeast and directly adjacent are the towers of the Amoreiras Shopping Centre, which from the inside have an impressive view over Monsanto and the river, but from the outside, despite their practicality in everyday life, appear imposing and impetuous in the cityscape. Previous urban planning attempts to revitalise the area have failed, and the caesura created by the construction of the large reservoir is being felt more than ever. The strategic connection to the neatly structured and well-functioning neighbourhood of Campo de Ourique is interrupted by the reservoir, which is a large bubble in the city, and the traffic arteries, prohibiting any seamless transition to the surrounding areas, whether to the Jardim da Mãe d'Água das Amoreiras or to get to Campolide. It almost seems as if the modern intervention has failed to include public space in its role compared to its historically earlier counterparts, Mãe d'Água and Reservatório da Patriarcal. Instead of any attempt at a garden or park with fountains, the reservoir rests with a purely functional *raison d'être* underground, and is not visitable either on its surface or as a spatiality. In this way, it differs essentially from the other, earlier reservoirs that combine function with public usability. They can be visited, and their ornamental decoration indicates the historical planning that always included the public eye. On the basis of this, a change in thought from early industrialisation to modernity can be seen, in which ornamentation and publicity were exchanged for pure functionality, as can be seen in the example of the Reservatório de Campo de Ourique.

The modern urbanisation processes of industrialisation have in many ways shaped the image we have today of a European metropolis. In Lisbon, urban development was primarily linked to the aqueduct and water supply. The public spaces that emerged are testimony to that dynamic infrastructure, which produced not only fountains but entire gardens and magnificent underground water reservoirs.

A chronological examination of the case studies of the reservoirs and the public gardens associated with them reveals a clear change. While the earlier reservoirs were designed with care and representation in

Figure 37
„Planta topográfica do Reservatório de Campo de Ourique“,
1888.

Figure 38
Sections of Reservatório de Campo de Ourique, 1888.

Sequence of maps:
The following schematic maps were created on the basis of historical maps of Lisbon by Duarte Fava (1807) and Silva Pinto (1911), tracing the urban densification that took place within a little over a century. The industrialisation and urbanisation of Lisbon is particularly visible in the Campo de Ourique, where rural zones were transformed into an urban grid over the course of the century.

Sequence of photographs:
The reservatório de Campo de Ourique, photographed by the author, 2021.

both the ornamentation and the design of their gardens, these objectives disappeared with the expansion of the city of Lisbon into a metropolis. Mechanisation and functionality conquer the field, and ornamentation and gardens, it seems, have to give way and no longer have a place in the mechanised water supply that finally reaches Lisbon in the 20th century. When one considers that the first reservoir buildings (Mãe d'Água, Reservatório da Patriarcal) are still timeless and vibrant places of public life today, the radicality of modernity, in which such aspects often found no place, becomes palpable. For future planning, it is worthwhile to take an example from the well-functioning timeless typologies of the 18th century and reinterpret the thinking behind them in order to continue to create timeless places of public life that are linked to infrastructures.

- buildings 1807
- buildings 1911
- - - streets 1807
- - - streets 1911
- - - river











CHAPTER III

„Um reservatório de espaços“

A hypothesis

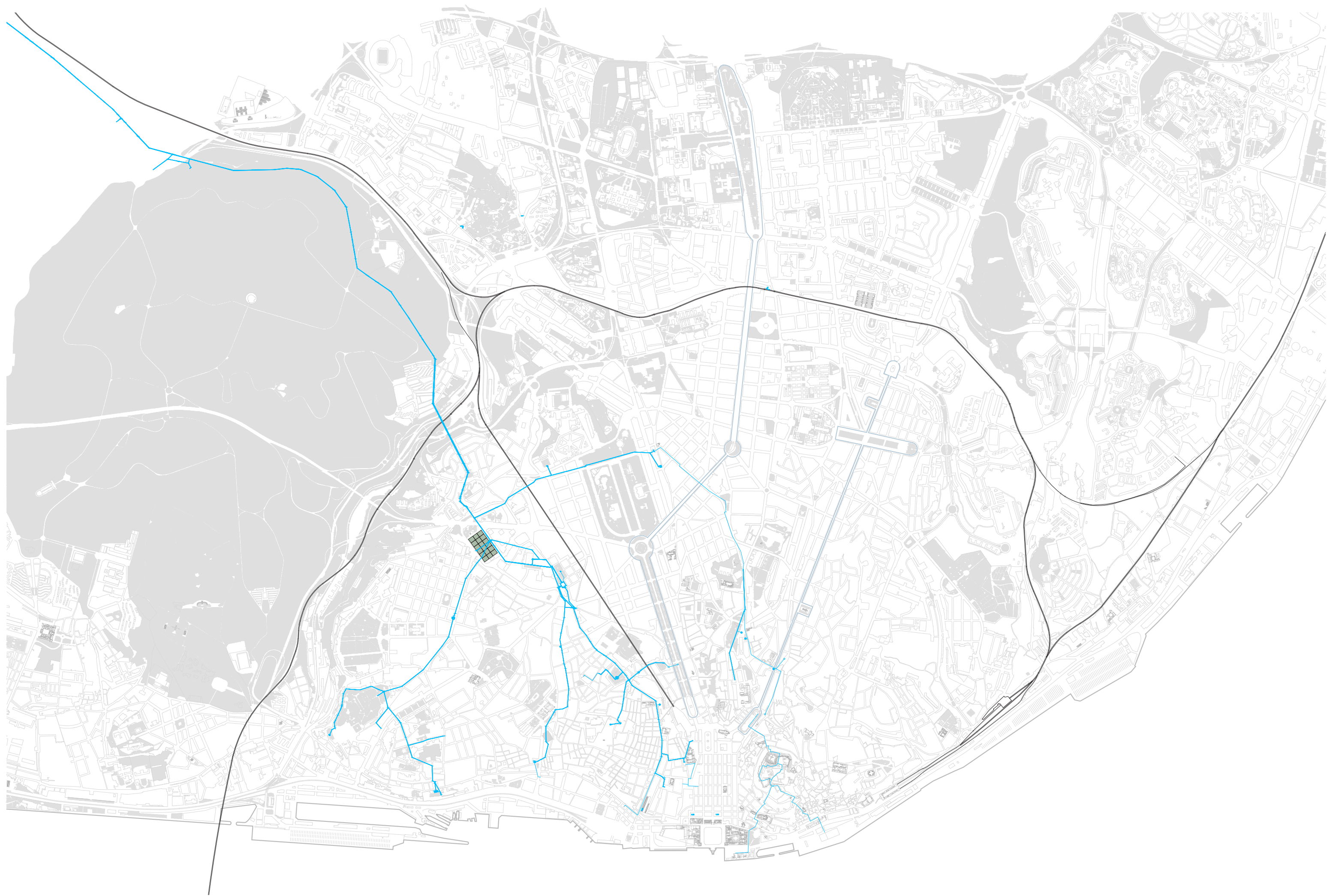
Strategy
City and Infrastructure

The significance of the aqueduct as a dynamic, prominent axis in the cityscape, which is so clearly visible on the maps but has been lost in reality, should be restored. The site approach follows the crossing of two infrastructures, the railway and the aqueduct.

In order to revive an idea of public space that accompanied the structure of the aqueduct for centuries, a hypothesis is put forward for an urban transformation of the Reservatório de Campo de Ourique for the area between Campo de Ourique, Campolide, Avenidas Novas and Santo António. The proposal aims to repair the urban caesura caused by the reservoir in the urban fabric and to integrate and vitalise it as a connecting point of the adjacent neighbourhoods.

 Aqueduct
 Railway

Lisbon
1:25000



Strategy
Infrastructure and public space

This map highlights the path of the aqueduct, showing the connection between the site (Reservatório de Campo de Ourique) and the other reservoirs (Reservatório dos Arcos, Mãe d’Água) that lead towards the lower part of Lisbon. Marked in blue are the reservoirs’ structures that are subterranean or on street level. Once again, the path of the aqueduct becomes clear on the map. Underground and partly above ground, it connects central public places, but various obstacles prevent a fluid connection in reality. In terms of urban planning, the project is located in a challenging node: it is bordered to the southwest by the gridded and well-functioning residential neighbourhood Campo de Ourique, and to the northeast it is within walking distance of the Jardim das Amoreiras with the Mãe d’Água, which forms the distributor for three galleries of the aqueduct towards the river. Also to the northeast and directly adjacent is the commercial Amoreiras Complex, whose tower brings an impressive urban scale to the site.

The grid

The starting point was to define a clear boundary within which a protected but accessible place, like a hortus conclusus, should lie. Different volumes were thought as access at the project boundaries.

The project boundaries are based on the urban axes that define the site, and furthermore follows the grid of Campo de Ourique and the structure of the subterranean reservatorio.

The connecting gallery follows the example of public galleries and loggias, which are mainly found in Italian Renaissance cities. Examples include the Corridoio Vasariano or Galeria dei Ciompi in Florence or the Rustem Pasha Caravanserai (1560) in Turkey, a typology of multi-storey galleries that bordered an inner courtyard and served merchants as resting places and markets. The classic hortus conclusus, found in monastery or temple typologies, which is essentially a garden physically separated from its surroundings by a walkway, also serves as a reference for the project.

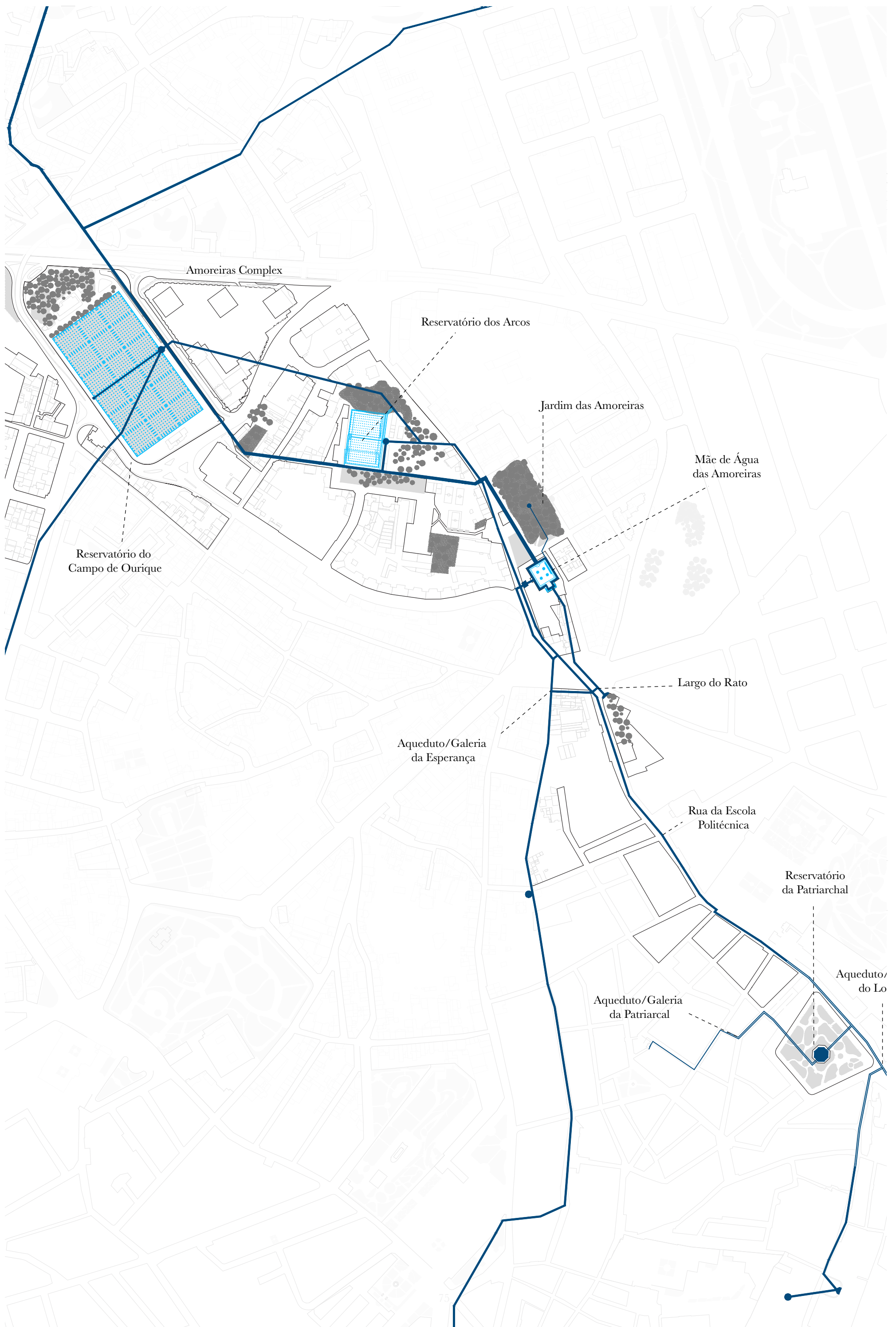
Figure 39
Karawanserei, Turkey, 1560.

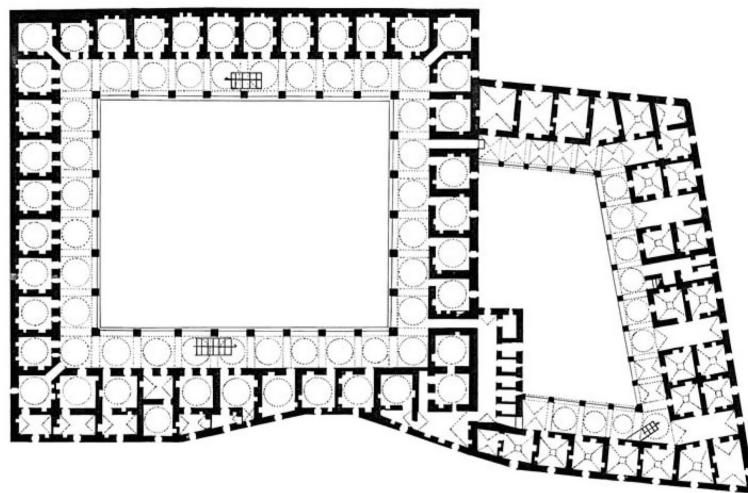
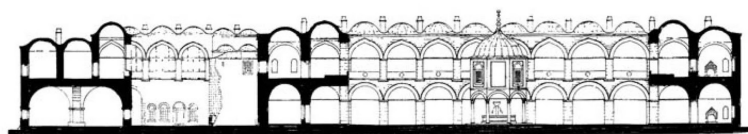
Figure 40
Areal photograph Karawanserei, Turkey.

Figure 41
Corridoio Vasariano, A gallery connecting Palazzo Vecchio and Palazzo Pitti, Giorgio Vasari, Florence, Italy, 1565.

Figure 42
The Corridor Of The Uffizi, Benedetto De Greyss, circa 1750.

Infrastructure and reservoirs
1:5000

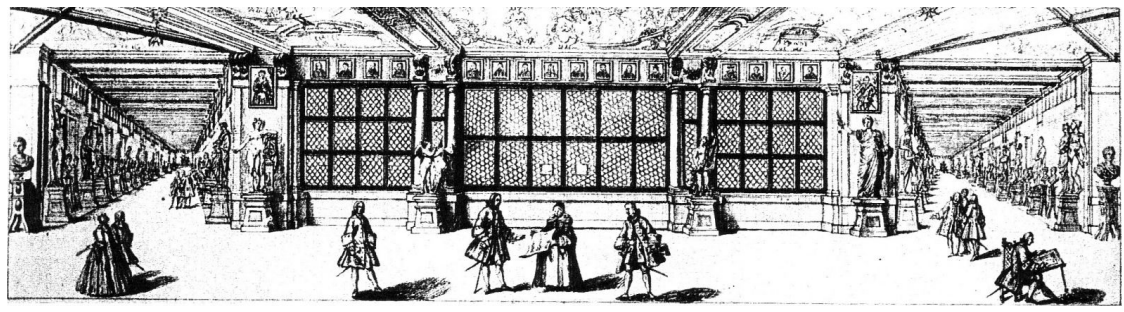
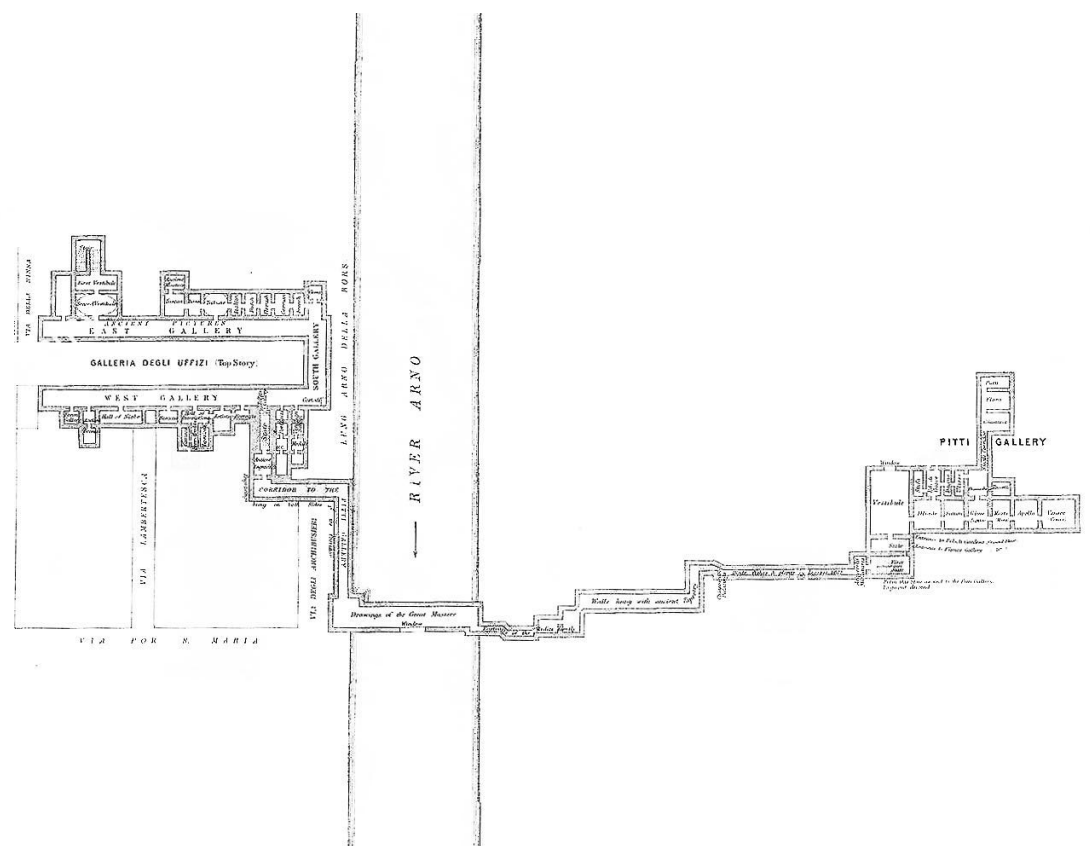


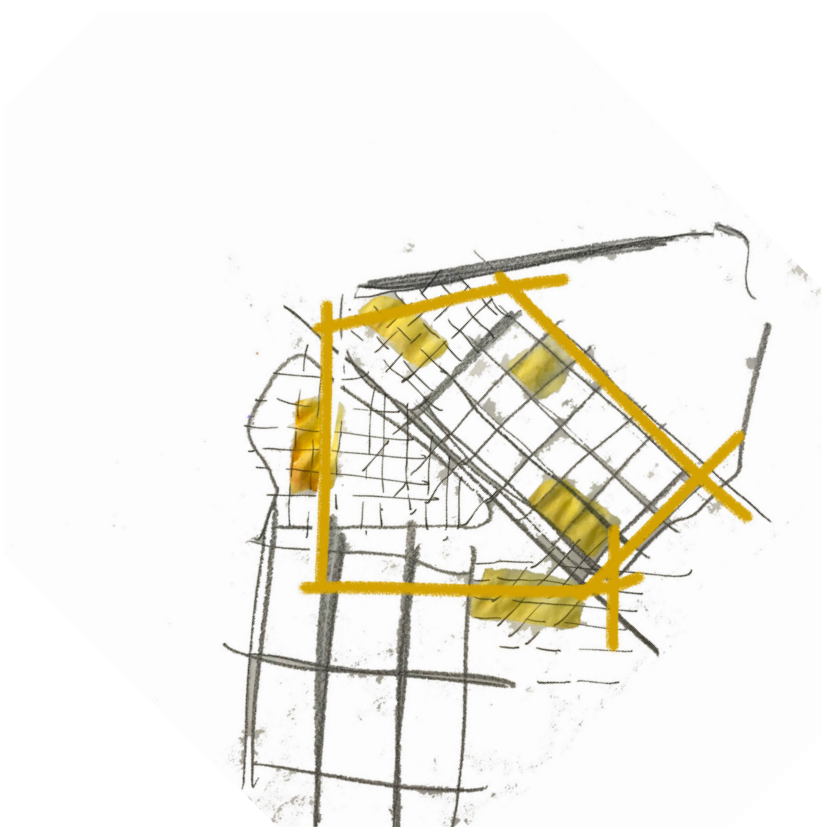
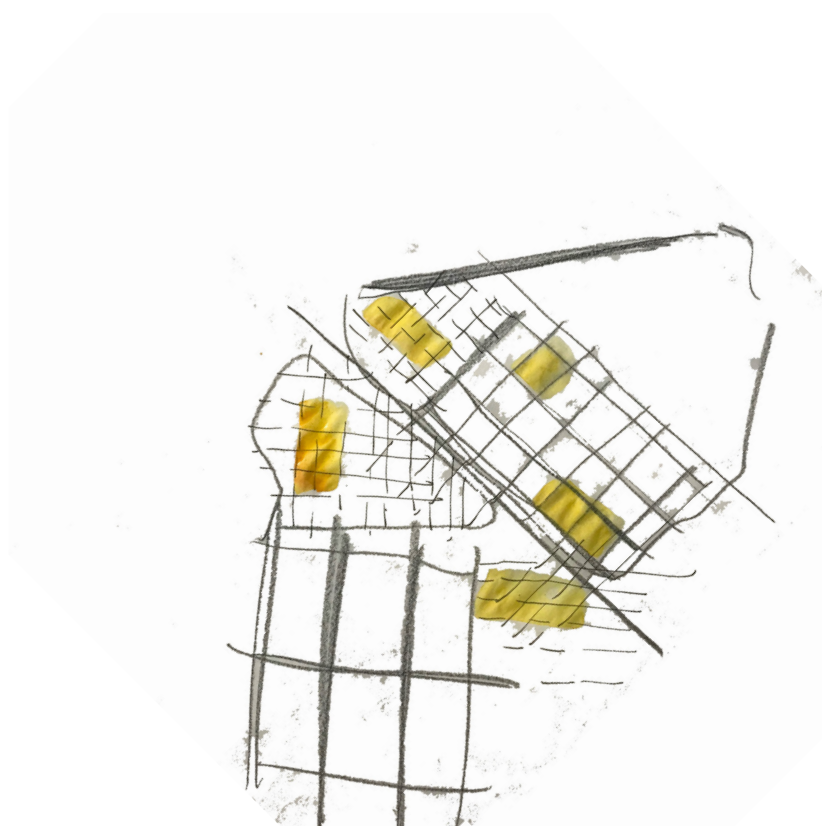
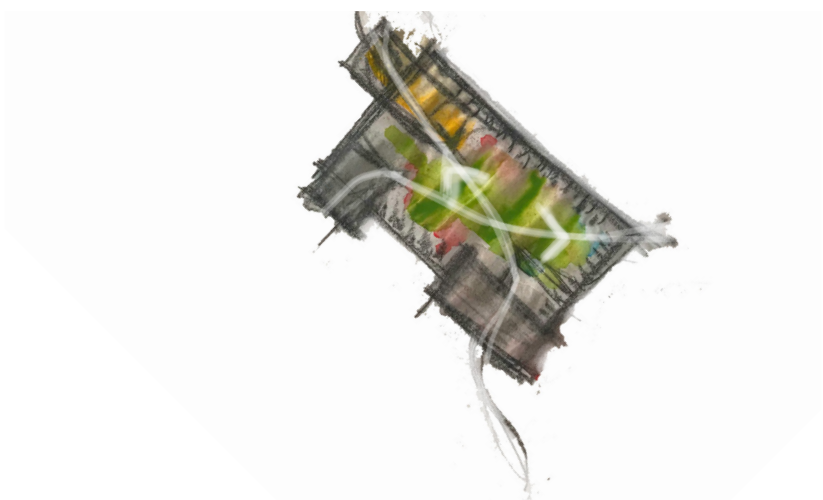
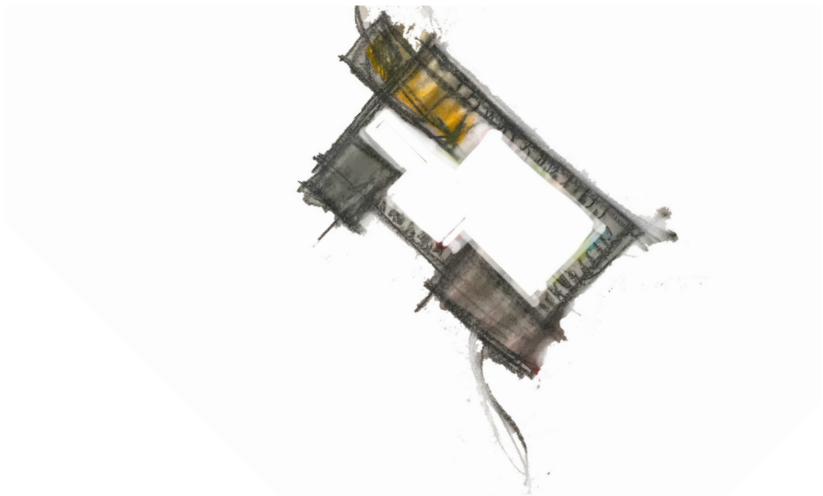


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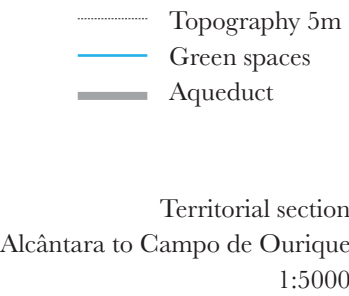


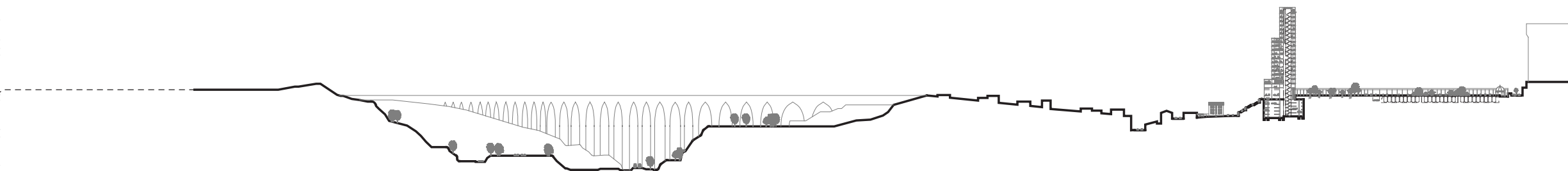
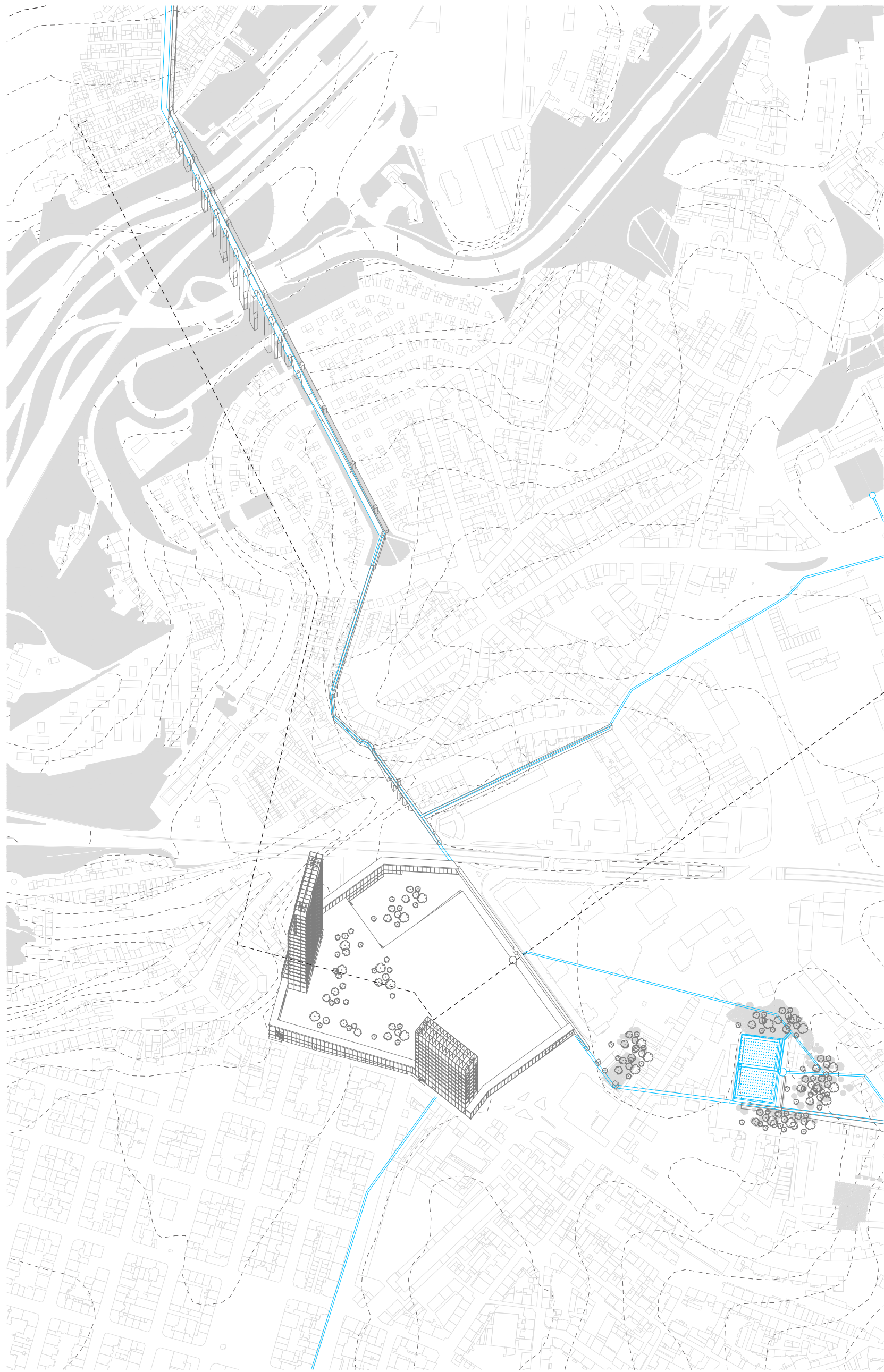


Strategy
Territorial sections

A territorial section is showing the path from the valley of Alcantara to the site of Campo de Ourique

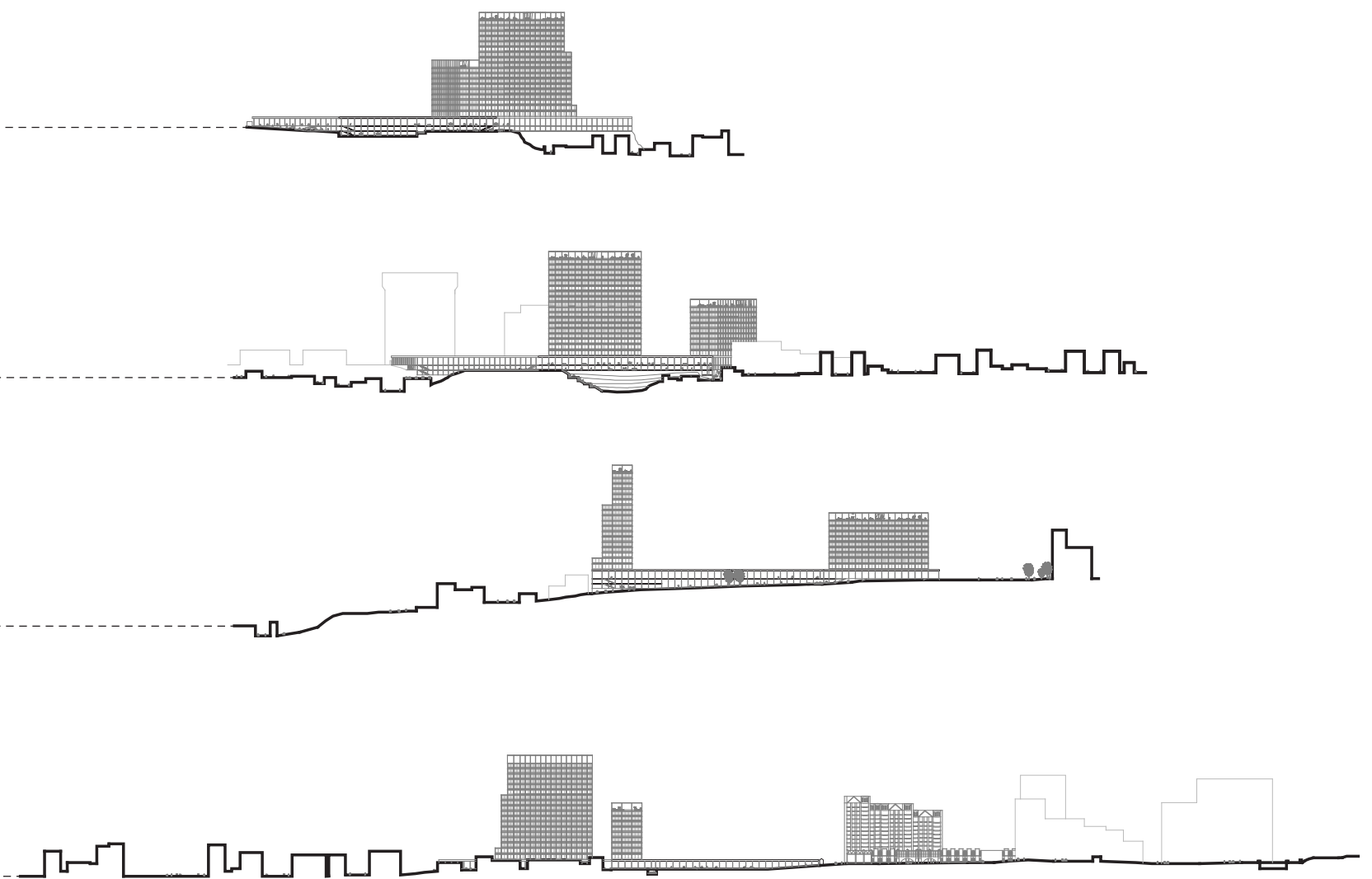
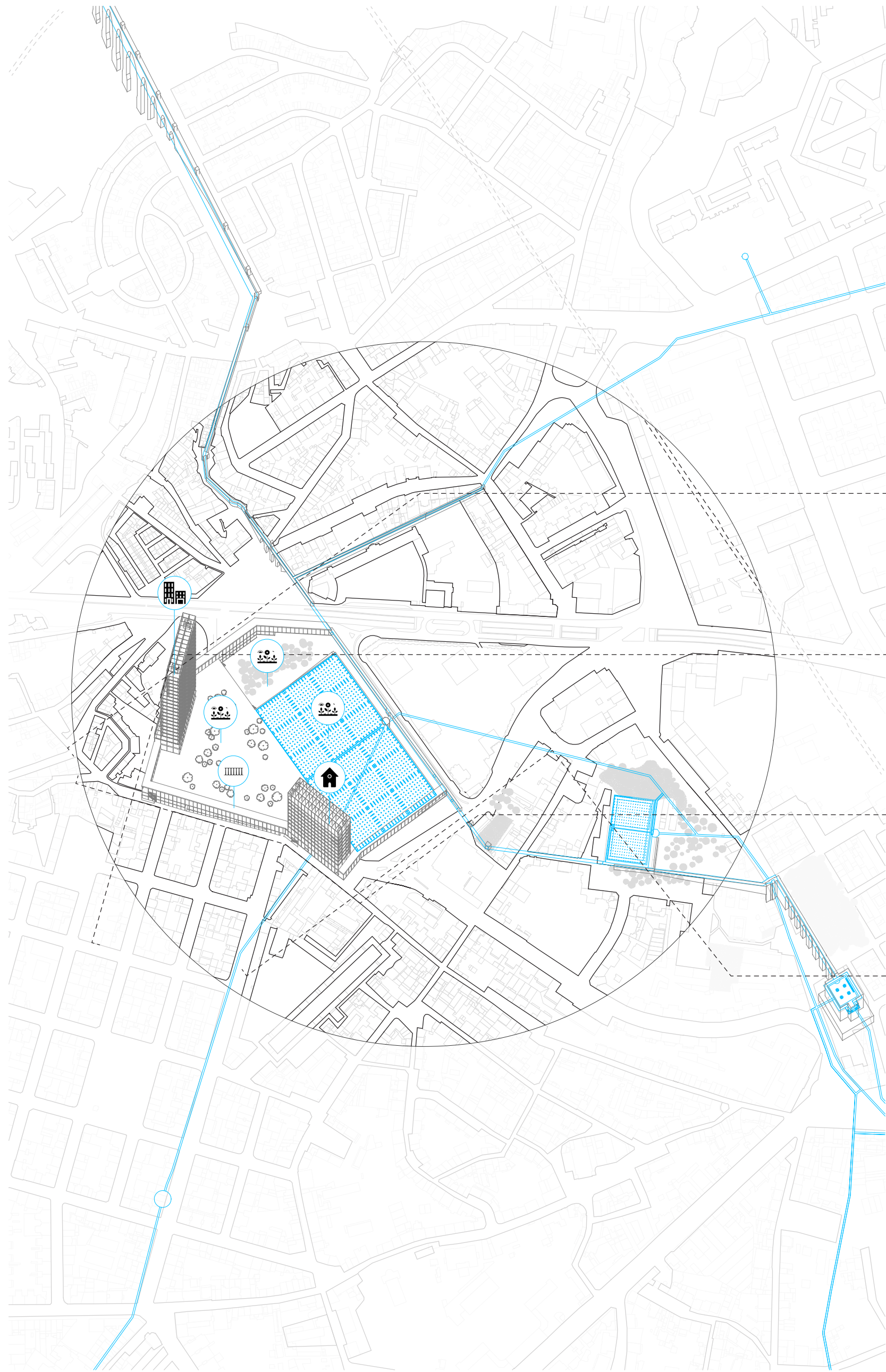
The proposal aims at connecting the districts, making the lawn accessible and creating a clear limit to the site which is permeable and allows for the passengers to pass through. A social platform consisting of a gallery, a park, and two public buildings with mixed functions (mixed-use and housing), acting as a social catalyst, allows for a fluid transition between neighbourhoods.





-  Tower - mixed use
-  Housing
-  Park
-  Public Gallery

Territorial section
1:5000



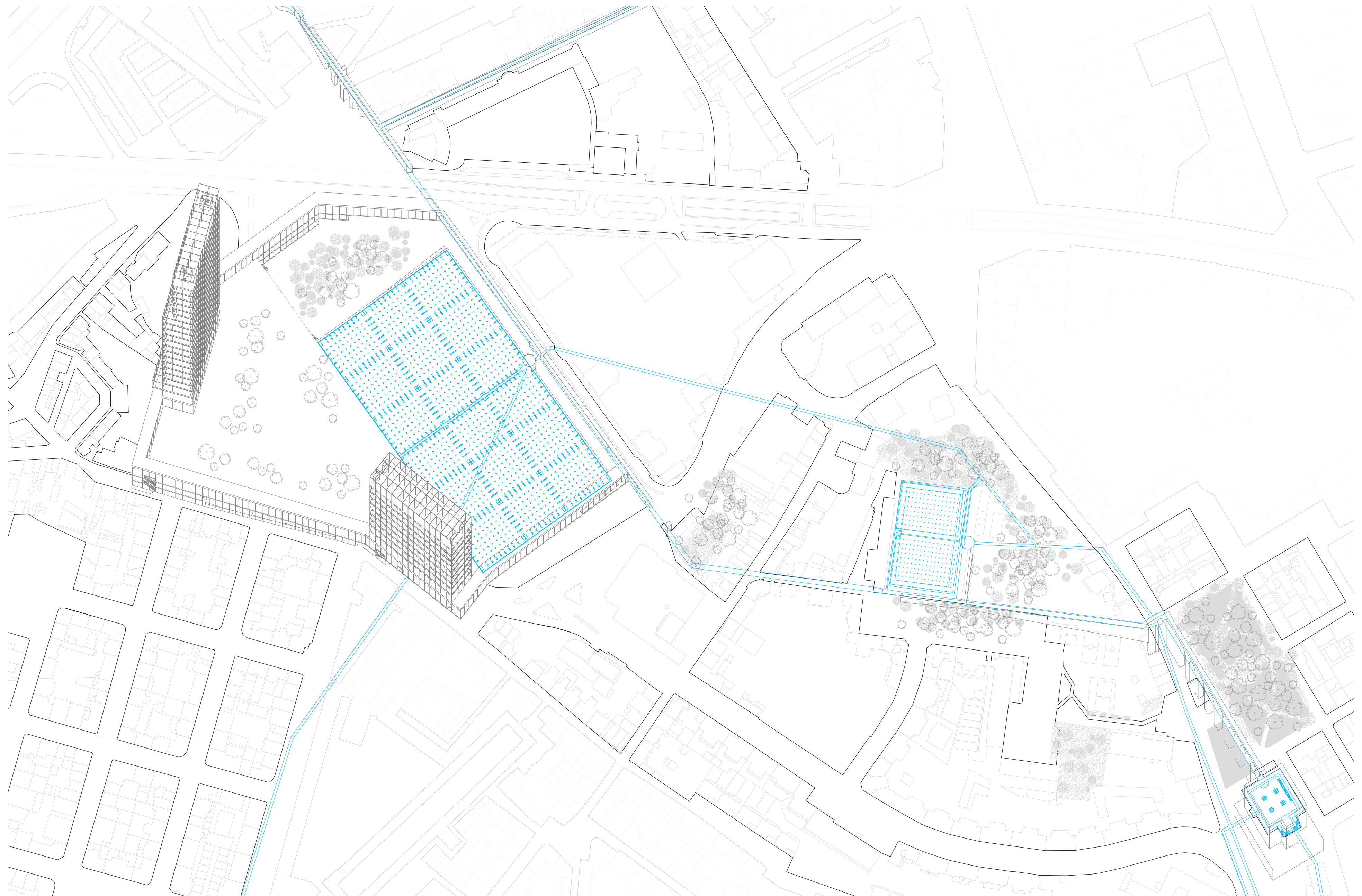
The platform and gallery

The platform is to be understood as a flat pedestrian zone, partly made of concrete and partly of green areas. The lawn, which is located above the reservoir, offers enough quality of stay in its original form and is not to be changed. Only small adjustments such as seating, playgrounds and smaller plantings are proposed here.

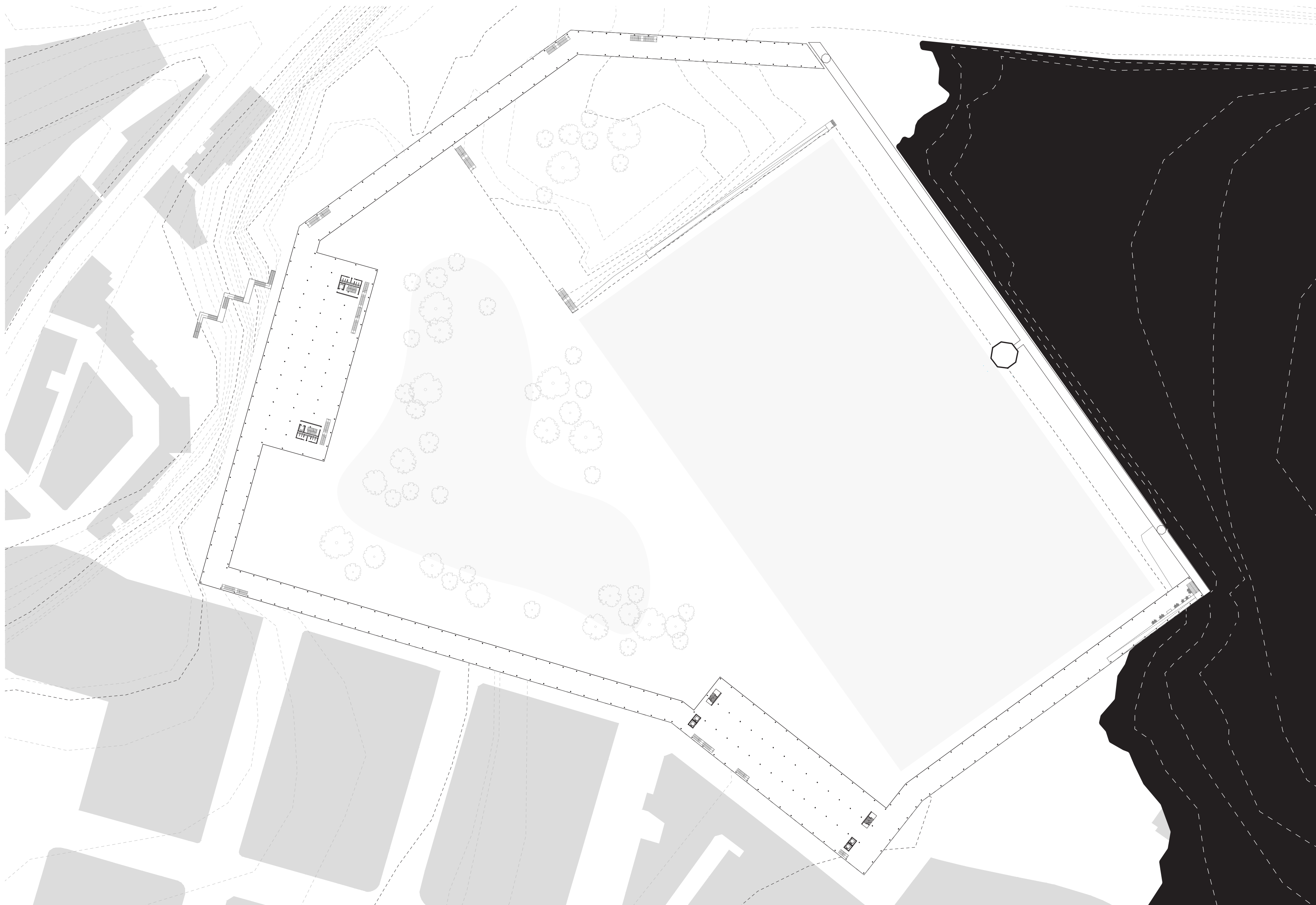
As a first step, the height differences and interruptions caused by traffic routes, which have so far made seamless passage for pedestrians impossible, are to be settled. In order to achieve this, the area between Rua de Campo de Ourique (the western entrance to Campo de Ourique), Avenida Eng. Duarte Pacheco (the main access to Lisbon), Rua Tierno Galvan (the boundary to Amoreiras Shopping Centre), Rua Carlos Alberto da Mota Pinto (the southern boundary towards Jardim das Amoreiras) is being covered by a plateau at a uniform level of +96m, which corresponds to the height of the reservoir's grass cover (+96m). In order to create a purely pedestrian zone, the road Rua José Gomes Ferreira, which meets Avenida Eng. Duarte Pacheco, is being covered and lowered to a height of +90m. It is furthermore narrowed from four to two lanes to diminish sound and traffic.

On top of the platform, a public gallery acts as a border and at the same time as an access, grows with the topography and increases in height, sometimes one, sometimes two or more levels. Its role is to establish communication between the proposal and neighbourhood and to compensate for differences in height. Sometimes it is open, sometimes it is shielded from the outside to give a feeling of shelter and the possibility to linger. The lower levels are open towards the streets and bordered by walls below the platform. They serve as supply areas, while the main level of the gallery +96m forms a fluid circulation zone and, thanks to the absence of any traffic, shortens the distances to access the entire area.

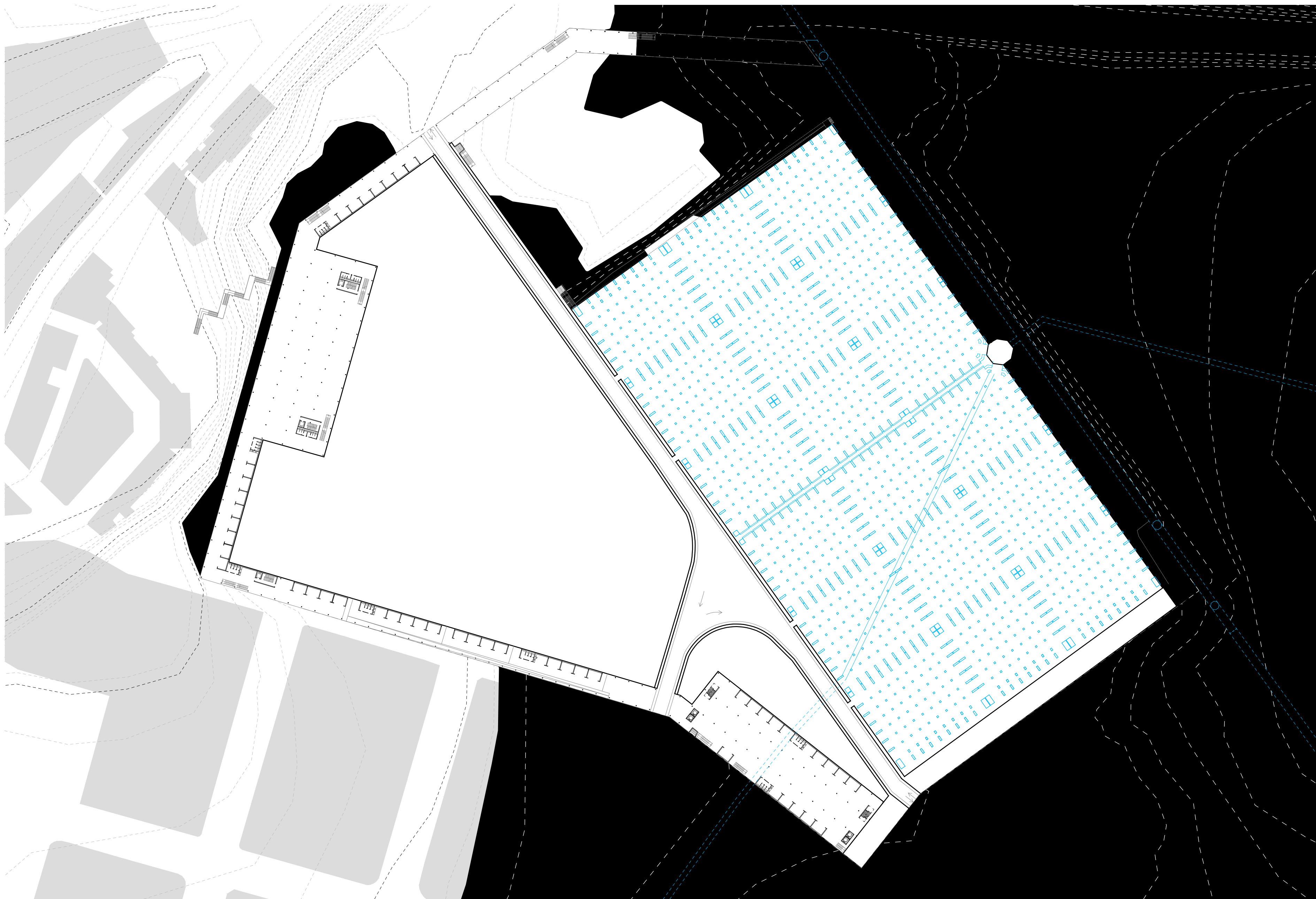
Axonometric proposal
1:2000



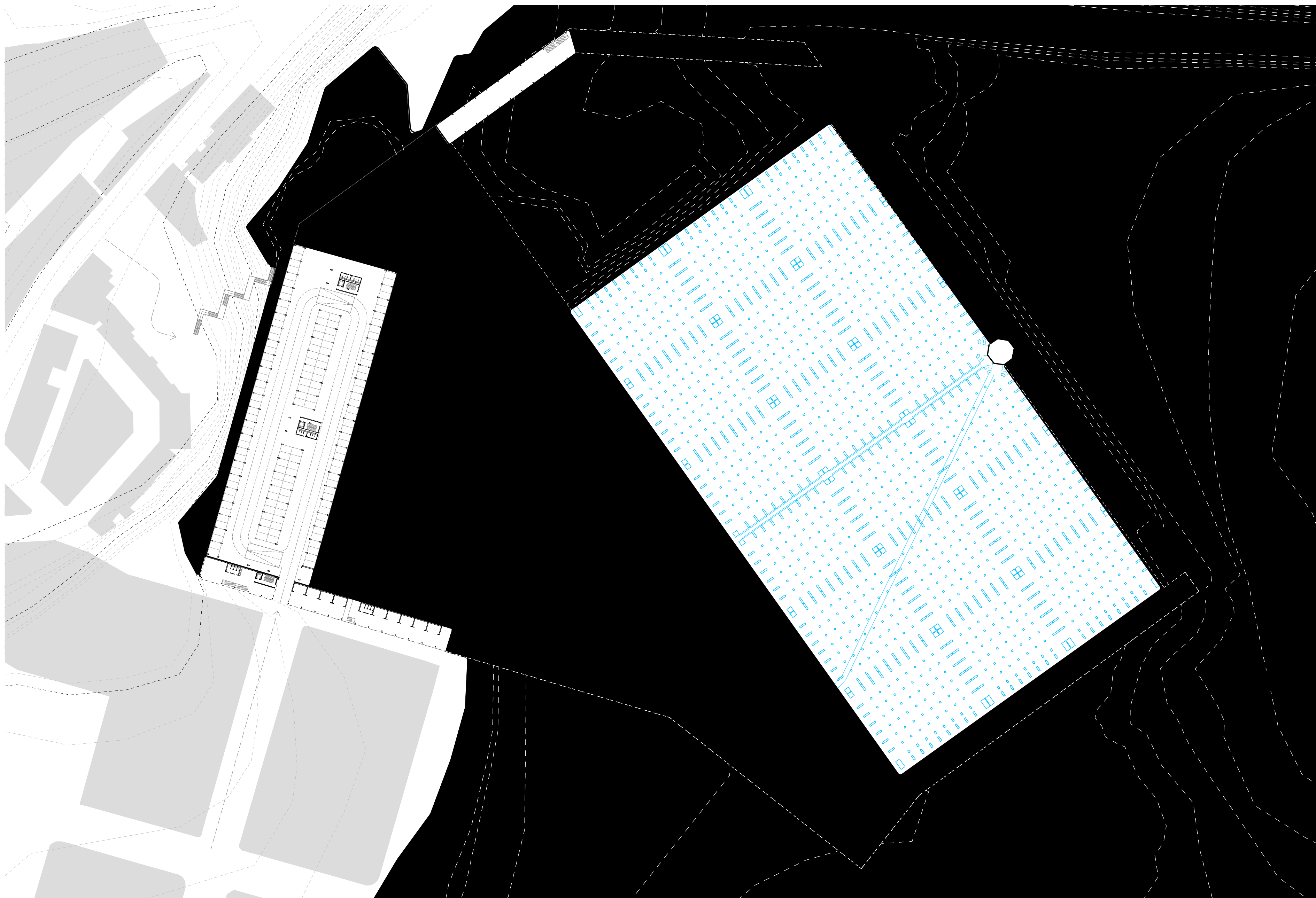
Main platform level +96m
⌚ 1:1000



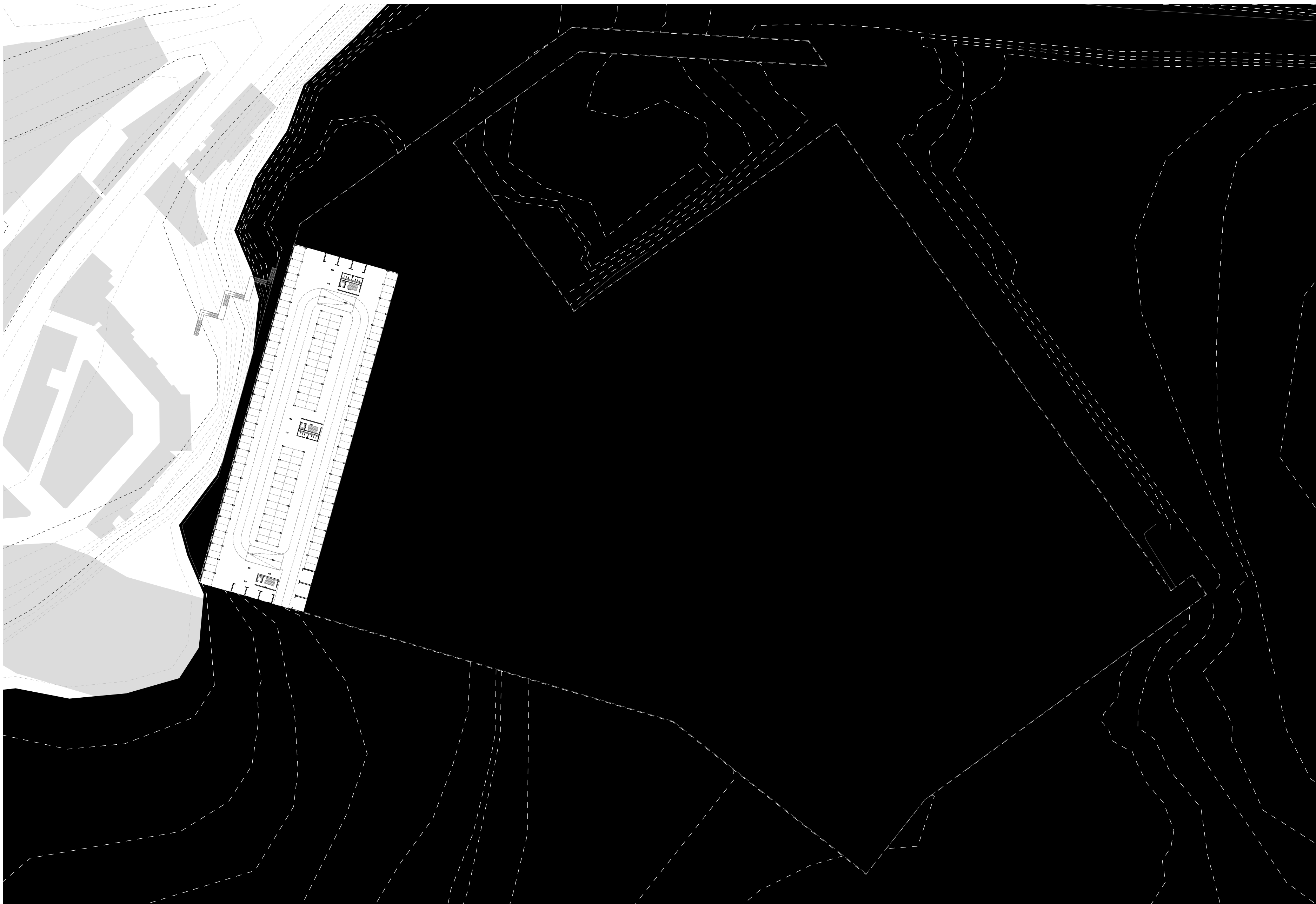
Reservatório below platform +92m
⌚ 1:1000



Access parking Campo de Ourique +88m
⌚ 1:1000



Parking level underground +85m
⌚ 1:1000



The higher buildings

The two higher buildings, made up of the same constructive system as the gallery, are located at two strategic core points. They form landmarks insofar as their use is programmatically oriented to the surroundings. The tower almost keeps up in height with the Amoreiras towers, as can be seen in the sections, and thus maintains an urban scale. It is positioned towards the northwest, facing Monsanto and the river. Access to the tower from the Rua Maria Pia, 25m below, is created via terracing stairs. Thus, the building complex rests sheltered yet accessible from the surrounding on its plateau and overlooks the lower levels. The Tower follows the concept of public buildings such as the Centre Pompidou in Paris or the SESC Pompéia in São Paulo. It can be understood as a cultural centre that accommodates a diverse program of mixed uses. Among other things, its layout lends itself to a public ground-floor zone with a library and partly commercial uses (shops, cafés) while, at the same time, it should not be chargeable in any way. Offices can be located on the upper floors.

Exploded axonometry - all levels
1:5000

Tower
+186m

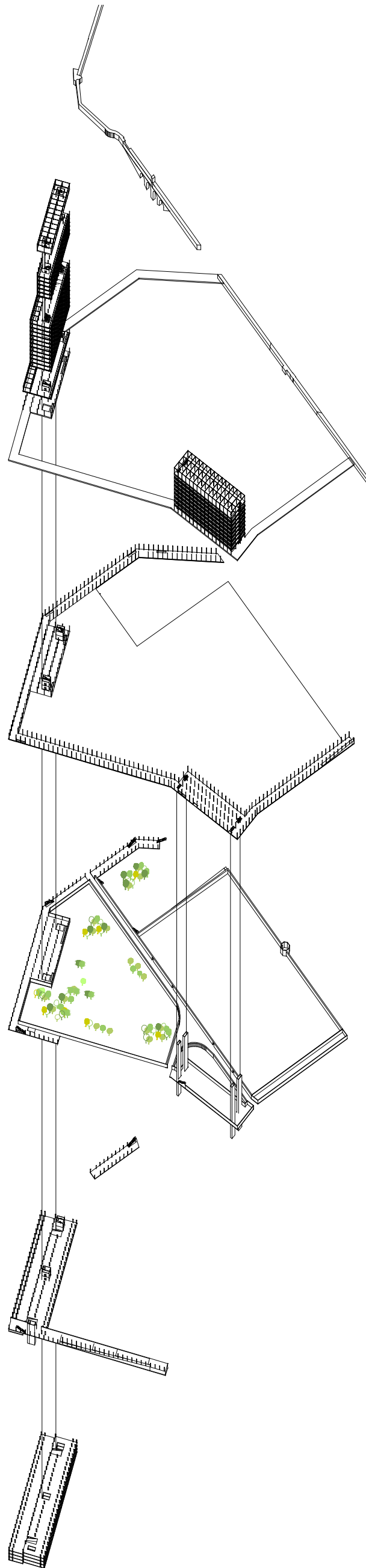
Housing
+148m

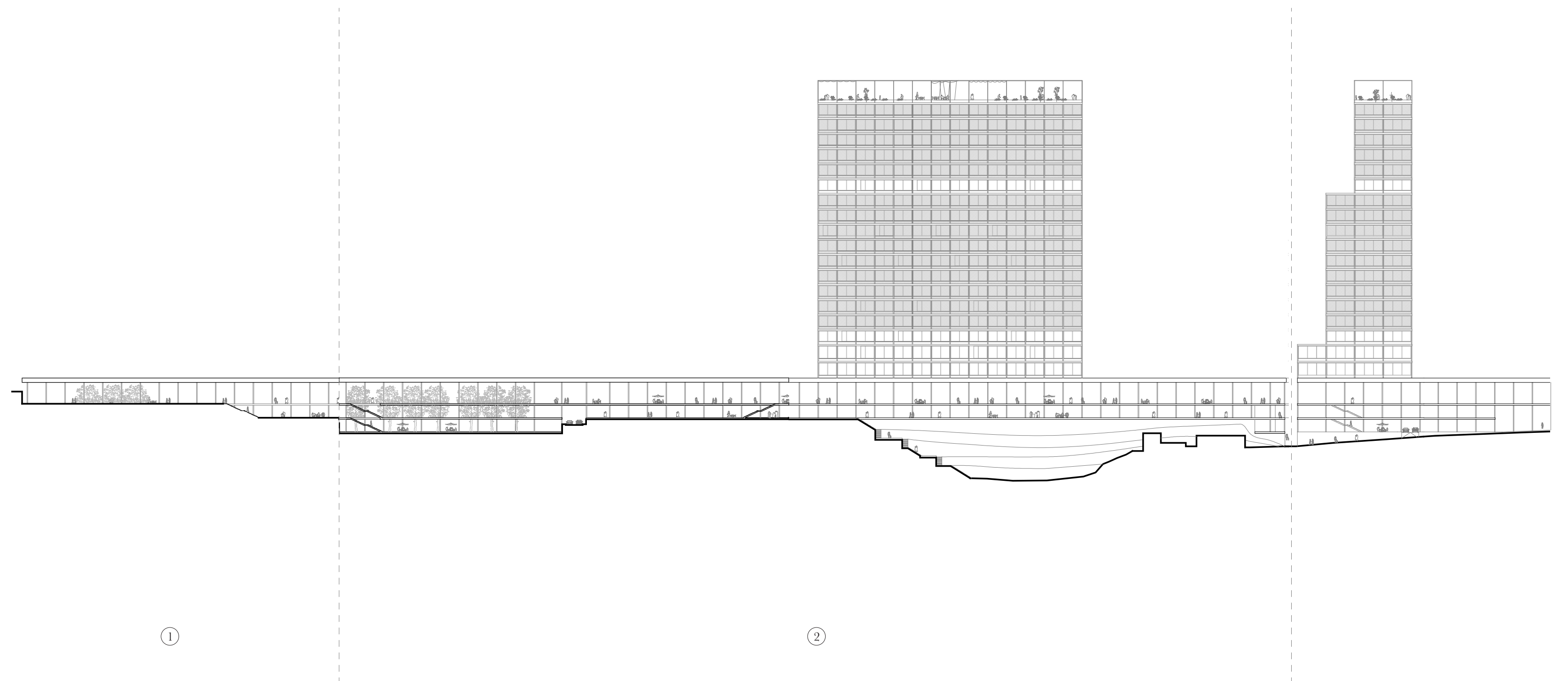
Level
+102m

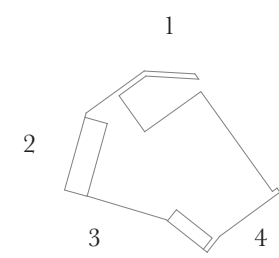
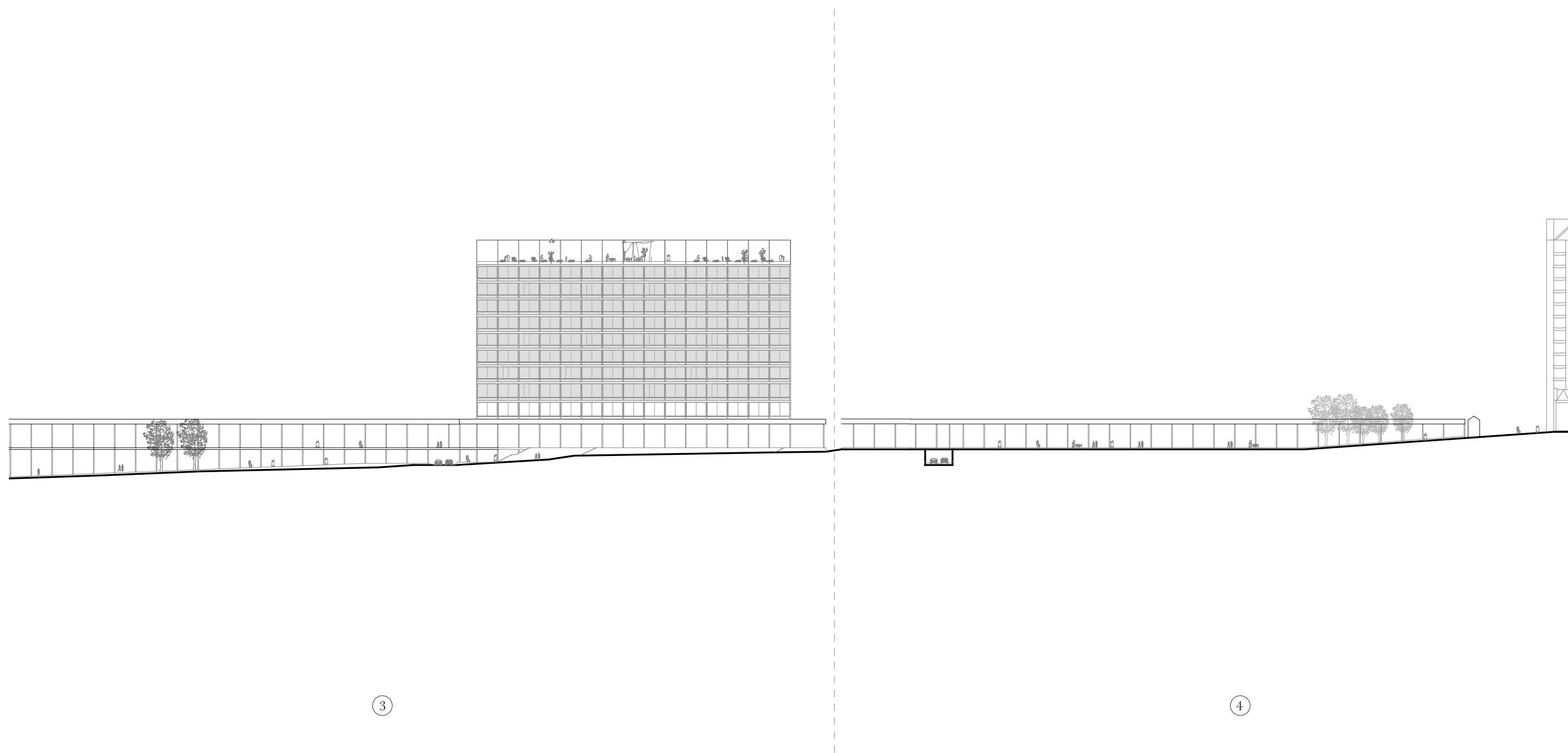
Level platform
+96m

Parking access Campo de Ourique
+88m

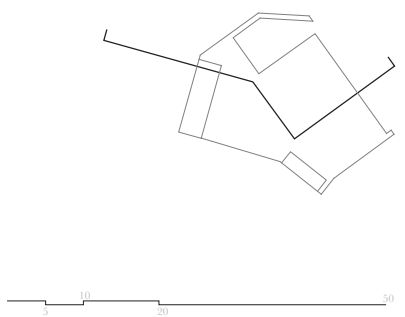
Parking
+85m



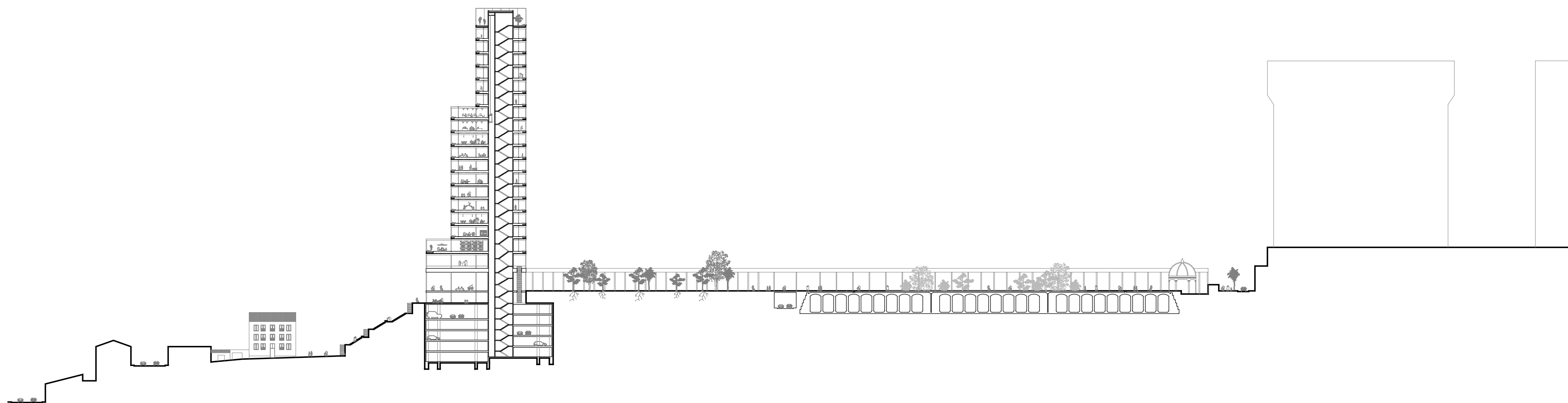


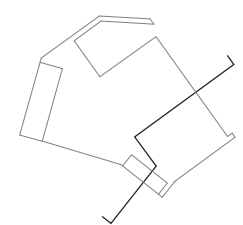


Unfolded Elevation
 1:2000

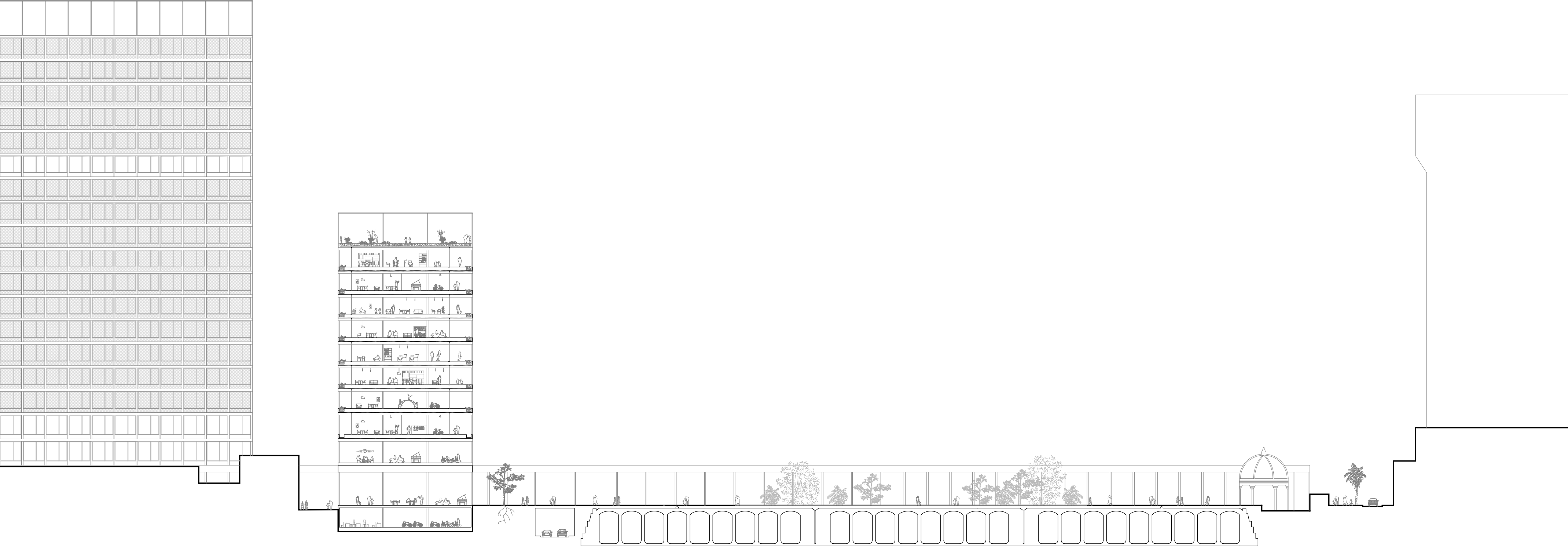


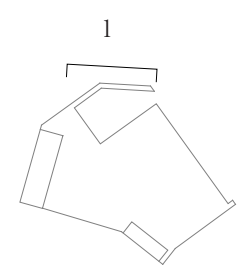
Tower - cross section
1:1000



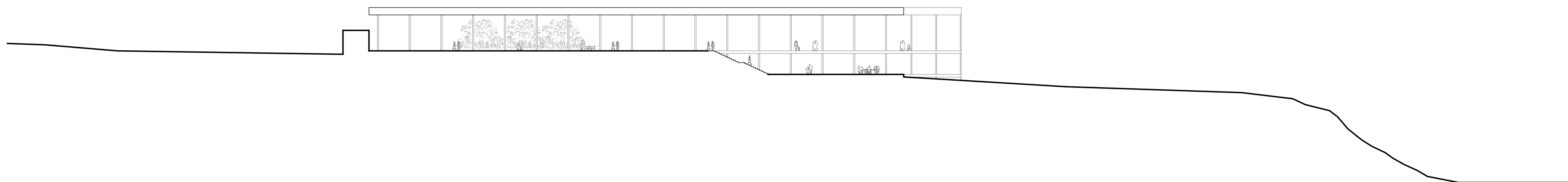


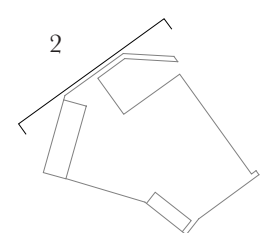
Tower - cross section
1:500



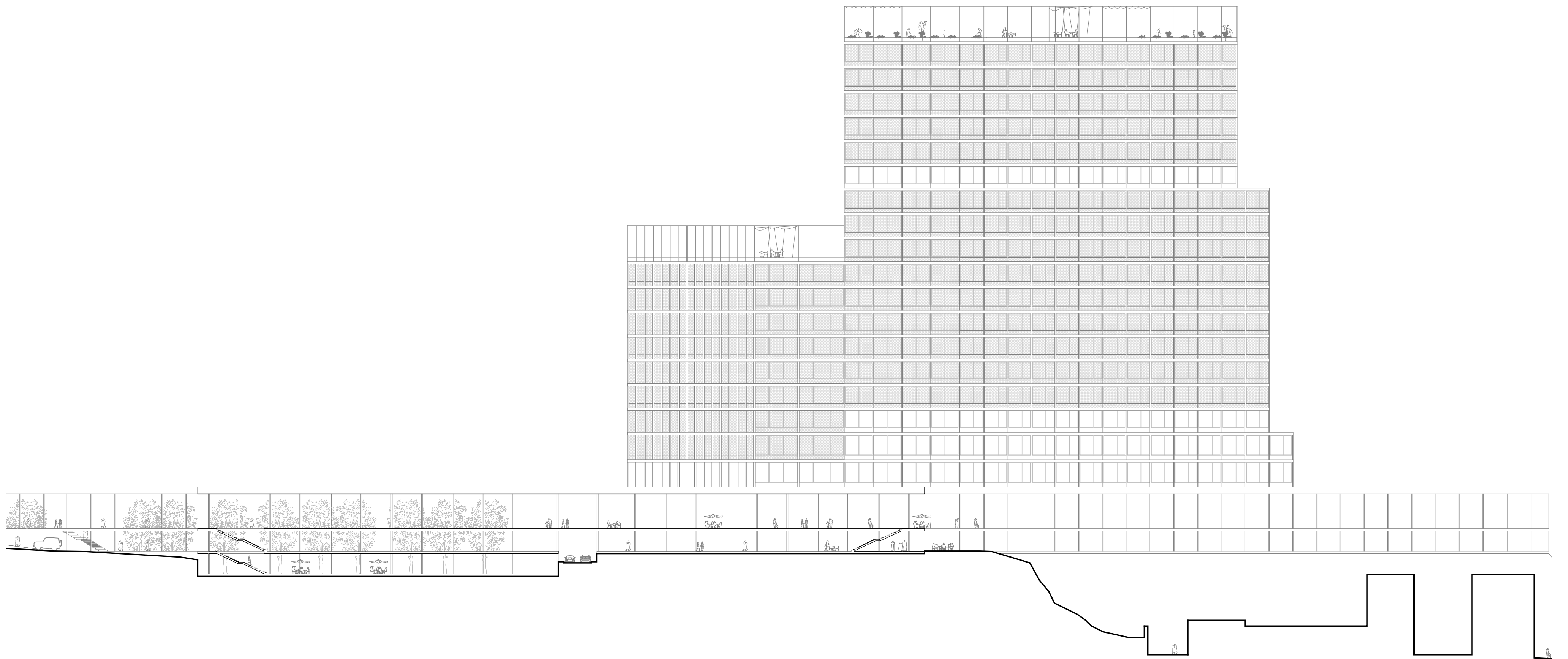


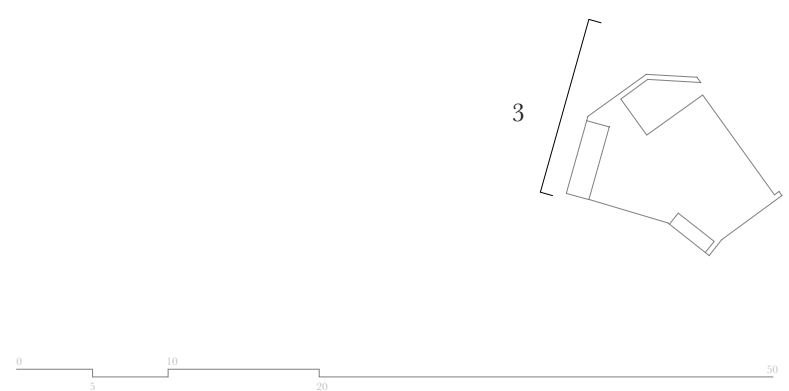
Elevation north, towards Av. Eng. Duarte Pacheco
1:500



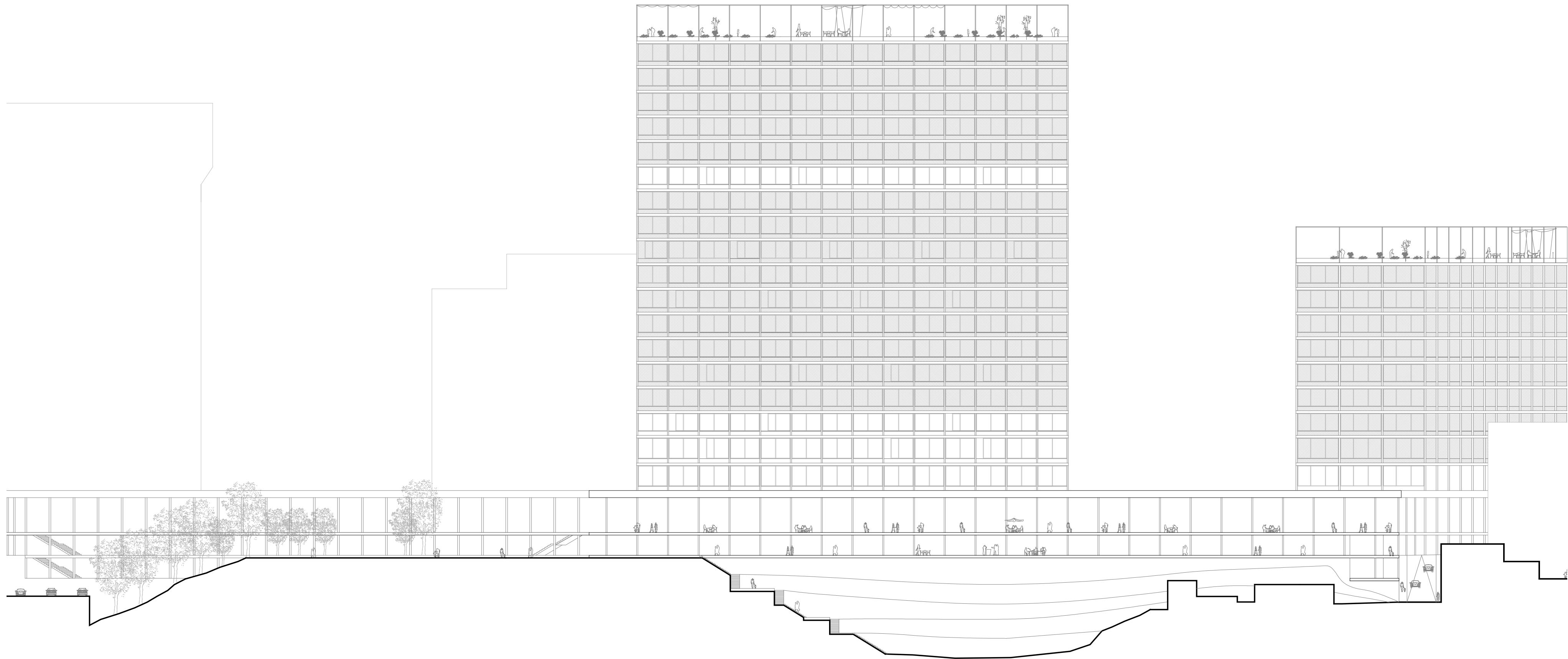


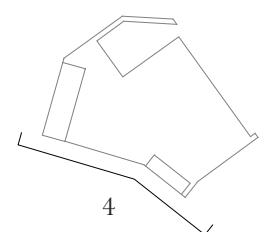
Elevation north-west, towards Av. Eng. Duarte Pacheco
1:500





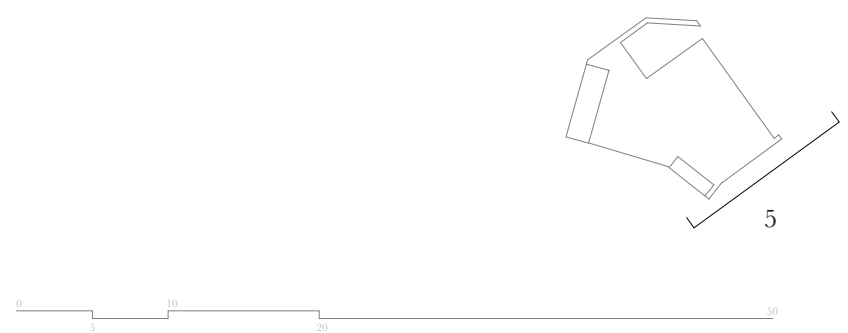
Elevation north-west, towards Rua Maria Pia
1:1000



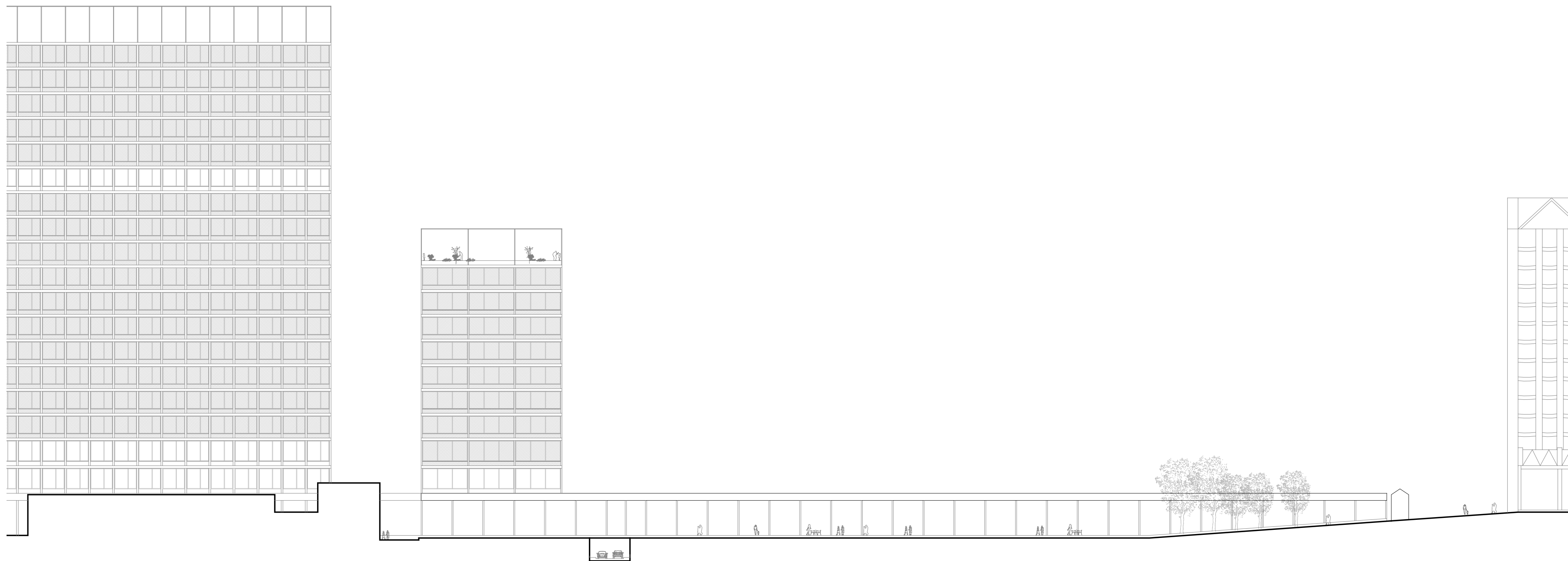


Elevation south-west, towards Rua de Campo de Ourique
1:1000





Elevation south-west, towards Rato
1:1000

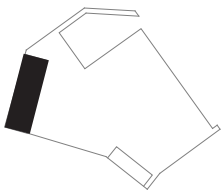


The higher buildings

The tower

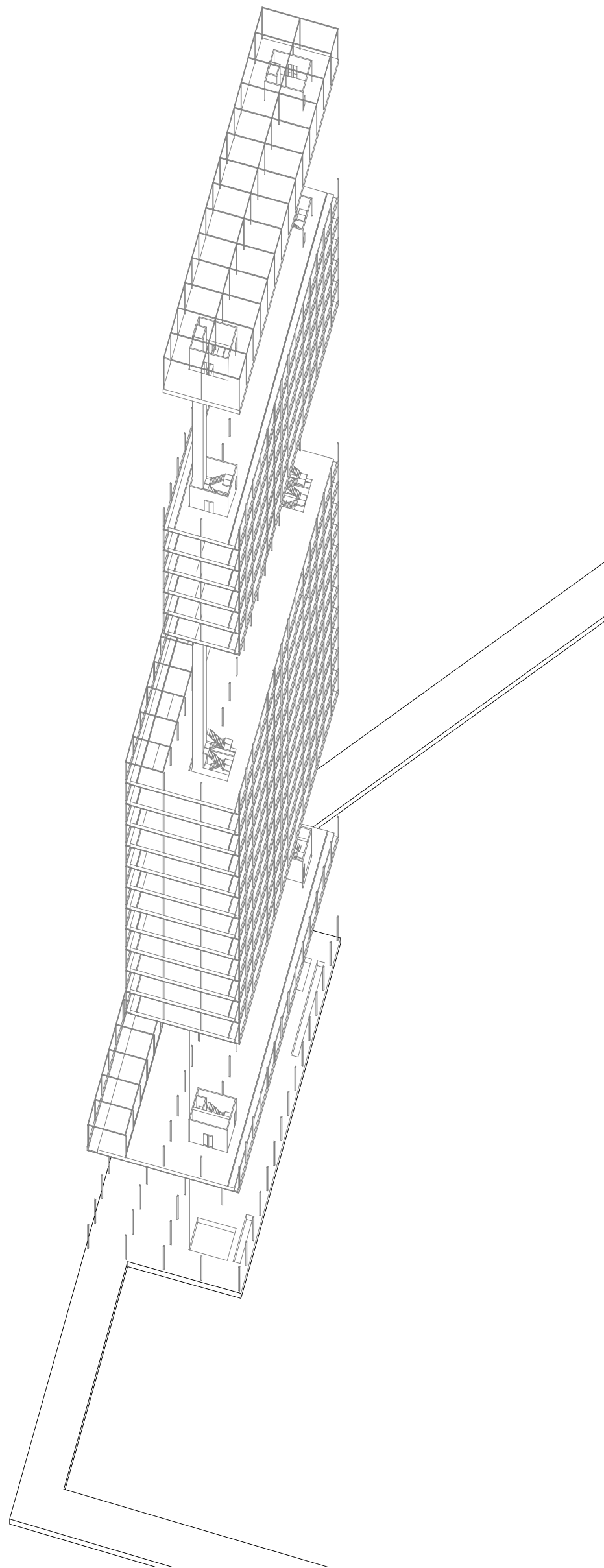
Measuring only the above street levels, the tower has a height of 90m with floors of different size. Its geometry narrows towards the top, which has the effect of filtering the air from Monsanto, the lungs of Lisbon, before entering the “oasis” of the project. The garden areas will contribute to air filtration and ventilation of the buildings, as well the green and permeable facades (see details). 5 levels of parking each offer around 200 parking spots, helping to liberate the district’s streets by parked cars.

The floorplans offer a most flexible program which can range from housing to office, cultural or sports facilities.

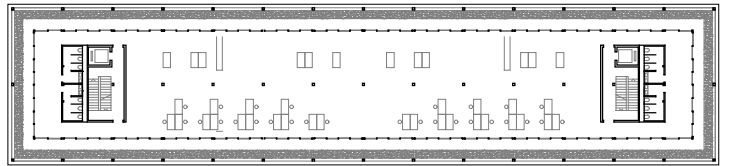


Tower - axonometry
1:1000

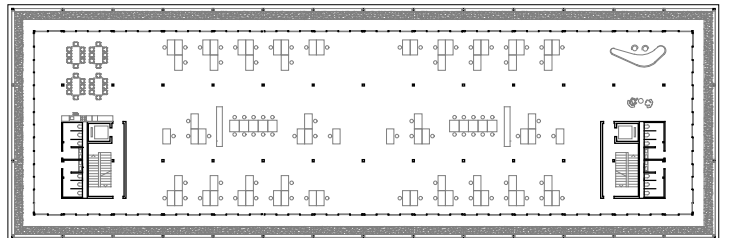
Tower - standard floor plans
1:800



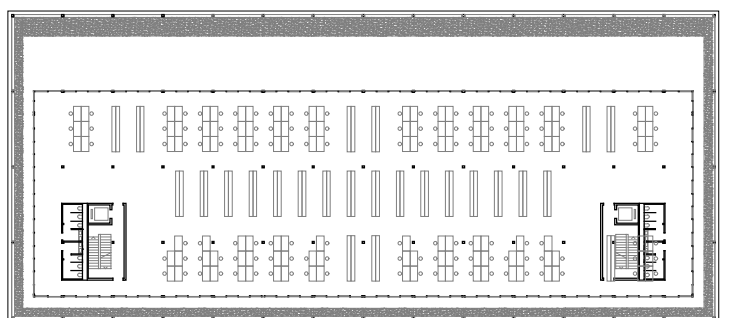
Tower
+186m



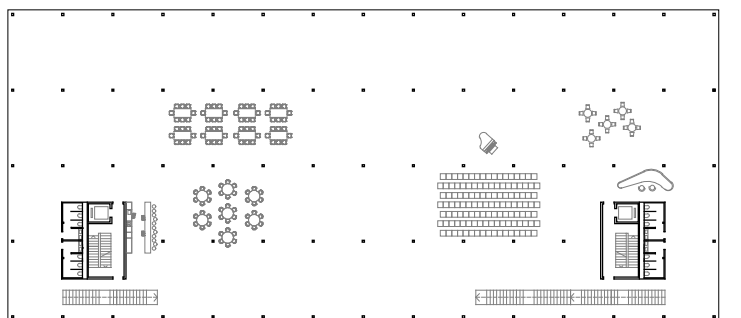
Open office floor plan
+151m



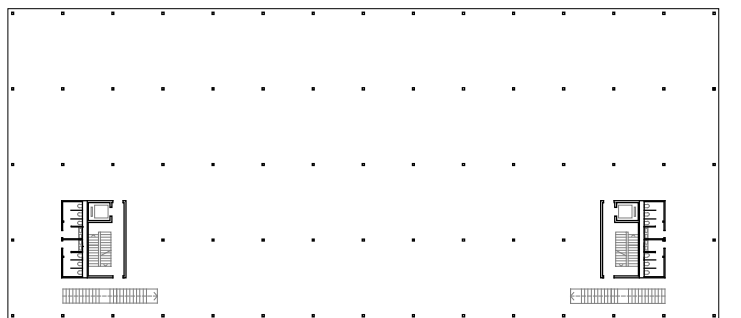
Library floor plan
+108m



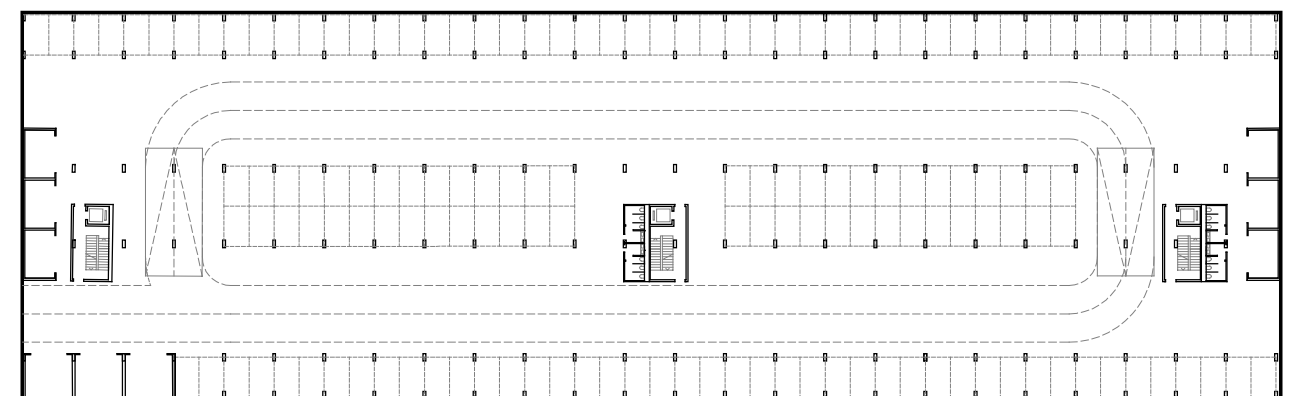
Main groundfloor level
+96m

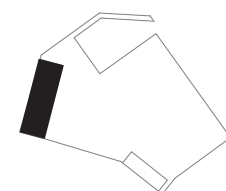


Lower groundfloor level
+92m



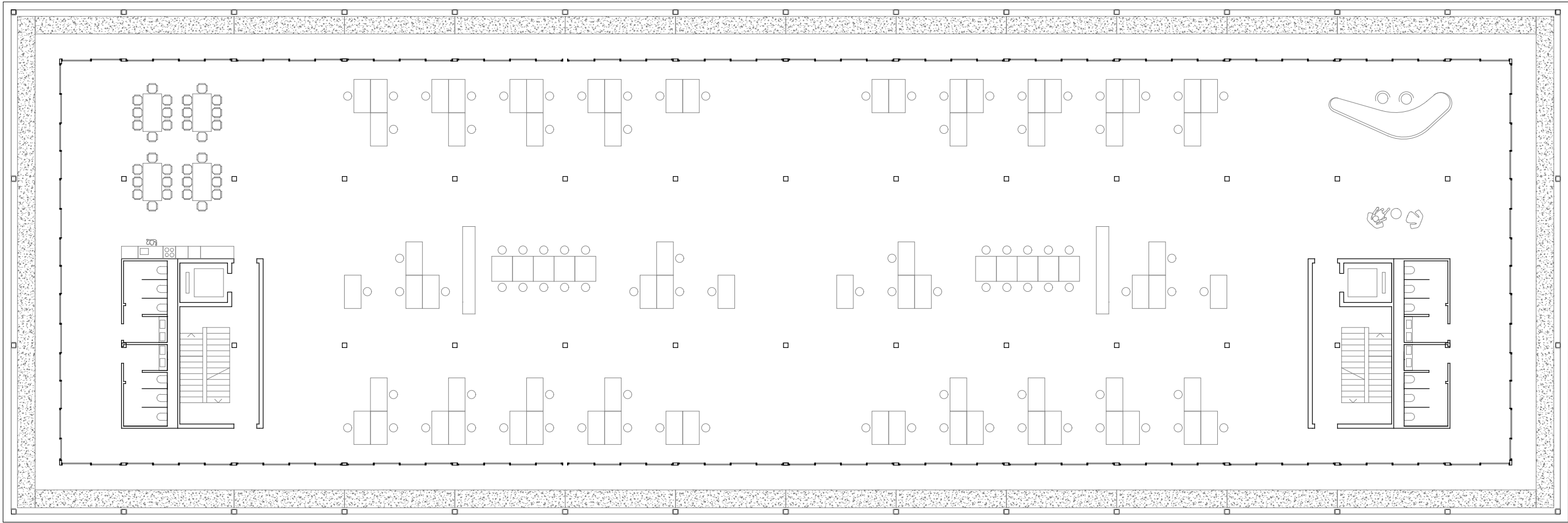
Parking
+85m



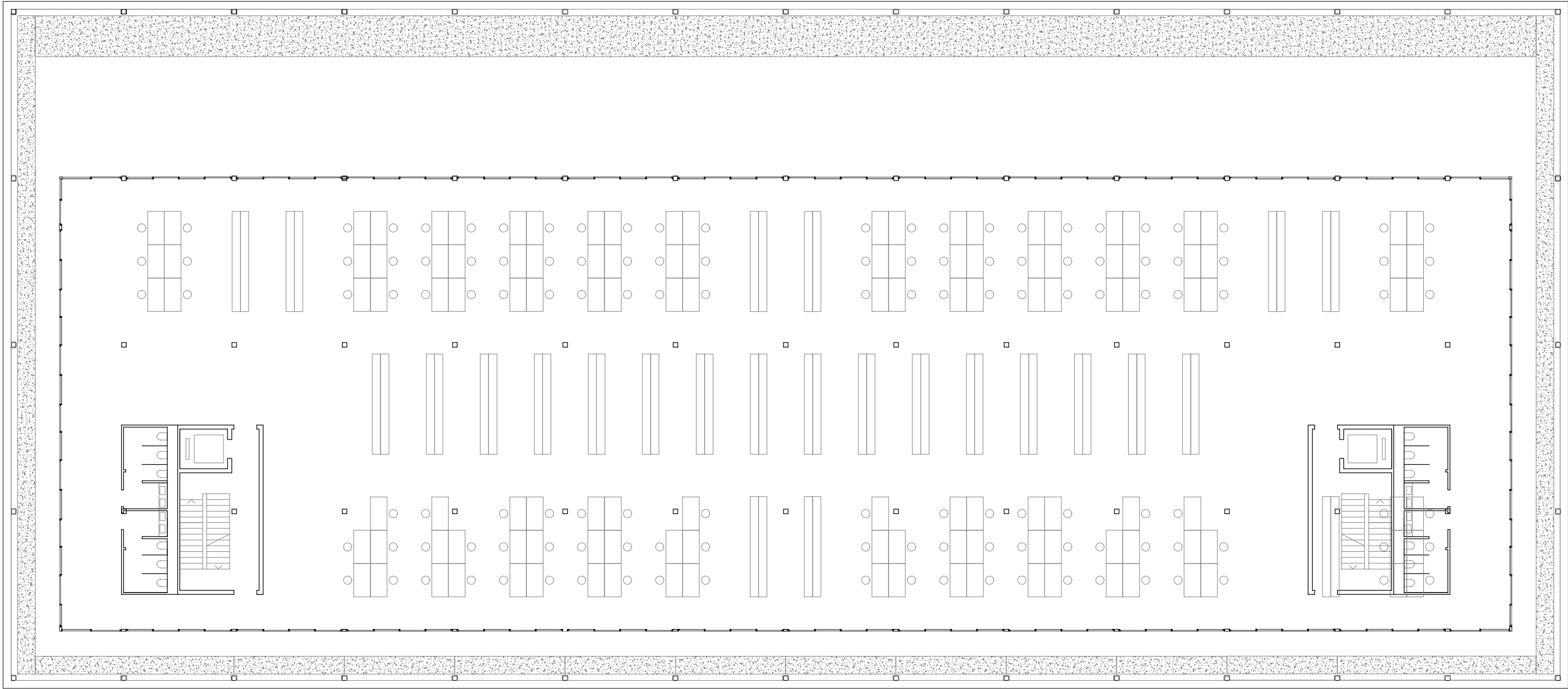


Tower - floorplans library +108m, office +151m
1:800

Open office floor plan
+151m

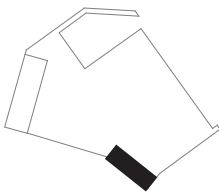


Library floor plan
+108m



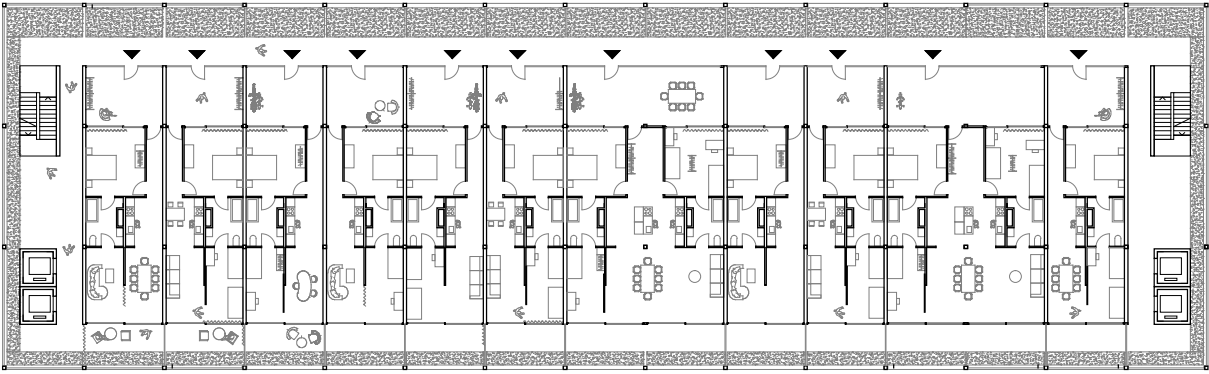
Housing units

The housing units result spatially from the modular system of the 8x5m structural grid. Depending on the inhabitants, they can be expanded or reduced in a modular way to suit both traditional and modern housing models. For example, a classic family of several people can move into a residential unit of 200m², which corresponds to two centre distances. The same size is suitable for a shared apartment. If such a unit is halved, there is space for a smaller family or a couple on 100m², for example. Access is via a semi-public arcade zone located between the green façade and the entrances to the residential units. Each residential unit has its own private balcony and, at the same time, the possibility to use the communal balcony zone that runs along the access corridor.

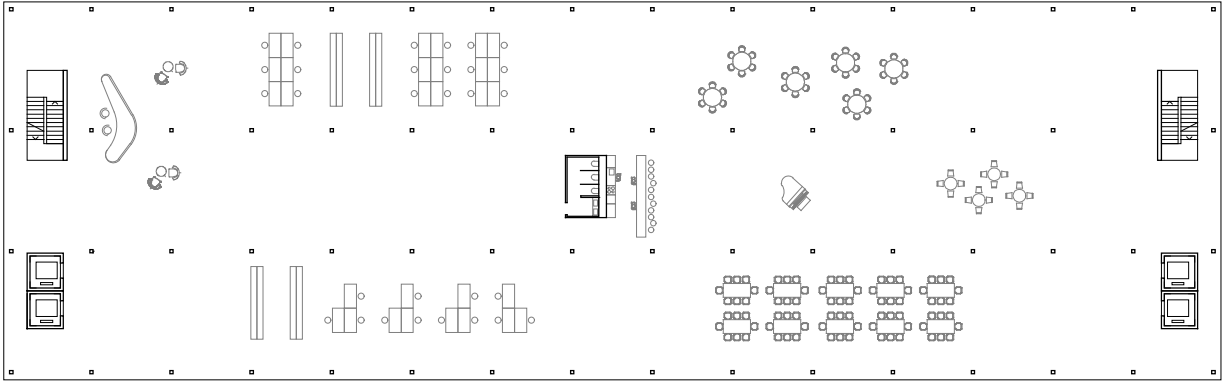


Housing - axonometry
1:1000

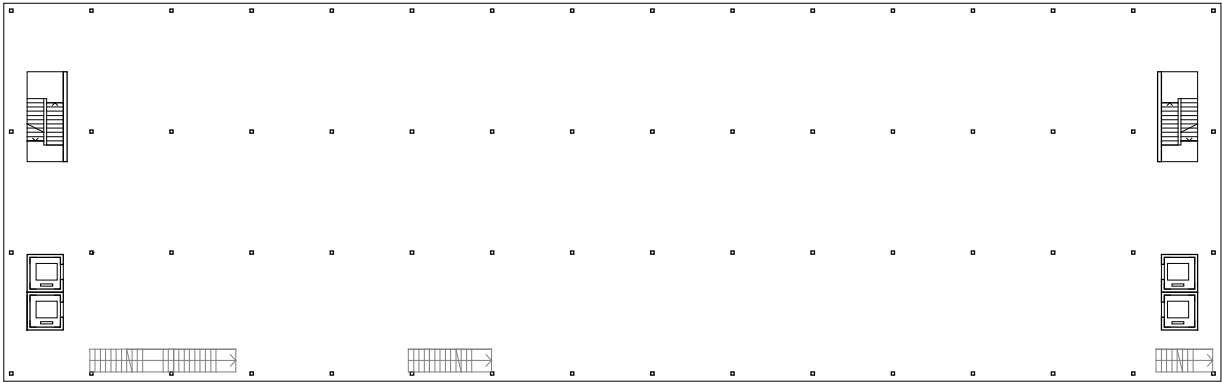
Housing - standard floor plans
1:500



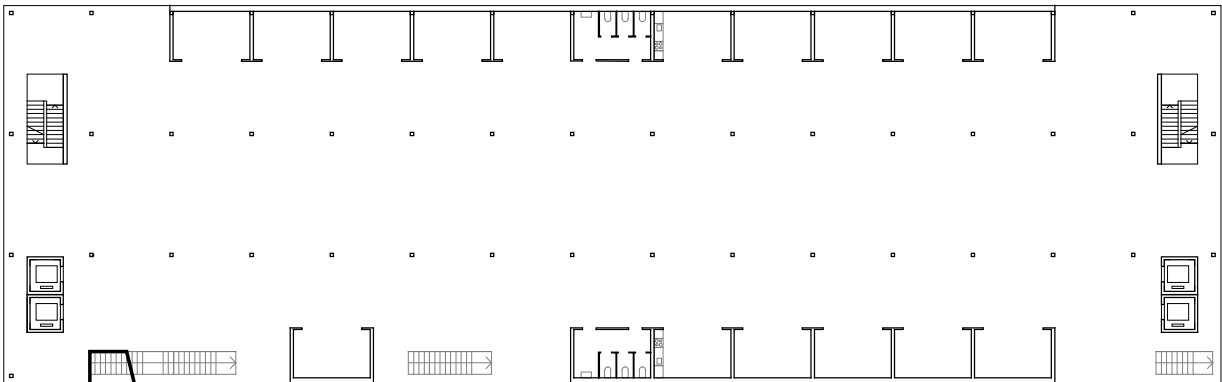
Modular living units
+108m



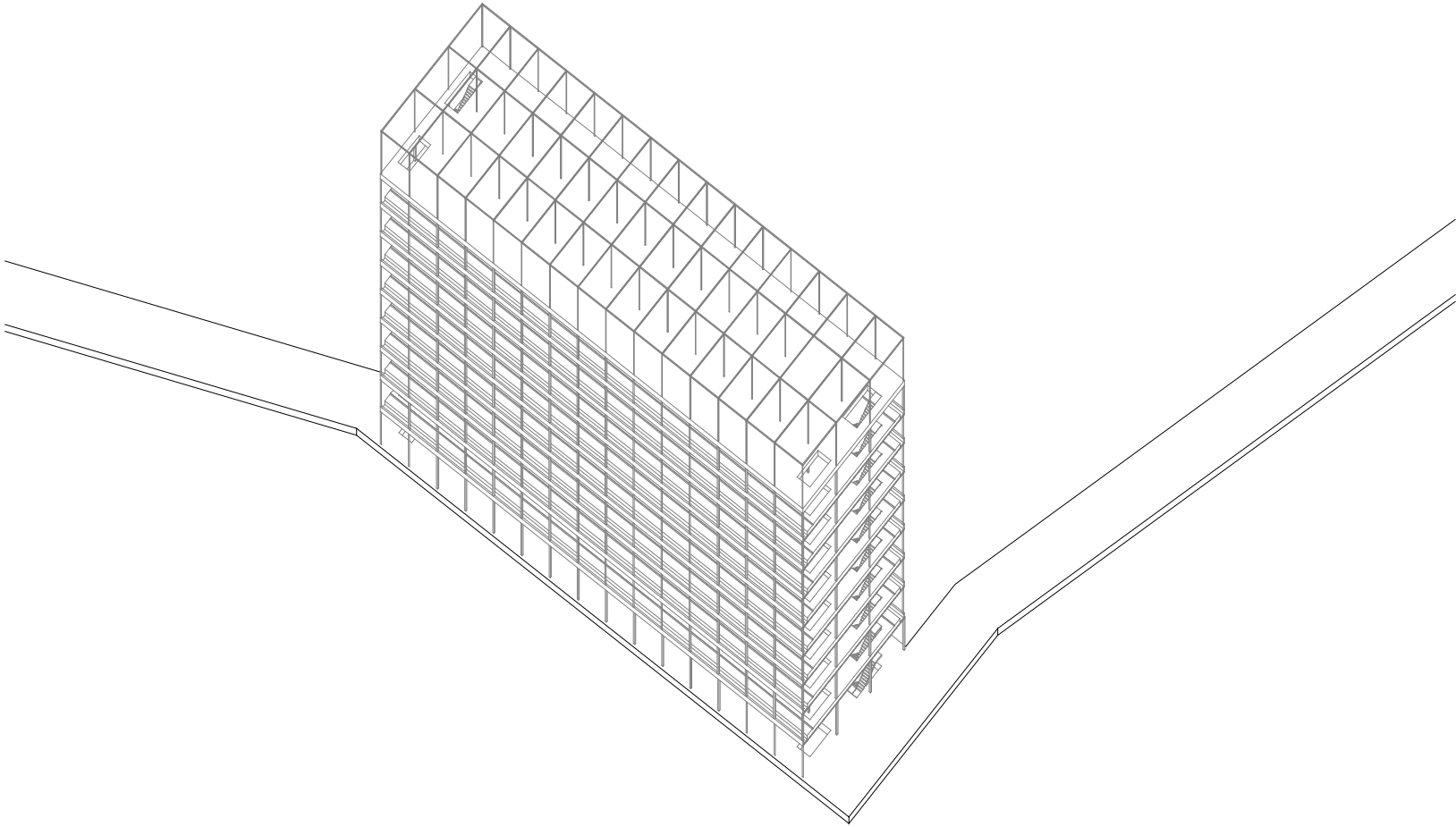
Foyer
+102m

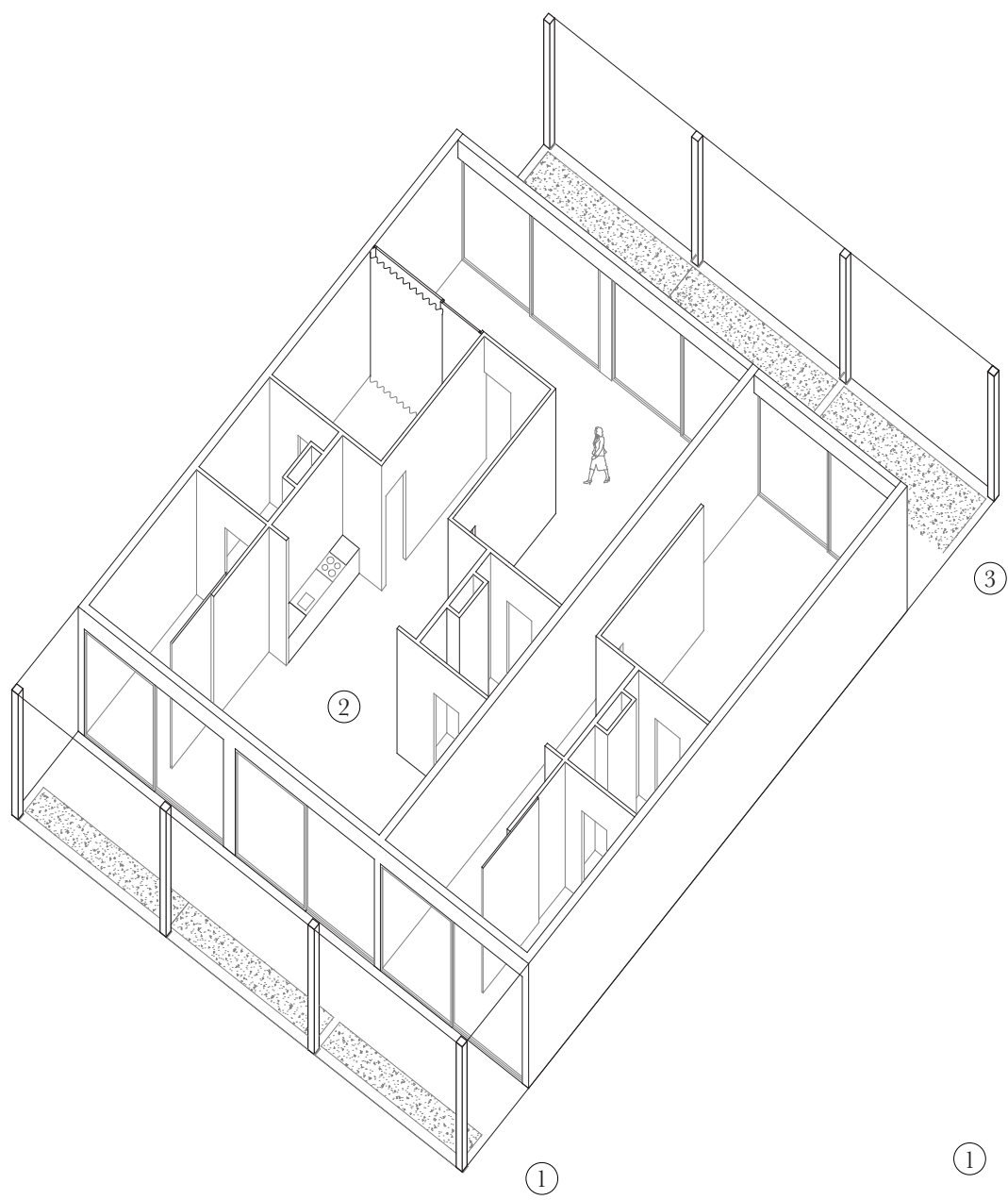


Main groundfloor level
+96m

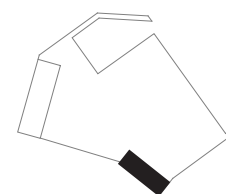


Basement level
+92m

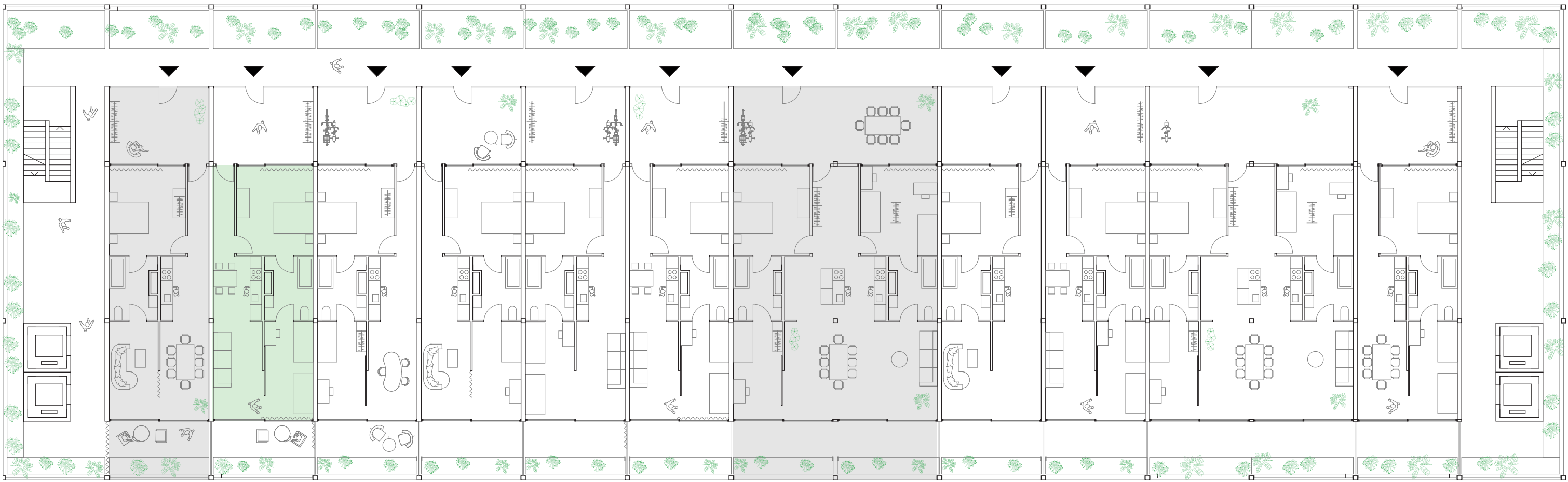




- ① Private balcony zone
- ② interconnectable living unit
- ③ Access corridor



Housing - axonometric module - family or shared flat
1:200
Housing - floor plan modular units
1:200



100 m2

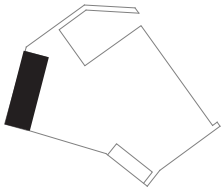
65 m2

200 m2

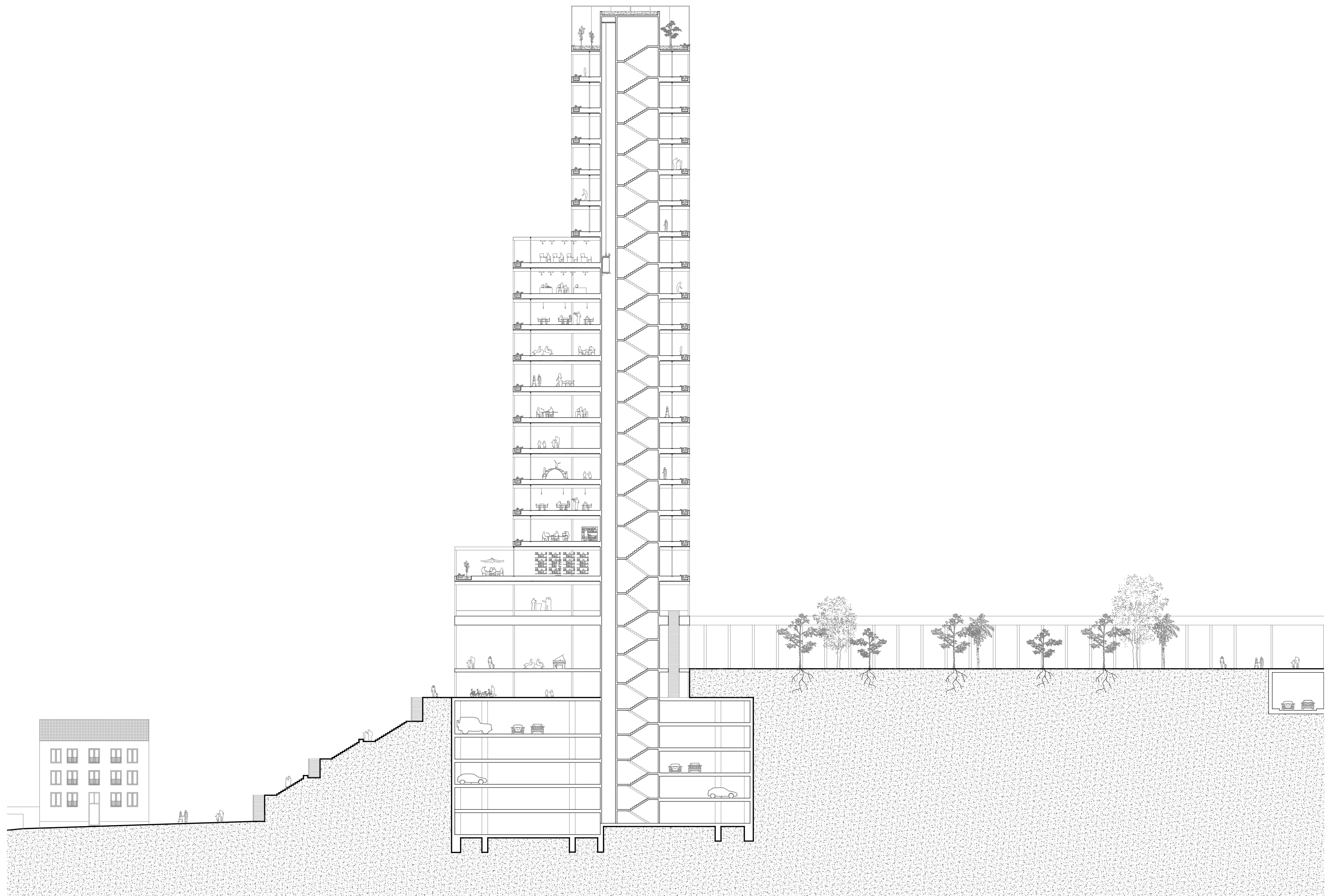
Flexibilty

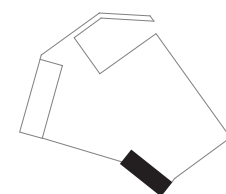
Construction

A constructive and programmatic flexibility is the superordinate theme of the proposal. Instead of dictating a fixed program, the open structure should allow for a flexible program that can change over time. Thus, the structural grid can be used for public purposes as well as for housing. The structure of the building consists of steel columns and beams with spans of 5 x 8 metres. The steel structure can be equipped with modular components that can be replaced, extended or removed over time depending on use. A system of two layers is planned for the façade. The first layer forms the thermal separation between the interior and exterior spaces and is composed of a supporting structure and sliding glass doors. The second layer is a curtain-type galvanised steel mesh construction with openable panels that allows both ventilation and vertical planting. The space between the two layers is understood as a communal and circulation zone with planted areas, and in the case of the tower, accommodates vertical access.

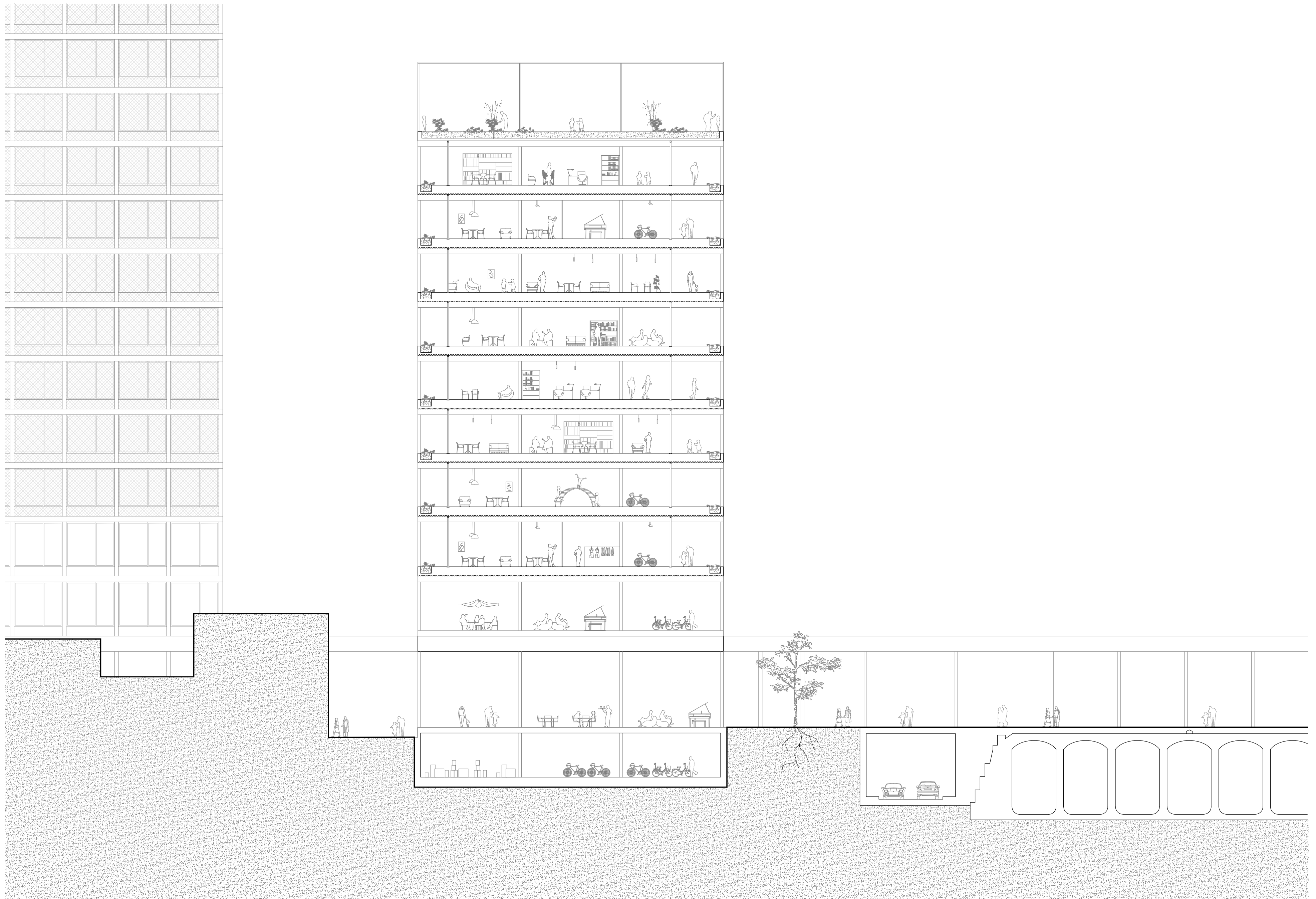


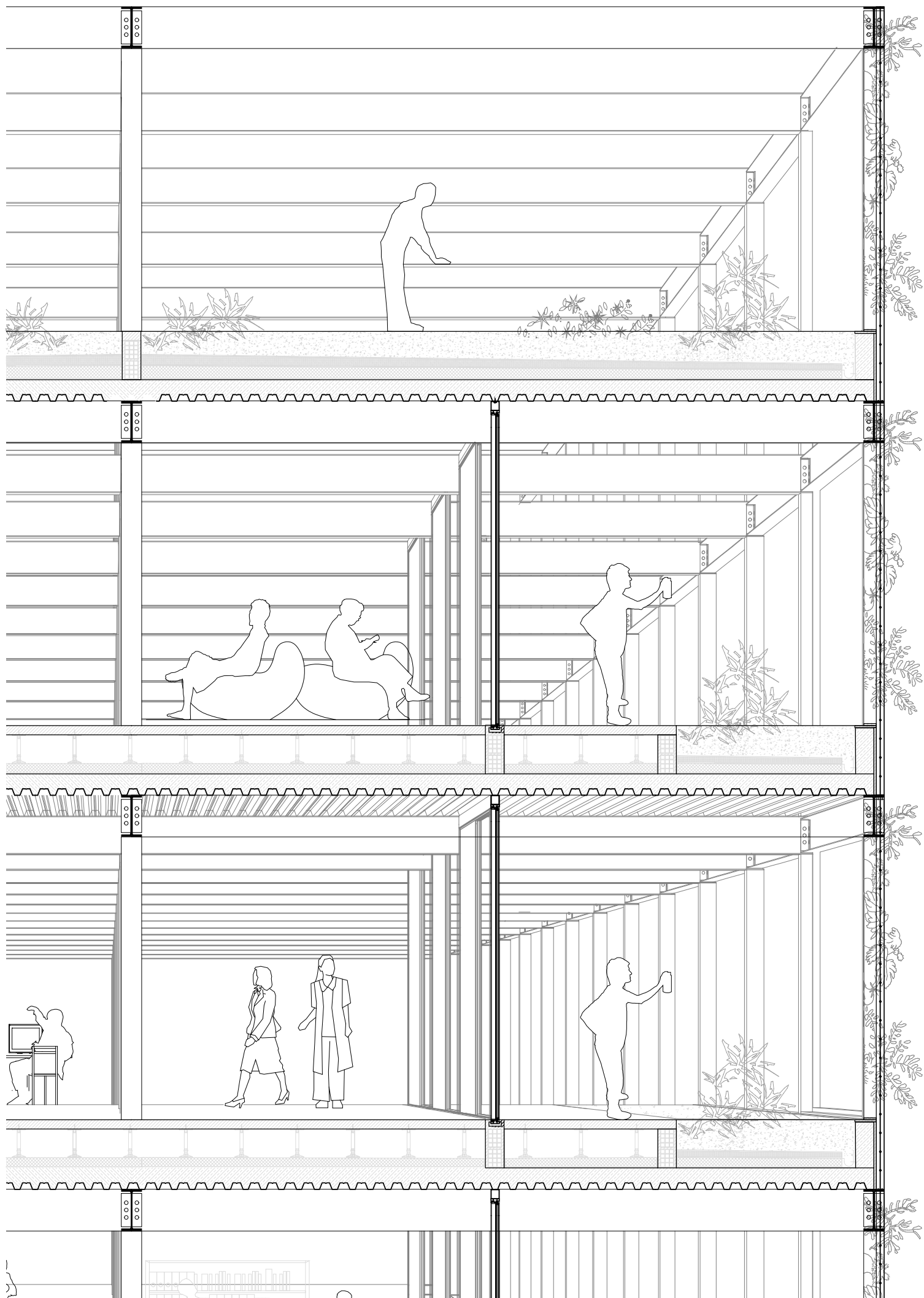
Tower - section through Rua Maria Pia and reservoir
1:350



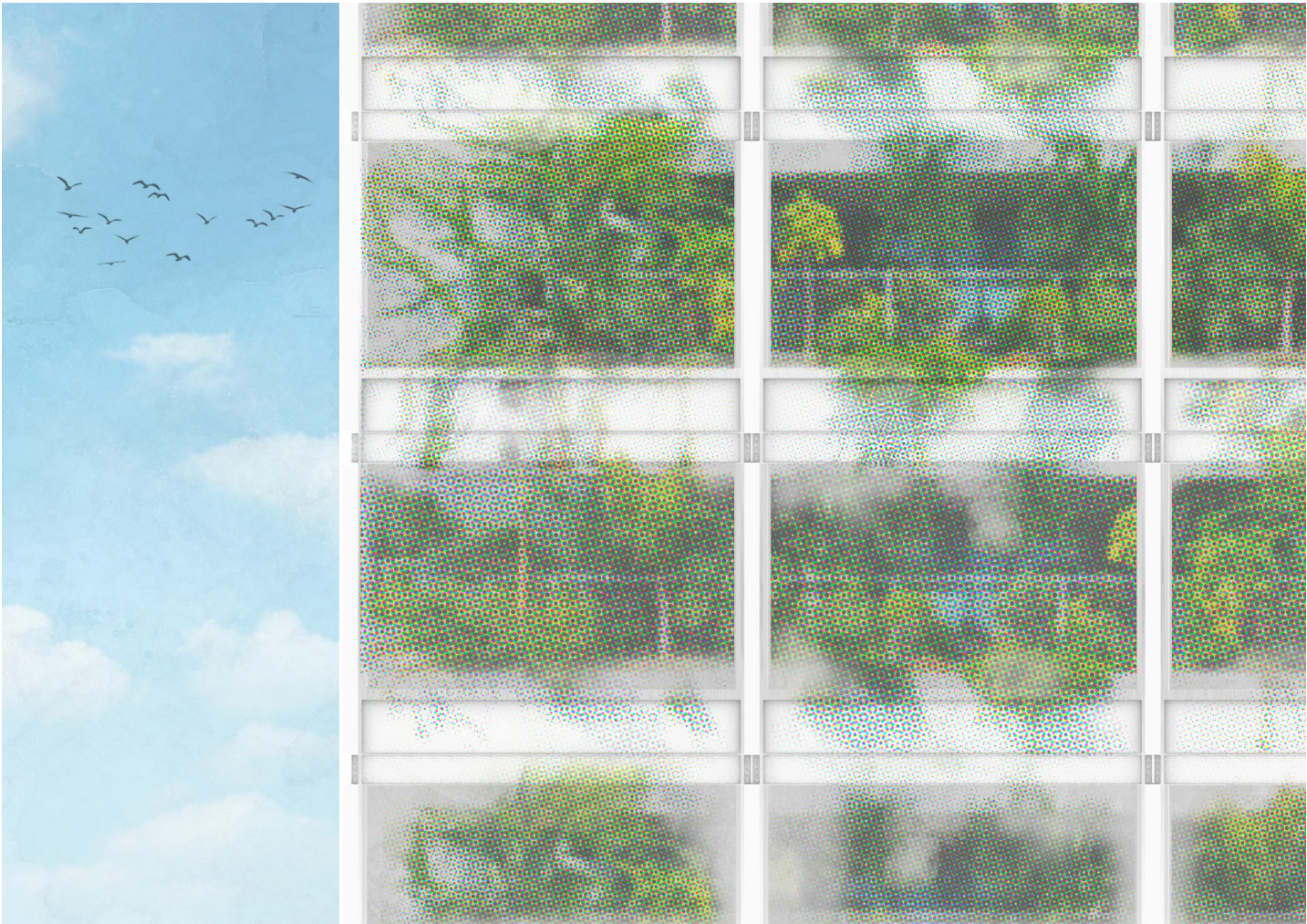


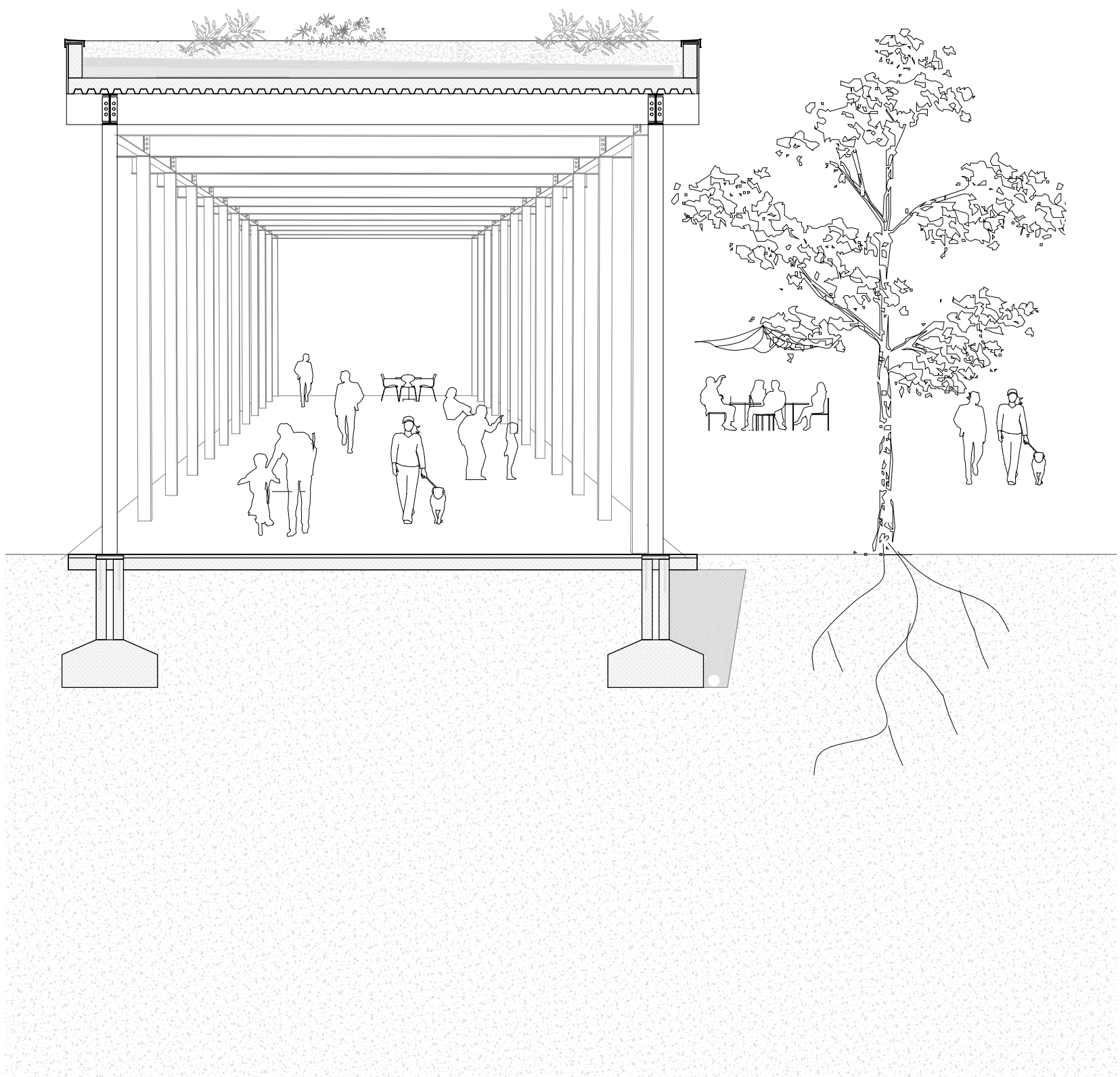
Housing - section through Rua de Campo de Ourique
1:350



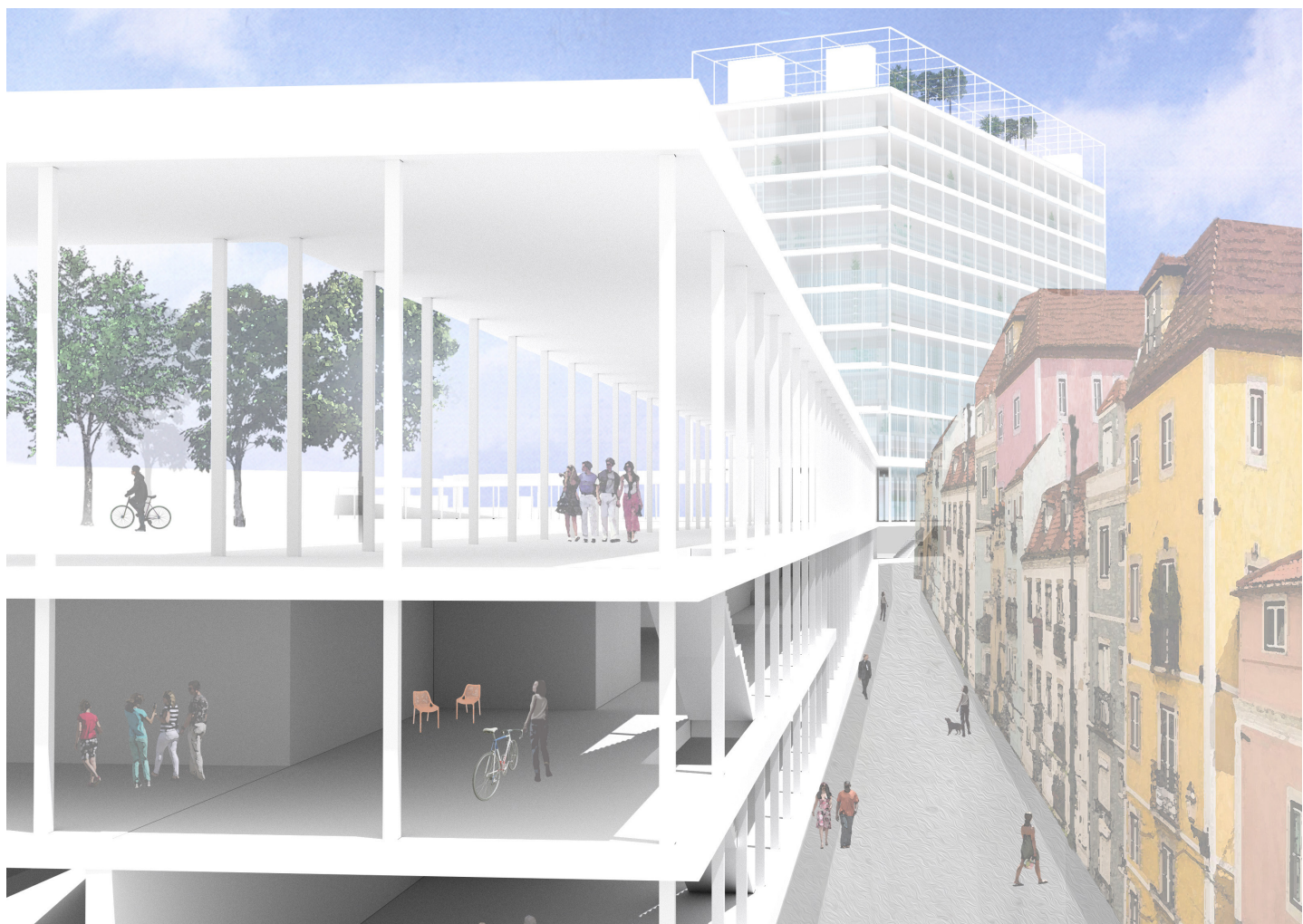


Tower - facade section
1:50

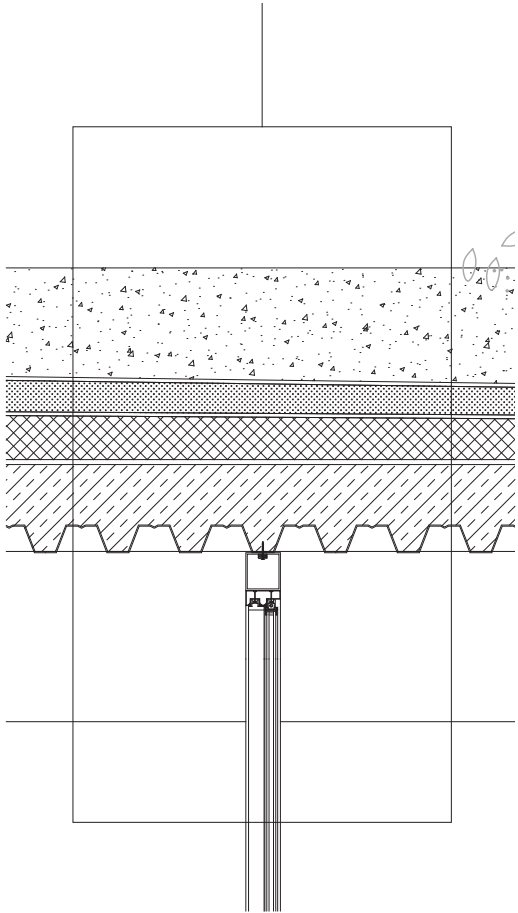




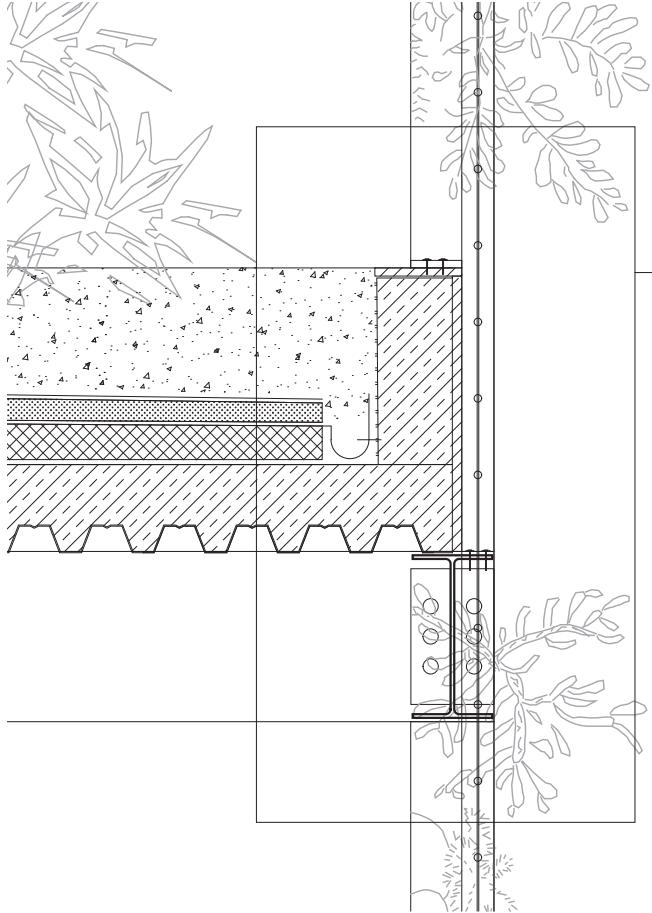
Gallery - perspective section
1:75



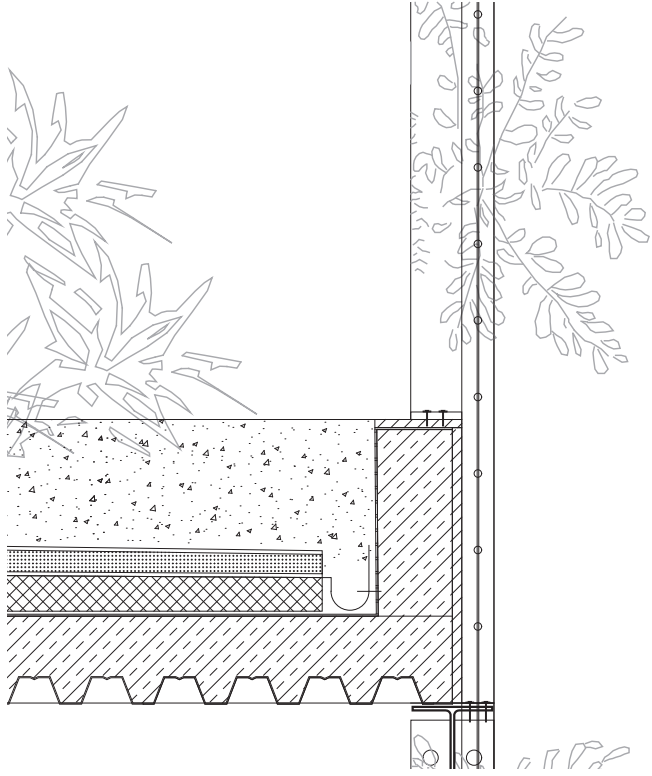
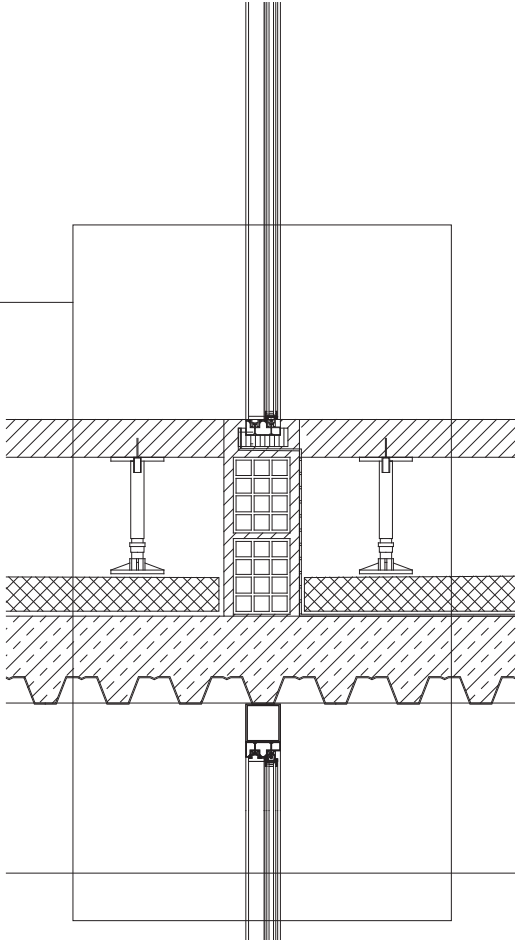
Detail 2



Detail 1

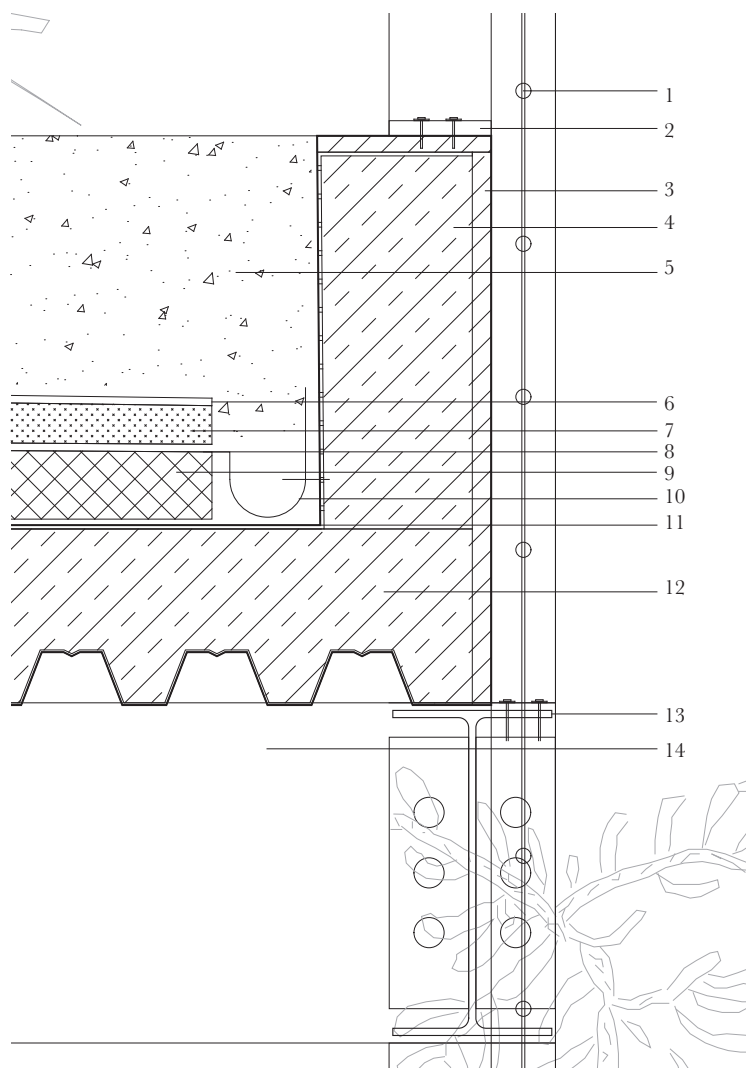


Detail 3

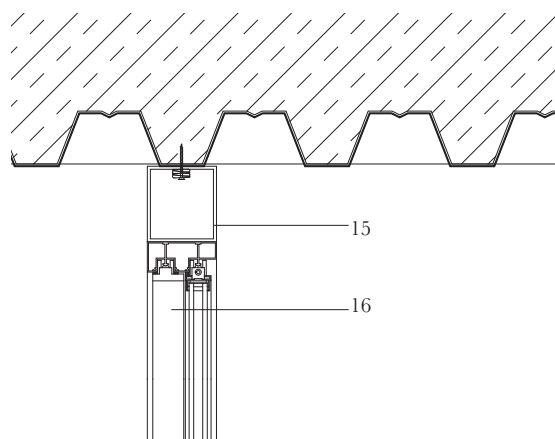


Tower + housing - constructive section
1:20

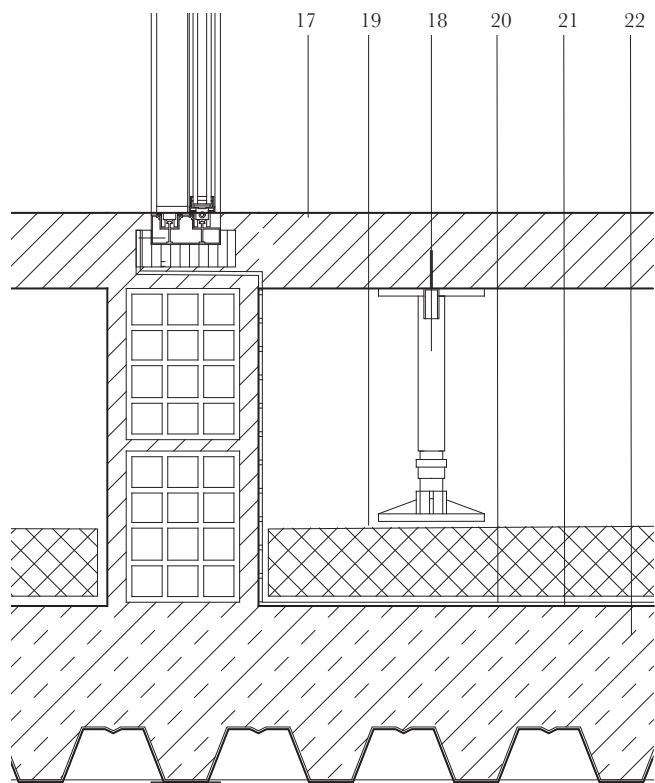
Detail 1



Detail 2



Detail 3

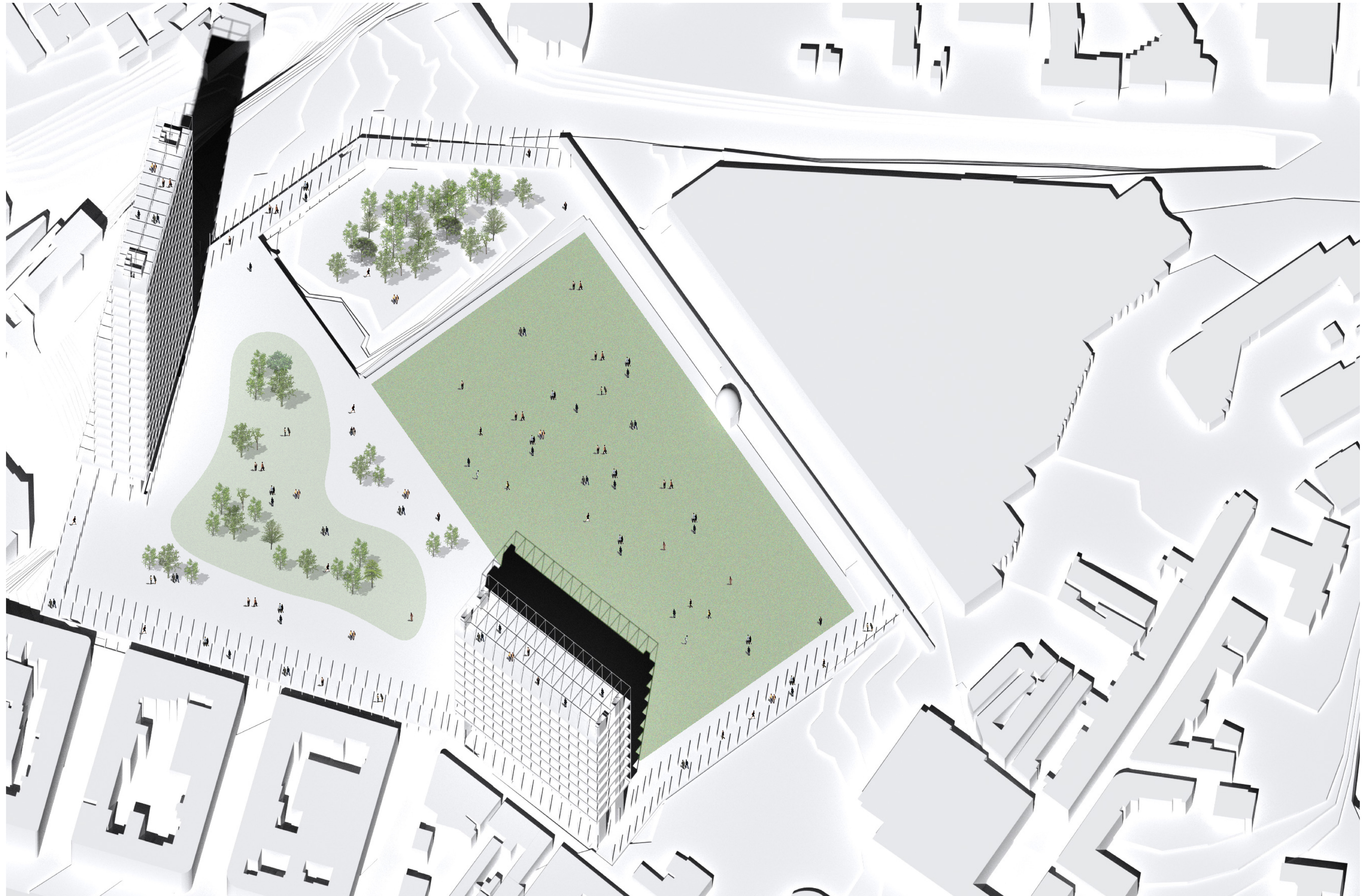


1. Galvanized steel mesh $\varnothing$ 20 mm
2. Metal frame for mesh 80 mm, bolted
3. Concrete slab cladding 25 mm
4. Reinforced concrete 200 mm
5. Substrate
6. Fabric filter
7. Filter layer washed gravel
8. Geotextile
9. Insulation
10. 100 mm
11. Drainage metal gutter $\varnothing$ 6 mm
12. Waterproofing
13. Composite ceiling profile, reinforced concrete 200 mm
14. Steel beam 210 x 430 mm
15. Metal profile, screwed to concrete
16. Double-rail slideable glass doors
17. Floating concrete floor
18. Floating floor support
19. Insulation 100 mm
20. Waterproofing
21. Vapour barrier
22. Floor reinforced concrete

Tower + housing - constructive details
1:10

A green oasis

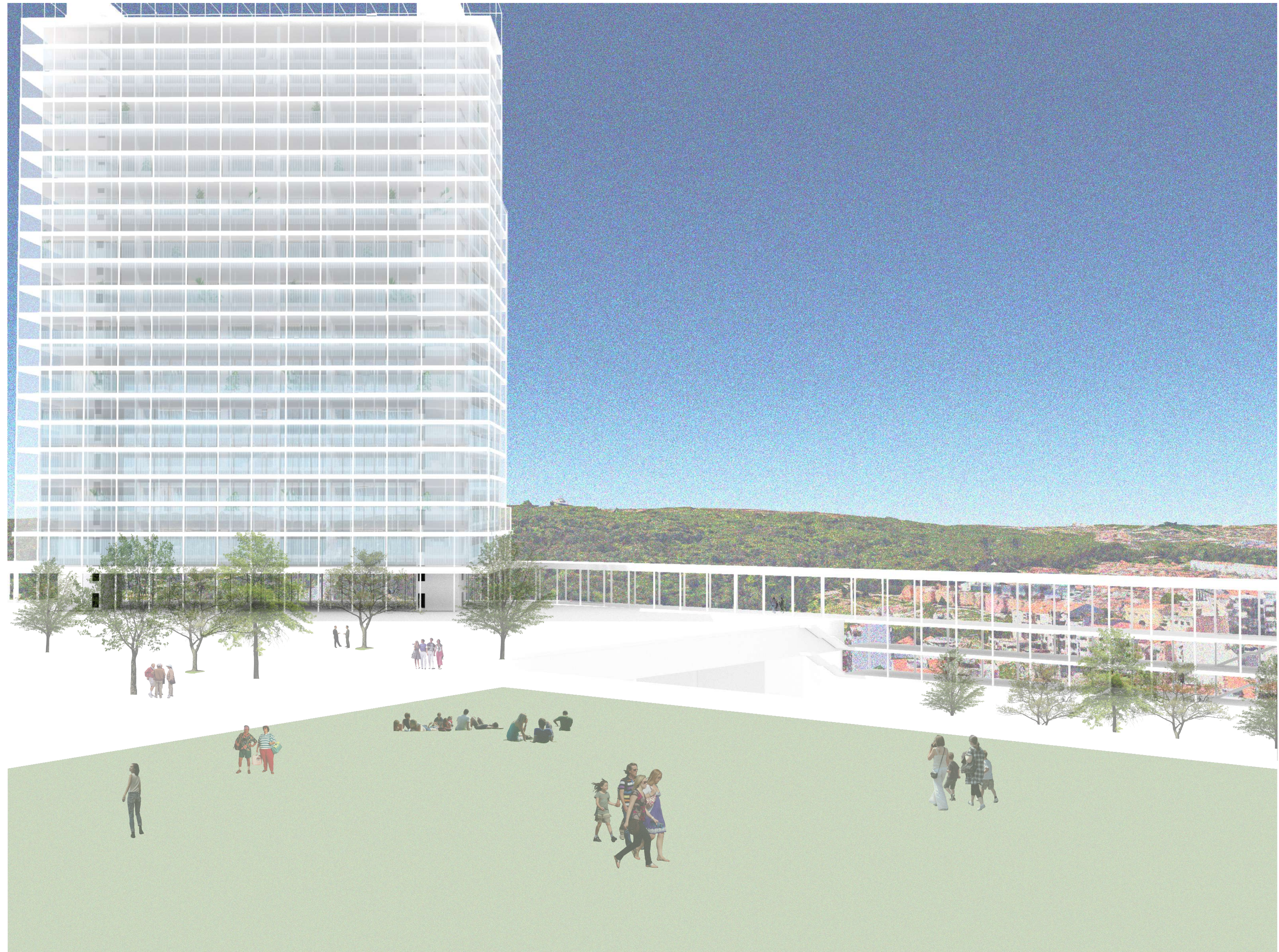
Green spaces stretch across the entire Platform area and offer recreational opportunities as well as climatic benefits. As a large open space, the lawn that covers the reservoir already offers enough quality of stay in its original state and is not to be subjected to any major changes. Other green spaces aim to enliven and at the same time structure the area. Zoning through green spaces and sealed areas can unify and spatially organise the overall large area.



A green oasis

Natural ventilation

The place can be seen as a green oasis in the centre of the city. Winds that bring fresh air from the west, from Monsanto, can be filtered thanks to the upward tapering shape of the tower, carrying a pleasant climate and fresh air into the oasis. This effect is supported by the fact that inside the oasis there is a park, and the vertical facades of the buildings are greened. The fresh filtered air is carried into the building and flows through cross ventilation the premises.



How will we come together in the future?

Since time immemorial, places connected to water have been central points of public life. Today, they no longer serve their former function as water suppliers, yet persist as public places in the form of squares, parks or gardens. Cities are constantly reinventing themselves, old infrastructures become obsolete, but their physical frameworks remain. Sustainability is an important keyword here: instead of tearing down old structures and building everything anew, the transformation of the existing is a tried and tested means of sustainable design. In the process, the existing qualities of the existing structures can be used to integrate them meaningfully into a new design.

The example of the Reservatorio de Campo de Ourique can be used to illustrate a number of points: viewed in a historical context, it is one of the youngest and last reservoirs built before the aqueduct finally became obsolete. As a product of industrialisation, it was built as a purely functional reservoir and thus differs from its predecessors (see Mãe d'Água das Amoreiras), where public space was a crucial part of the design. The basic composition of reservoir, park, and fountain of the pre-industrial reservoirs has survived the test of time, while the Reservatório de Campo de Ourique, to which nothing but a lawn covering was attributed in terms of public design, has become an urban planning challenge. On the one hand, taking the design thoughts of historical precedents as an example, on the other hand, contemporary projects of transformation serve as an impetus for the project proposal of this work. In 2010, a former airport in Berlin was opened to the public and has since functioned as a park. The 4000.000m² area, today known as “Tempelhofer Feld”⁵⁹, was left as it is and, apart from the maintenance of the lawns, was not subjected to any architectural changes. At the Reservatório de Campo de Ourique, too, the sheer lawn area of an impressive 26.000m² alone holds potential for a park of enormous amenity quality. In its case, the main challenge was to make this lawn accessible in an adequate way and to connect the surrounding districts.

Figure 43+44
Berlin, Tempelhofer Feld, 2018.

59. MADANIPOUR, Ali; KNIERBEIN, Sabine; DEGROS, Aglaée, “4,000.000 m² of Public Space: The Berlin ‘Tempelhofer Feld’ and a Short Walk with Lefebvre and Laclau”. First edition. New York: Routledge, 2014. ISBN 978-0-415-63834-0. Chapter 6, p. 63.

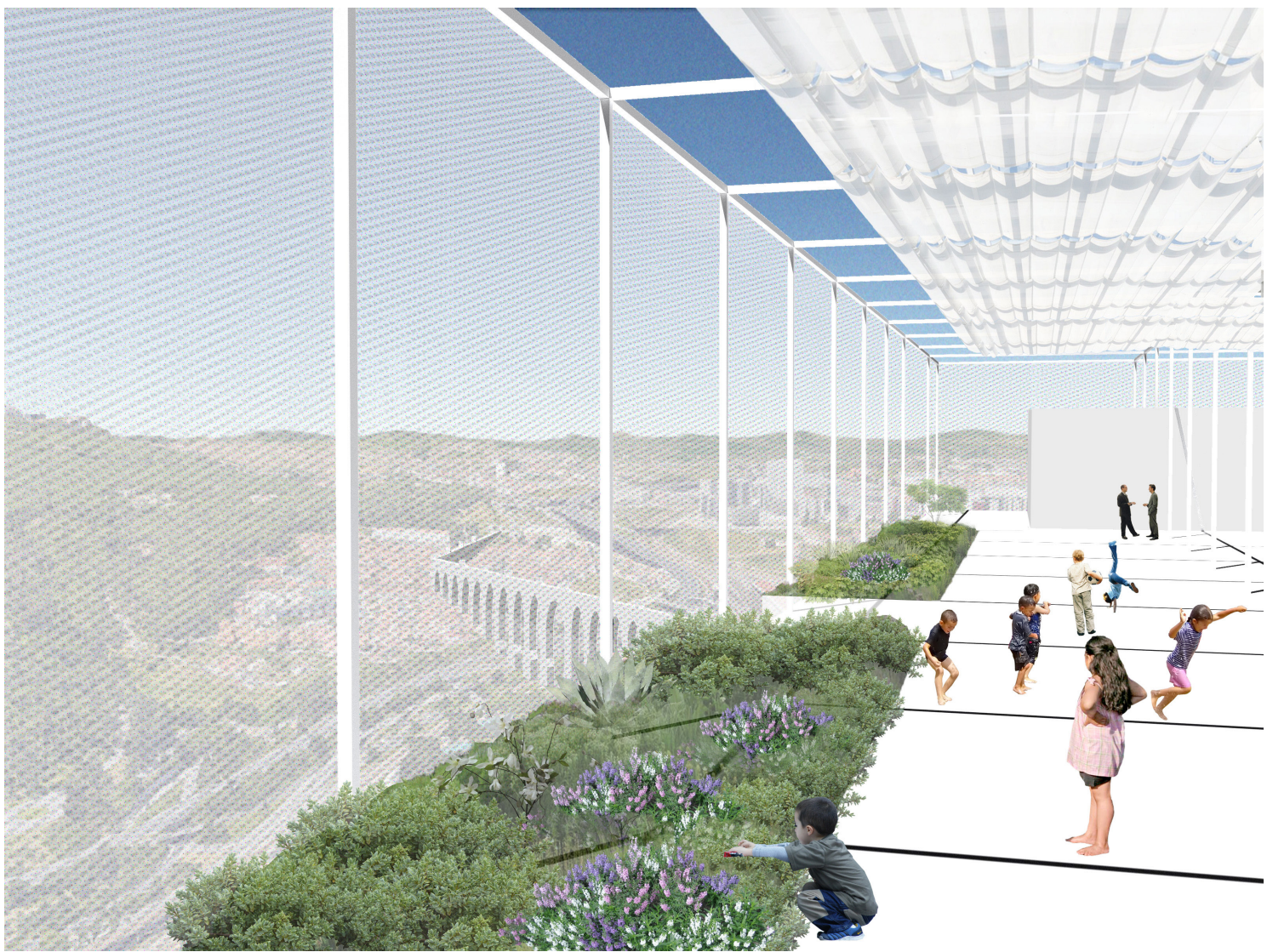


43



44

The project's design approach was to incorporate both public space and transparency as well as security and protection. Above all, the right scale had to be chosen that would do justice to the given infrastructural parameters (aqueduct, roads, transport links) and create added value in the neighbourhood. The gallery emerges as a core element here, as its scale can be understood as a small infrastructure itself, and follows the model of timeless public typologies of the Renaissance and antiquity, without wanting to copy them in purely formal terms. In its circumferential nature, it can also be understood as a controlling element, as visibility is given from every angle. The safety factor is to be considered fundamental in a public project such as a park. Furthermore, the breach that was historically created by the construction of the underground reservoir is smoothed out.



To return to the theoretical core idea of the project, the parameters mentioned at the beginning of the work are reflected in its architectural realisation: the infrastructure and the public space, both in a reinterpretation that is intended to do justice to its time. The idea of repurposing old infrastructures is by no means a new one, and whether it is water reservoirs, former airports, multi-storey car parks or department stores, which are likely to be empty shells in the city in the future due to car-sharing and online shopping, the strategy of the project can be used to revive obsolete infrastructures in the form of public places. The infrastructure of the water supply, which served as the core object of the thesis, is only one example that can be transferred to other structures. In the end, a city is not a static but a dynamic construct, in which conditions constantly evolve over time. It is an expression of political power relations, social and structural changes and always a testimony to its time. Nowhere is this more physically visible than in architecture.



fin.



BIBLIOGRAPHY

ALMEIDA MAIA, Susana Pais de; CORREIA DINIZ, Silva, “O bairro de Campo de Ourique: projectos e actuações (1878-1958)”, Dissertação de Mestrado em História da Arte Contemporânea, Lisboa: UNL, 2013, p.14. Available at: <https://run.unl.pt/handle/10362/13691> (accessed 2021).

ANDRADE, Velloso de; SERGIO, José, Memoria sobre chafarizes, bicas, fontes, e poços públicos de Lisboa, Belem e muitos logares do termo : oferecida á ex.ma camara municipal de Lisboa. Lisboa: Silviana, 1851, p. 4-6. Available at: <https://archive.org/details/memoriasobrechaf00vell/page/263/mode/thumb>.

BENALI, Karim Cunha, “O Aqueduto das Águas Livres como elemento dinamizador e regenerador do eixo Lisboa-Sintra”, Dissertação para obtenção do grau de Mestre em Arquitectura, Lisboa: FAUL 2016. Available at: <http://hdl.handle.net/10400.5/12049> (accessed 2021).

CASEIRO, Carlos; PENA, Américo; VITAL, Raul, “Histórias e outras memórias do Aqueduto das Águas livres”, Lisboa: EPAL, 1999.

CHOAY, Françoise, The Modern City: Planning in the 19th Century. New York: George Braziller, Inc., 1969.

FERREIRA, Maria Dolores, “O abastecimento de água à cidade de Lisboa nos Séculos XVIII e XIX” in Revista Finisterra, Vol. 16, N.º 31. Lisboa: Finisterra, 1981. Available at: <https://doi.org/10.18055/Finis2193>.

GANDY, Matthew, “The Fabric of Space: Water, Modernity, and the Ur-

ban Imagination” in Leviathan. Berlin: Nomos Verlagsgesellschaft mbH. ISSN: 03400425. Vol. 33, No. 4 (December 2005), German Translation by Maren Harnack.

LARCHER, Cap. Jorge das Neves, Memória Histórico sôbre o abastecimento de Água a Lisboa até ao reinado de D. João V, Lisboa: suplemento do Boletim do Comissão de Fiscalização das Obras de Abastecimento de Água à Cidade de Lisboa, 1937.

MARAT-MENDES, Teresa (coord.); MOURÃO, Joana; BENTO D’ALMEIDA, Patrícia; NIZA, Samuel, “Water and Agriculture Atlas: Lisbon Region 1900-1940”. Lisboa: ISCTE-IUL, 2015, p. 22-23. DOI: 10.15847/pm.2015.001. Available at: <https://repositorio.iscte-iul.pt/handle/10071/8985>.

PICON, Antoine, “Constructing landscape by engineering water”, in Landscape Architecture in Mutation: Essays on Urban Landscapes, Institute for Landscape Architecture, ETH Zurich, Zürich: gta Verlag, 2005.

RODRIGUES, Joana Mafalda Pimenta, “Caminho de vida : Aqueduto das Águas Livres : património hidráulico português”, Dissertação de Mestrado em Arquitectura, Lisboa: Universidade Lusíada, 2017. Available at: <http://hdl.handle.net/11067/3326>.

SITTE, Camillo, Der Städtebau nach seinen künstlerischen Grundsätzen. Reprint of the 4th edition of 1909, first edition published in 1889, Basel, Boston, Berlin: Birkhäuser, 2001.

SITOGRAPHY

CEMBALEST, Robin, “From Kongo to Othello to Tango to Museum Shows”, in ARTnews (October 25, 2012). Available at: <https://www.artnews.com/art-news/news/image-of-africans-in-western-art-2119/> (accessed September 6, 2021).

EPAL, s.v. “Aquaduto das Águas Livres”. Available at: <https://www.epal.pt/EPAL/menu/museu-da-água/exposição-permanente-património-associado/aquaduto-das-águas-livres> (accessed February 15, 2022).

EPAL, s.v. “Reservatório da Patriarcal”. Available at: <https://www.epal.pt/EPAL/menu/museu-da-água/exposição-permanente-património-associado/reservatório-da-patriarcal> (accessed February 15, 2022).

Wikipedia, The Free Encyclopedia, s.v. “Galeria do Loreto”. Available at: https://pt.wikipedia.org/wiki/Galeria_do_Loreto (accessed February 15, 2022).

Wikipedia, The Free Encyclopedia, s.v. “Infrastruktur”. Available at: <https://de.wikipedia.org/wiki/Infrastruktur> (accessed February 15, 2022).

Wikipedia, The Free Encyclopedia, s.v. “Jardim das Amoreiras”. Available at: https://pt.wikipedia.org/wiki/Jardim_das_Amoreiras (accessed February 15, 2022). Sistema de Informação para o Património Arquitectónico. Available at: http://www.monumentos.gov.pt/site/app_pagesuser/SIPA.aspx?id=25486 (accessed May 2, 2021).

Sistema de Informação para o Património Arquitectónico, s.v. “Jardim do Príncipe Real”. Available at: http://www.monumentos.gov.pt/Site/APP_PagesUser/SIPA.aspx?id=6998 (accessed February 15, 2022).

Sistema de Informação para o Património Arquitectónico, s.v. “Reservatório de Campo de Ourique”. Available at:

http://www.monumentos.gov.pt/Site/APP_PagesUser/SIPA.aspx?id=26936 (accessed February 15, 2022).

VAN LAAK, Dirk, “Eine kurze (Alltags-) Geschichte der Infrastruktur - Essay” (April 11, 2017). Available at: <https://www.bpb.de/apuz/246420/eine-kurze-alltags-geschichte-der-infrastruktur#footnode3-3> (accessed September 6, 2021).

INDEX OF IMAGES

01. Ponte Vecchio, 2020

Source: unknown

Available at: <https://wallpapi.com/>

02. Bird’s-eye view of Venice, 1559

Source: Based On The Map Of Forlani. The Vignette With Part Of The Doge’s Procession Is Taken From M. Pagani (1559).

Available at: <https://sanderusmaps.com/our-catalogue/antique-maps>

03. Paris, Plan De Méraín 1615

Source: Unknown, Paris, 1615

Available At: [Http://www.oldmapsofparis.com/](http://www.oldmapsofparis.com/)

04. La Plage à Trouville, Claude Monet, 1870.

Source: unknown

Available at: [https://upload.wikimedia.org/wikipedia/commons/5/55/](https://upload.wikimedia.org/wikipedia/commons/5/55/Monet_paris_marmottan_strand_trouville.jpg)

[Monet_paris_marmottan_strand_trouville.jpg](#)

05. Swimming in the Rhine in Basel, ca 1980.

Source: unknown

Available at: <https://www.prospectmagazine.co.uk/magazine/travel-basel-rhine-wickelfisch-swimming-river>

06. Paul Cézanne, “La Tranchée du chemin de fer”, 1870

Source: Paul Cézanne, “La Tranchée du chemin de fer”, 1870

Available at:

https://pt.wikipedia.org/wiki/Ficheiro:La_Tranch%C3%A9e_du_chemin_de_fer

07. Chafariz no Largo do Carmo, 25 de Abril 1974

Source: unknown, 1974

Available at: <https://arquivomunicipal.lisboa.pt/>

08. Largo do Carmo (former Largo do Chafariz), 2022

Source: Aires dos Santos, 2017

Available at: <https://www.trekearth.com/>

09. Perspective of the Aqueduto das Águas livres, circa 1800

Source: unknown, circa 1800

Available at: <https://www.pinterest.pt/pin/196962183682478266/>

10. Siege of Lisbon, Roque Gameiro, 1917

Source: Roque Gameiro, Siege of Lisbon, 1917

Available at: <https://pt.m.wikipedia.org/wiki>

11. Rua Nova dos Mercadores, séc. XVI.

Source: unknown, séc. XVI

Available at: <http://lisboa-c-o-tejo.blogspot.com>

12. Chafariz d’El-Rey, circa 1580

Source: unknown, Chafariz d’El-Rey, circa 1580 (Palácio da Bacalhôa)

Available at: https://en.wikipedia.org/wiki/The_King%27s_Fountain

13. Valley of Alcântara and the Aqueduto das Águas Livres, circa 1790

Source: unknown, Arquivo Municipal de LisboaAvailable at: <https://arquivomunicipal.lisboa.pt/>

14. Aguadeiros in „Chafariz de Dentro”, em Alfama, 1907

Source: Joshua Benoliel em “Gente de Lisboa - (1907)

Available at: <https://aps-ruasdelisboacomhstria.blogspot.com/>

15. Chafariz D’El Rey, Alfama, 1907

Source: unknown, Arquivo Municipal de Lisboa

Available at: <https://amensagem.pt/>

16. Aqueduto das Águas Livres, Lisboa, 1912

Source: unknown, 1912

Available at: <https://cronicas03.wordpress.com/>

17. Aguadeiros in „Chafariz da Esperança“, Alfama, 1907

Source: Joshua Benoliel em “Gente de Lisboa - (1907)

Available at: <https://arquivomunicipal.lisboa.pt/>

18. Piazza della Signoria, Florence, Giuseppe Zocchi, 1744

Source: unknown

Available at: https://pt.wikipedia.org/wiki/Piazza_della_Signoria#/media/Ficheiro:Giuseppe_Zocchi_-_The_Piazza_della_Signoria_in_Florence_-_WGA25992.jpg

19. Figure _Piazza della Signoria, Florence, 2010

Source: unknown

Available at: https://commons.wikimedia.org/wiki/File:Firenze_-_Florence_-_Piazza_della_Signoria_-_View_NW.jpg

20. Schemes from Camillo Sitte - City Planning According to Artistic Principles (1889)

Source: City Planning According to Artistic Principles (1889), Translated by George R. Collins and Christiane Crasemann Collins (London: Phaidon Press, 1965):91-104;105-112.

Available at: https://blogs.ethz.ch/prespecific/2013/09/18/camillo-sitte-city-planning-according-to-artistic-principles/?fbclid=IwAR3Fkl20N3opDaW_d_Xj8ZkokTT0XqxFIVM6FTWxE8qpc5s1z83YIn-iCKuc

21. Chafariz do Rato, circa 1905

Source: unknown, circa 1905

Available at: <https://egeac.pt/>

22. Arches of the aqueduct along the „jardim das Amoreiras“, 1914

Source: unknown, Arquivo Municipal de Lisboa

Available at: <https://arquivomunicipal.lisboa.pt/>

23. Bird eye view of Mãe de Água das Amoreiras, 1930

Source: Mário de Oliveira, 1930, Arquivo Municipal de Lisboa

Available at: <https://arquivomunicipal.lisboa.pt/>

24. ”Jardim das Amoreiras”, 2022

Source: unknown, 2022, Arquivo Municipal de Lisboa

Available at: <https://arquivomunicipal.lisboa.pt/>

25. “Jardim das Amoreiras“, 1930

Source: unknown, 2022, Arquivo Municipal de Lisboa

Available at: <https://arquivomunicipal.lisboa.pt/>

26. Map with Jardim das Amoreiras, Mãe de Água and Largo do Rato, Lisbon, 1857.

Source: Arquivo Municipal de Lisboa

Available at: <https://arquivomunicipal3.cm-lisboa.pt/>

27. Planta de Lisboa, 1807

Source: Duarte Fava, 1807, Arquivo Municipal de Lisboa

Available at: <https://arquivomunicipal.lisboa.pt/>

28. Mapa de Lisboa, 1904-1911

Source: Silva Pinto, Arquivo Municipal de Lisboa

Available at: <https://www.researchgate.net/figure/Cartographic-map-by-Silva-Pinto-1904-1911>

29. Jardim do Principe Real, 1890

Source: Levantamento topográfico de Francisco Goullard, 1890

Available at: <https://arquivomunicipal.lisboa.pt/>

30. "Biblioteca no Jardim do Principe Real", circa 1935

Source: unknown, Arquivo Municipal de Lisboa

Available at: <https://arquivomunicipal.lisboa.pt/>

31. "Jardim do Principe Real", 1930

Source: unknown, Arquivo Municipal de Lisboa

Available at: <https://arquivomunicipal.lisboa.pt/>

32. „Planta de Campo de Ourique (antes da construção do Reservatório)", 1857

Source: Arquivo Municipal de Lisboa

33. „Vista aérea das zonas de Campo de Ourique e Amoreiras em Lisboa vendo-se o reservatório de Campo de Ourique", 1950

Source: Arquivo Municipal de Lisboa

Available at: <https://arquivomunicipal3.cm-lisboa.pt/>

34. "Reservatório de Campo de Ourique", 1904

Source: Arquivo Municipal de Lisboa

Available at: <https://arquivomunicipal3.cm-lisboa.pt/>

35. "Planta topográfica do Reservatório de Campo de Ourique", 1888

Source: Arquivo Municipal de Lisboa

Available at: <https://arquivomunicipal3.cm-lisboa.pt/>

36. Sections of Reservatório de Campo de Ourique, 1888

Source: Arquivo Municipal de Lisboa

Available at: <https://arquivomunicipal3.cm-lisboa.pt/>

39. Karawanserei, Turkey, 1560

Source: unknown

Available at: <https://hiddenarchitecture.net/rustem-pasa-caravanserai/>

40. Aereal photograph, Karawanserei, Turkey

Source: unknown

Available at: <https://hiddenarchitecture.net/rustem-pasa-caravanserai/>

41. Corridoio Vasariano, A gallery connecting Palazzo Vecchio and Palazzo Pitti, Giorgio Vasari, Florence, Italy, 1565

Source: unknown

Available at: <https://cryptic-k.com/Corridoio-Vasariano-1>

43. Tempelhofer Feld, 2018

Source: unknown, 2018

Available at: <https://theplaidzebra.com/>

44. The Corridor Of The Uffizi, Benedetto De Greyss, circa 1750.

Source: Benedetto De Greyss, The Corridor Of The Uffizi, Half Of XVIII Century.

Available At: [Http://Www.Engramma.It/Eos/Index.Php?Id_Articolo=2347](http://Www.Engramma.It/Eos/Index.Php?Id_Articolo=2347)

43. Tempelhofer Feld, 2018

Source: unknown, 2018

Available at: <https://theplaidzebra.com/>

44. Tempelhofer Feld, 2018

Source: unknown, 2018

Available at: <https://theplaidzebra.com/>