D2.4 Urban Plan
Part 1 - Introduction

Lead partner	CES
Type	Demonstrator
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Acronym	URBiNAT - Urban inclusive and innovative nature
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2021.06.18	V1	All	Proposal of the deliverable structure to be discussed
2021.07.31	V2	Gonçalo Canto Moniz (eds)	Submission of the deliverable with part 2, 3, 4 as an advanced draft
2021.11.21	V3	Gonçalo Canto Moniz (eds)	Submission of the deliverable complete with part 1, 2, 3, 4

Fonts

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Part 1 – Introduction

Purpose of deliverable

Deliverable 2.4 is a demonstrator of the proposal for urban plans of the Healthy Corridor in the URBiNAT frontrunner cities - Porto, Nantes, Sofia. The proposals were co-designed by the local taskforce with citizens and stakeholders according to the co-creation methodology. In this sense, the urban plan of the healthy corridor of each city integrates three main achievements: firstly, the local diagnostic, where the needs and expectations for the territory and for the community were identified; secondly the healthy corridor concept where the NBS proposed by the citizens were integrated in the global strategy for the local living lab and thirdly the co-implementation of NBS based on the stakeholders advisory board, where citizens follow the planning and construction procedures.

Although the urban plan followed the co-creation methodology developed by URBiNAT, it was adapted to the local urban planning culture and to the local municipality procedures. This flexibility and adaptability of the methodology is a central issue when the process runs in parallel in three different cities. The specificity of the urban plan is also anchored in the participatory process, where local citizens and stakeholders built together a vision based on clusters of NBS.

The urban plan aims to represent the healthy corridor in its physical dimension with technical specifications according to the international standards, from intermediate scale to detailed one, with analytical description, digital drawings, text specifications, interpretative diagrams, 3D models and also with virtual reality. Nevertheless, the representation of the physical solutions establishes a dialogue with the immaterial solutions, that aim to activate the social, cultural and economic dimension of the healthy corridor.

Roles and objectives in relation to other work packages

In the frame of WP2, deliverable 2.4 “Urban Plan” presents the proposal of the healthy corridor for the living labs of frontrunner cities - Porto, Nantes and Sofia. On one side, the healthy corridor aims to integrate the needs and dreams identified in the local diagnostic and reported in deliverable 2.1. On the other side, the healthy corridor is also the result of the knowledge shared between partners, cities, observers, and other H2020 projects on NBS, framed in task 2.2 Networking and 2.3 Community of Practice. Deliverable 2.4 will also inspire the urban plan of the healthy corridor of follower cities, deliverable 2.7. Finally deliverable 2.5, Roadmap for NBS and healthy corridors planning and implementation, will analyse the urban plan and establish the guidelines for co-planning, co-designing and co-implementing this innovative concept in local projects.

In relation with WP3, the urban plan of the healthy corridor was co-created by the local taskforce and citizens and stakeholders following the steps defined in WP3. Firstly, by identifying the local participatory culture (deliverable 3.1), secondly, by establishing the methods and tools for the uptake of NBS by citizens (deliverable 3.2), thirdly, by developing the co-creation process according to the guidelines defined in the task 3.5 for Participatory training workshops. This process is deeply described in the deliverable 4.2 healthy corridor concept.

The relation with WP4 was very important to co-design the NBS and to define the co-implementation stage. Deliverable 4.1 New NBS described how the NBS Catalogue inspired the NBS proposed by citizens, while deliverable 4.2 Healthy corridor concept related the new NBS with the needs identified by citizens, with the participatory process and with the global strategy for the study area. Finally, deliverable 4.3 plans the co-implementation of NBS establishing the stakeholders advisory board and the procedures of the construction of the healthy corridor. The task 4.5 supported D2.4 with design specification according to the international standards, from intermediate scale to detailed one, with analytical description, digital drawings, text specifications, interpretative diagrams, 3D models and virtual reality in articulation with an interdisciplinary team of technicians and local authorities.

The WP5, Observatory for Urban Inclusive and Innovative Nature, is developing a monitoring strategy for the urban plan of the healthy corridor, by collecting data before and after the implementation, related to the impact on health and environment (task 5.3), economy and social (task 5.4) and governance (task 5.5). The monitoring and evaluation are based on an analytical framework developed in task 5.6.

The communication and dissemination actions related with the urban plan are framed by WP5, namely the communication with citizens through the website and social media (task 6.2) and the urban plan dissemination in conferences and papers (tasks 6.3 and 6.4)

The WP7 is analysing the urban plan and its NBS co-created in each frontrunner to identify its business potential and select the business cases for replication and scaling (7.3 and 7.4)

Executive summary

The healthy corridor is a public space that connects and links neighbourhoods as a pathway across a green area and as a social, cultural and educational platform. It integrates not only nature-based solutions but also human-centered ones, providing a double effect on the environment and people's health and wellbeing.

The urban plan for the healthy corridor is a planning document that describes the intervention area, identifies the actual territorial and social context, defines the strategy with the master plan and develops the specific topics to guide the construction and implementation of NBS.

The urban plan is organised by the local taskforce and integrates the co-creation process developed with the participation of citizens and stakeholders. The local diagnostic mapped the needs and expectations and the co-design selected the NBS to be developed and integrated in a common vision.

The specificity of the local planning culture and the local participatory process, produced very different approaches to each urban plan and to each healthy corridor, although the methodologies and the concepts are in line with URBiNAT principles. This demonstrates the flexibility and adaptability of the process.

The urban plan is a demonstrator and, in this sense, it uses less text and more drawings, schemes, models, 3D models and virtual reality. The design approach and the representation criteria were not imposed to the cities although the networking between partners during the last two offers created common understandings.

Nevertheless, the structure of the deliverable was agreed between the three taskforces: Porto, Nantes and Sofia - in order to facilitate the analysis of the document. The structure of the deliverable is organized in four parts: part 1 is an introduction to three urban plans where principles and methodologies will be established; part 2 presents the urban plan of Porto's healthy corridor; part 3 presents the urban plan of Nantes' healthy corridor; part 4 presents the urban plan of Sofia's healthy corridor.

Each city will organise its urban plan according to the following structure:

The "Introduction to the intervention area" presents and describes the urban context and the site with images (plans and photographs) and schemes providing a synthesis of the material already developed in the local diagnostic

The chapter 2 "Needs and expectations" analyses the results of the co-diagnostic participatory activities in order to establish the baseline for the co-design of the healthy corridor in social and territorial terms.

The chapter 3 "Healthy corridor" is dedicated to the urban plan relating to the current situation with the proposal focused on the territorial transformations as the physical support for the social, cultural and economic solutions. It starts with the master plan where the strategy and design principles are established and then it develops the specifications according to the characteristics of the intervention area (terrain modelling, pedestrian network, vegetation and irrigation, built structures, pavements, urban furniture, among others). Then it describes the "People places"

representing the main intervention places combining the physical interventions in the public space with the NBS proposal that will activate the social, cultural, educational, sports and social economy dimensions. Finally, it develops the territorial nature-based solutions that were integrated on the urban plan based on the technical needs and on the citizens' proposals. Chapter 4 “Main Achievements” identifies the Main findings and results, as well as the Lessons learnt.

D2.4 Urban Plan Porto

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30.07.2021	V1	José Miguel Lameiras, David Campos, Beatriz Truta, Rosendo Silva	-
31.07.2021	V2	José Miguel Lameiras, David Campos, Beatriz Truta, Rosendo Silva	-
21.11.2021	V3	all	Some additions on the project development.

Fonts

Montserrat	by Julieta Ulanovsky
Source Sans Pro	by Paul D. Hunt

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Part 2 – Porto

1.Introduction

This document will focus on the urban project developed for the intervention area in Campanhã, Porto. The intervention area is located in the interface between Cerco do Porto, Falcão and Lagarteiro social housing neighbourhoods. It was selected through a deductive process (Figure 1) consisting of an analysis of the city and the identification of the study and intervention area. Several actors, supported by Porto taskforce team, were involved in the development of this process.

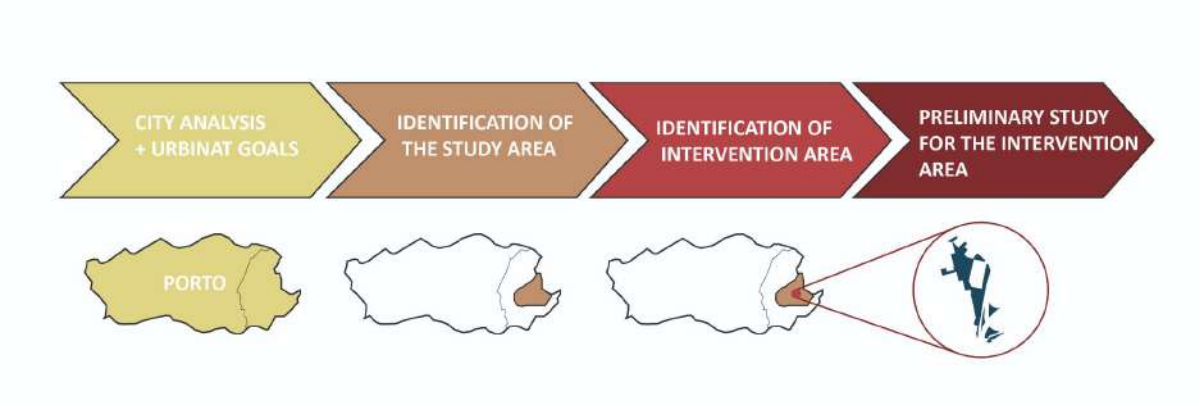

Figure 1. Deductive process for the identification of the intervention area (URBiNAT, 2021)

Urban context

The intervention area (Figure 2) reveals the transformations that this part of the city has undergone. Until the eighteenth century, the site was mainly used for farming and the layout of the agricultural holdings stamped it with its own particular identity. The nineteenth century ushered in industrial development and the expansion of transportation. This development continued until the second half of the twentieth century, after which industrial activity declined and disappeared and more people moved into the area. In response to a growing need to expand the city to the east, this area was selected for the building of several social housing projects. The urban transformations that followed, particularly the construction of the A43 motorway and Alameda de Cartes, significantly altered what remained of the pre-industrial agricultural landscape. It also introduced problems of urban fragmentation and territorial disconnection in an area that was already marked by the discontinuities of its natural topography.

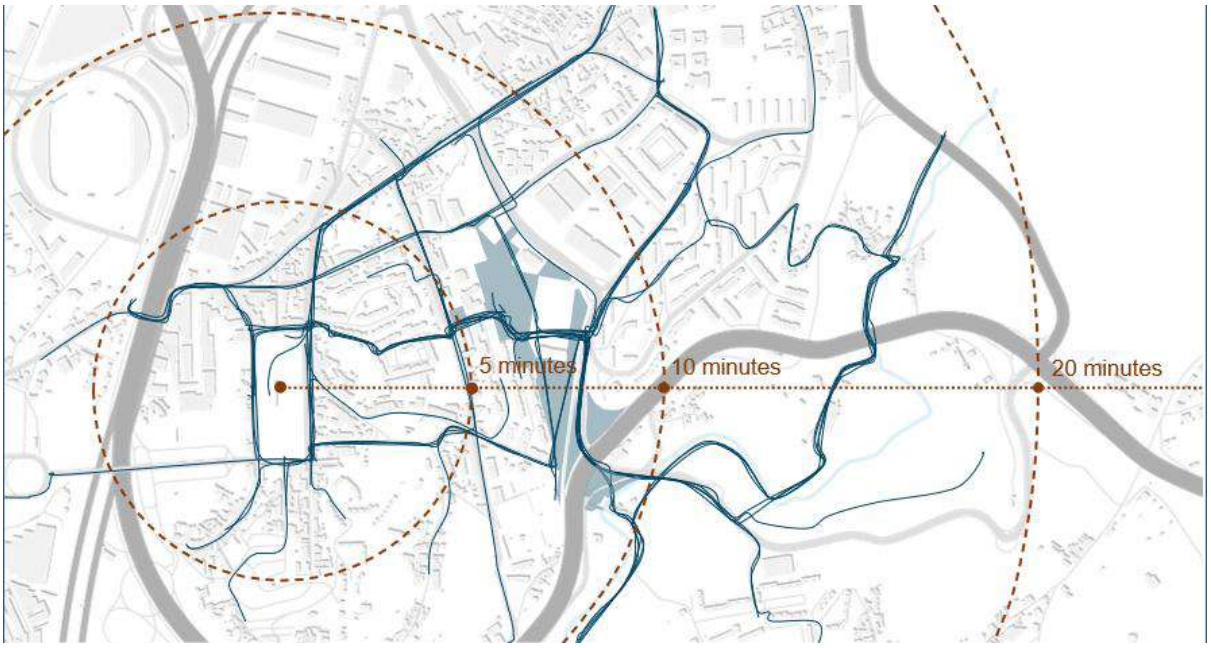

Figure 2. Urban context of the intervention area (in blue) and main pedestrian connections (blue lines)

One of the main functions of this space is to provide pedestrian links between areas of predominantly residential nature and multifunctional areas that access parks, schools, facilities and services, such as those found around Praça da Corujeira. The behavioural mobility studies show that this is an area in which people tend to travel by foot and where the main destinations (schools, supermarkets, public transportation) can be walked to in less than 15 minutes. The links to the easternmost parts of the city are more limited, especially the pedestrian connections to the Lagarteiro neighbourhood, Azevedo de Campanhã and the Oriental Park expansion areas. The fact that the intervention area is crossed by A43 is of particular relevance to this area, as it is the only such crossing along a 1 km stretches of the motorway.

The site

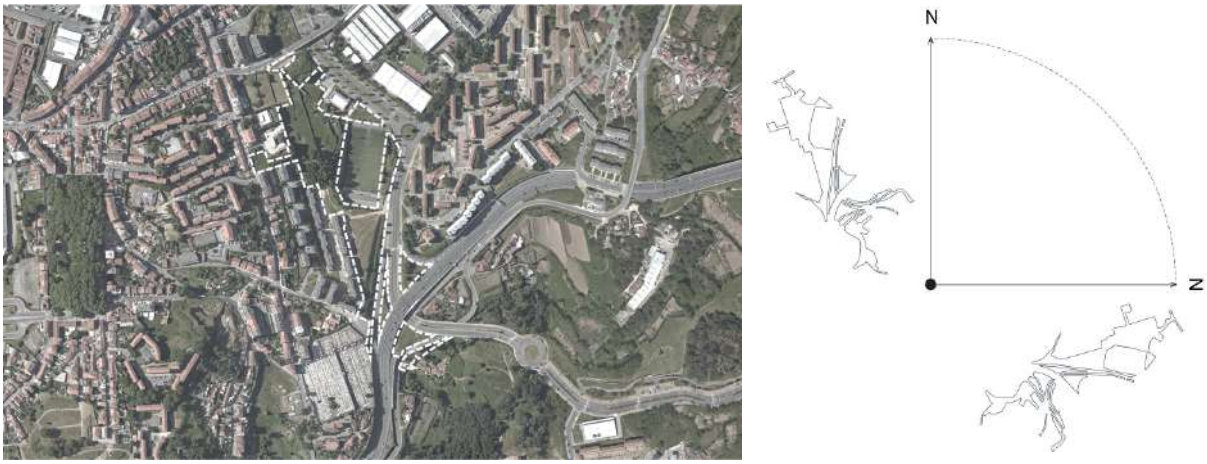

Figure 3. Limits for the implementation of the Healthy Corridor in Campanhã Parish; Graphic representation of the rotation for future plans

Most of the intervention area (Figure 3) is located between Rua do Falcão, Alameda de Cartes and N12. This space, which will lie along an east-facing slope, is highly heterogeneous due to the transformations it has been subjected to over time.
The northern area (to the right on Figure 4) has preserved its agricultural character, marked by terraces supported by granite masonry walls. Due to its less steep topography, there are possibilities for the development of recreational areas. Further to the south (to the left on Figure 4), the terrain has been greatly disturbed by urbanistic interventions. The remaining areas are composed of steep slopes as embankments for the road systems.

Figure 4. Existing situation (Aerial view)

A. Falcão primary school
B. Oliveira urban garden
C. Municipal swimming pool, with entrance to Alameda de Cartes
D. Football field, with entrance to Avenida Artur de Andrade
E. Campanhã Cemetery, with a secondary entrance to the intervention area
F. Oriental Park expansion areas, along the Tinto River
G. Agrupamento Habitacional do Falcão



1. Walled plot adjacent to Falcão primary school
2. Plot adjacent to the Oliveira urban garden
3. Flat clearing on the lower level of the Oliveira urban garden



4. Ruin of the old Falcão Farmhouse
5. Current access to Rua Emílio Biel (westwards) or Alameda de Cartes (eastwards).
6. Green space adjacent to the municipal swimming pool



7. Open space between the football field and the municipal swimming pool
8. Moderately sloped clearing in front of the Falcão housing
9. Embankments running alongside Avenida Artur de Andrade



10. Area between the A43 underpass and Estrada da Circunvalação (N12).
11. Access to the new Oriental Park expansion areas
12. Existing granite walls and pedestrian paths

2. Needs and expectations

The participatory process and the local diagnostic allowed for the identification of several needs and expectations already listed in Deliverable 4.2 (Table 1). The involvement of citizens, passers-by, municipal technicians and the URBiNAT taskforce was key to developing the healthy corridor concept.

a) Territorial Analysis

- Green areas and their connection for leisure and sports activities
- Better conditions of pedestrian paths. New connections
- More accessible paths for all citizens
- Lighting
- Stay/sitting/resting areas
- Qualified green areas and nature in the urban environment
- More autochthonous plants and trees
- Play areas for children

b) Social Analysis

- Adequate cleanliness and maintenance of the public space
- Socialization/community/entertainment opportunities. Community spaces improvement
- Improve local economy
- Respect existing memory
- More connectivity with existing and future projects/initiatives
- Participatory opportunities/tools for citizens engagement in urban planning
- Improve literacy for environmental issues

Table 1. List of needs identified in D4.2 for the city of Porto

This document will mainly focus on territorial needs. After the delivery of the Local Diagnostic (D2.1) and the final approval of the intervention limits, the local team felt the need to perform specific diagnostic studies and more detailed analysis at this new scale of intervention:

- **Territorial studies** - concerning topography, pedestrian mobility, existing built structures, vegetation, lighting, perception of safety and visibility;
- **Survey to the users** - applied to 100 passers-by to identify uses, local needs and to get users' opinions.
- **Technician's feedback** - meetings with different municipal departments to collect feedback for the preliminary study of the Healthy Corridor.
- Participatory activities & walkthroughs - in situ

Figure 5 lists and organises some testimonies shared by the passers-by interviewed during the implementation of the local survey:

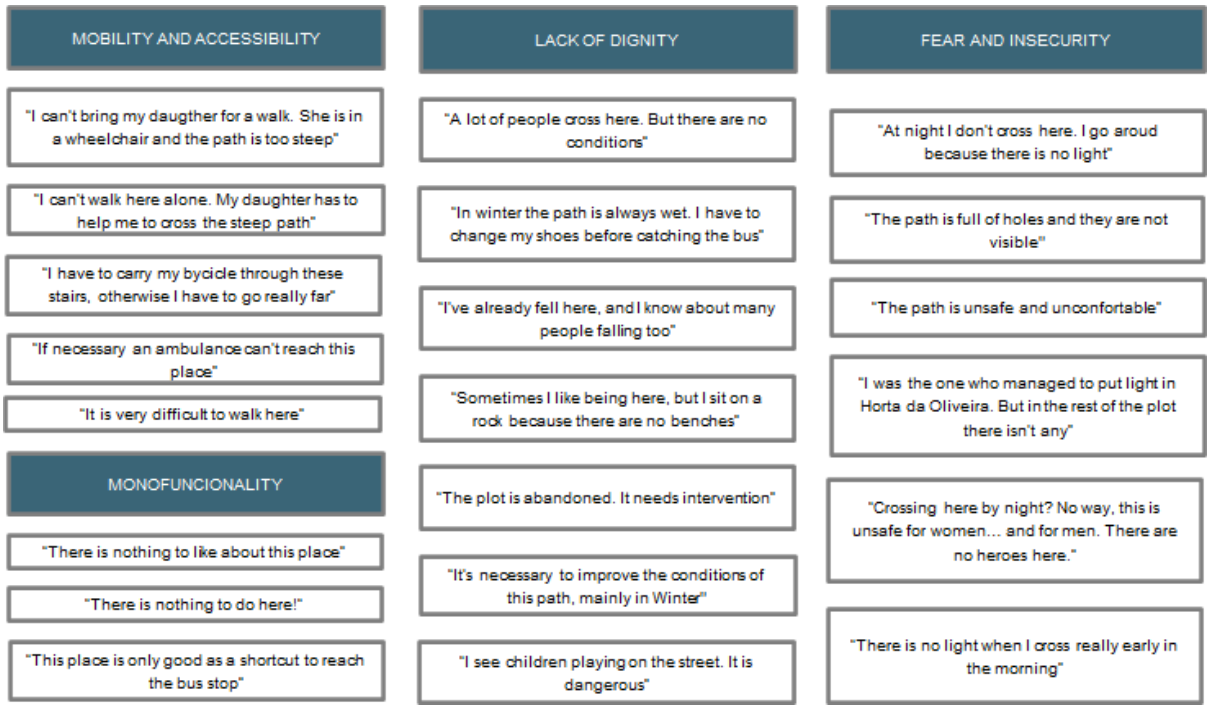

Figure 5. Passers-by's testimonies relative to the intervention area

The territorial studies had already identified part of these constraints of the intervention area. Most of them are a consequence of landscape evolution and relation with the surrounding territory. From a social perspective, the feeling of insecurity is one of the main needs to be exposed. It results from a combination of several factors (Figure 6): the visual obstruction caused by existing vegetation (mostly invasive exotic species); the presence of landfills; the poor conditions of the informal paths (without formal pavement, showing signs of erosion and steep slopes); the physical and visual obstruction caused by the position of the football field and the Municipal swimming pool; the illegal use of the old Farmhouse ruin and the sense of cloistering and visual barriers created by its vertical walls. The most unsafe areas of this territory share a common denominator: they have no visual relation with the landscape.


Earth landfill causing a visual obstruction

Visual obstruction created by the solidity of the invasive exotic vegetation.

Insecurity created by a lack of visual relationship between the spaces

Figure 6. Territorial needs identified in the intervention area

Also, the intervention area is not covered by any light system, which is a source of insecurity and compromises its use early in the morning and at night (Figure 7). In contrast, the areas surrounding the intervention area, such as the roads and the football field, are generally well lit. This contrast makes the absence of lighting in the area even more clear.

① Lighting of the intervention area and its ② Resident lighting their way with the torch ③ Lack of lighting on the main path

Figure 7. Lighting problems identified in the intervention area

Along the co-creation process, **different departments** of the municipality were also actively involved. They were part of some participatory activities and project meetings to follow the development of the Healthy Corridor and validate project decisions. Figure 8 lists some of the guidelines to be taken into consideration during the design of the Healthy Corridor provided by municipal technicians and other involved entities.

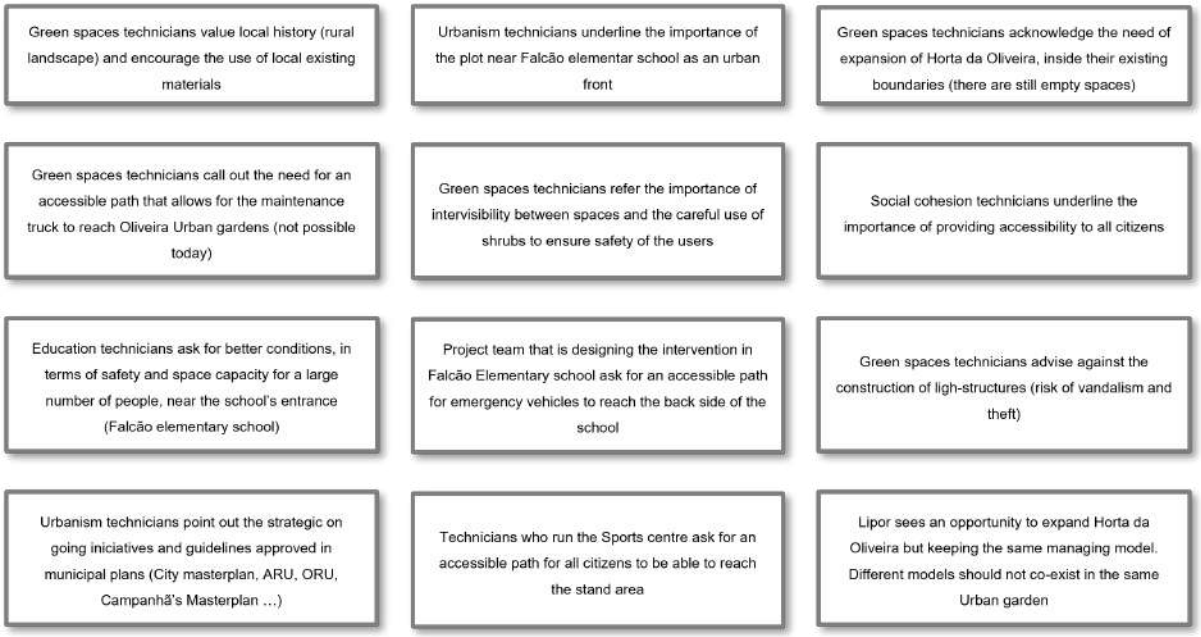

Figure 8. Guidelines provided by municipal technicians and other involved entities

This information allowed for the identification of the following most relevant interventions to be implemented, aligned with the needs carefully described in the following chapter Figure 9:

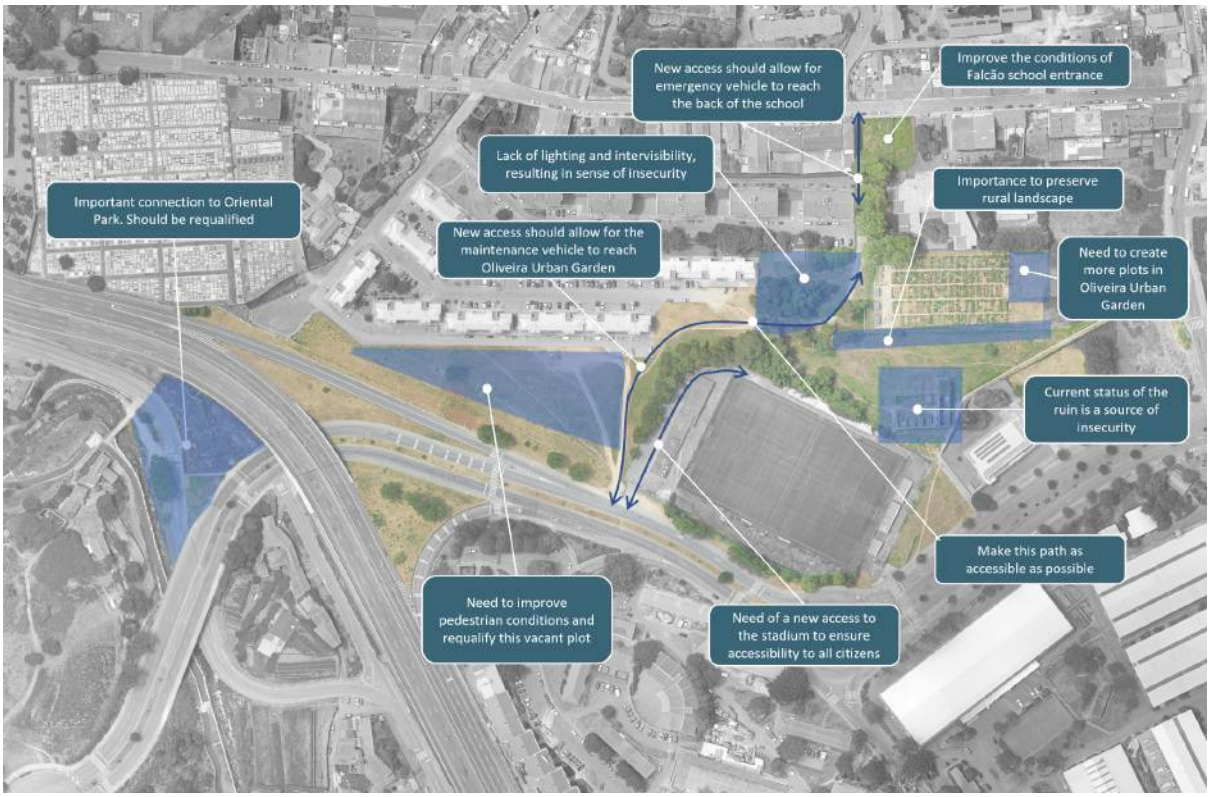

Figure 9. Most relevant interventions to be implemented in this space

3. Healthy corridor

3.1 Masterplan

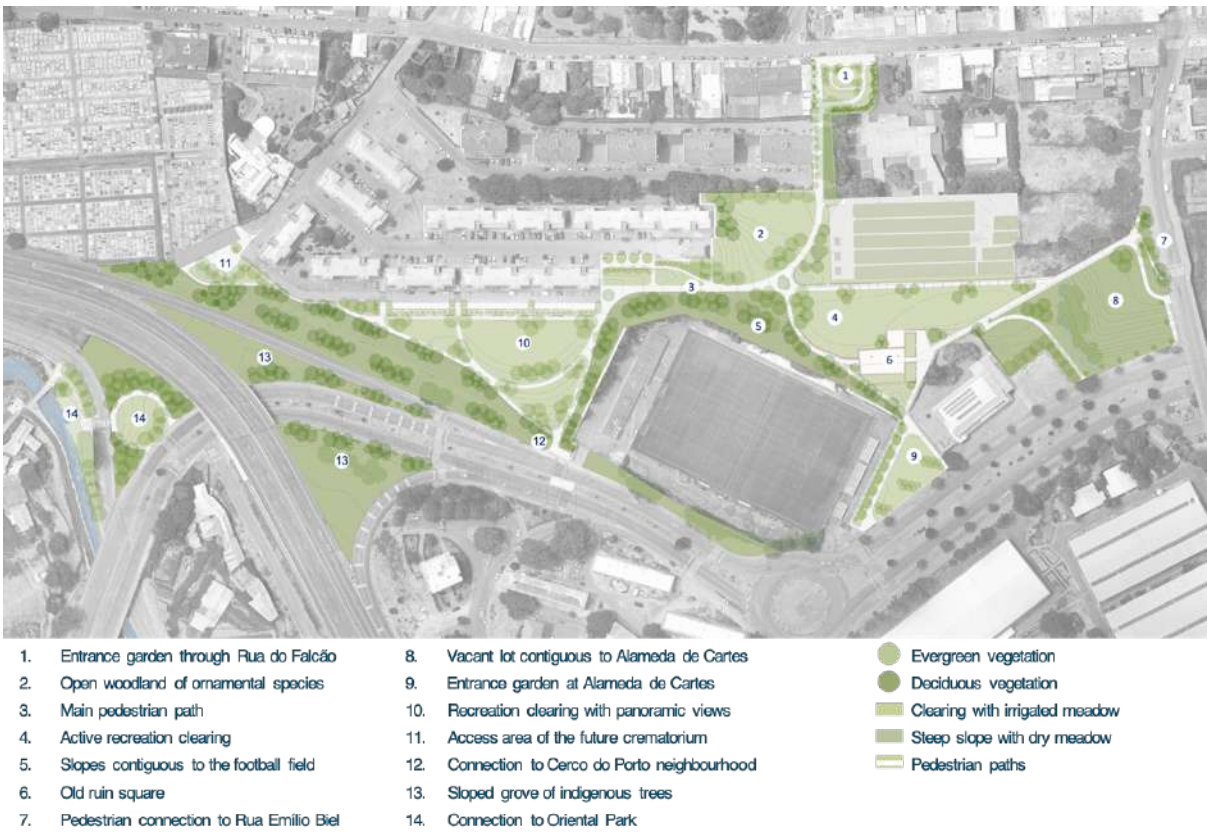

Figure 10. Masterplan

The Park (Figure 10) comprises spatial units with different functions and opportunities. The design combines the development of pedestrian connections with meeting spaces, leisure opportunities, active recreation spaces and biodiversity promotion.

The park's entrance areas mark the access and distribution points. They create the right conditions for social interaction by providing sitting opportunities in climatically pleasing locations. From these areas, it is possible to access a network of pedestrian paths (a total of 1,5 km), that provide internal access to recreational areas and several key points in the surrounding area.

The proposal for the Healthy Corridor aims to solve as many safety perception problems as possible by removing landfills, invasive vegetation and other built structures that are compromising the intervisibility between spaces. The key is to open this area to its surroundings and ensure that the pedestrians have full visibility to the contiguous areas and paths. The 3D model produced along with the development of the project was extremely useful to test the modelling design solutions and check the improvement of intervisibility between spaces.

Three large clearings surrounded by clusters of trees will be created. These will provide scale, shade and visual quality, ideal for physical exercise, temporary events or resting/socializing and contemplation. The clearings will contrast with trees' clusters, which will foster the aesthetic and sensorial quality of the space as well as its biodiversity and amenity.

The space currently occupied by the old ruins of Falcão farmhouse will be redesigned into a paved platform surrounded by structural fragments of the building that give continuity and dignity to the memory of the place.

The area near the A43 underground passage connects with Estrada da Circunvalação. It will form a strategic link that will enable access to the recently completed expansion of Oriental Park and also offer the possibility of connecting south to Freixo, or north to Tinto River.

Terrain modelling

Figure 11. Current topography and its characteristics

The coexistence of different functions has profoundly altered the morphology of this former agricultural land (Figure 11). Except for the northern areas, where the original terraced structure with gentle to moderate slopes are still present, the topography is the result of urban interventions, namely the construction of Alameda de Cartes, the football fields and the social

housing units. The topographic integration of those constructions has produced an uneven terrain composed of steep slopes with stability problems.

Figure 12. Proposed terrain modelling

The terrain modelling project was developed according to functional, ecological and aesthetic principles (Figure 12).

At the functional level: a) implementation of pedestrian paths with maximum gradients of 11% in the steepest areas (the best possible scenario given the existing topography); b) design of three clearings with gentle slopes for active recreational activities; c) stabilization of the steepest slopes, namely in the surroundings of the football field (Figure 13) and along Avenida Artur de Andrade; d) removal of the large landfill near Oliveira urban garden; e) removal of other visual obstructions caused by the terrain (Figure 14).

At the ecological level: a) creation of rainwater retention basins; b) strong relation between the terrain modelling and the planting design, given that the vegetation will be the most responsible for slope stability.

At the aesthetic level: a) improvement in terms of intervisibility, by removing landfills and reprofiling existing slopes (Figure 15); b) preservation of the vernacular terrain structure; c) creation of clearings with gentle slopes that allow a visual relationship with the surrounding landscape; d) s-shaped slope modelling to ensure topographic articulation and smooth transitions.

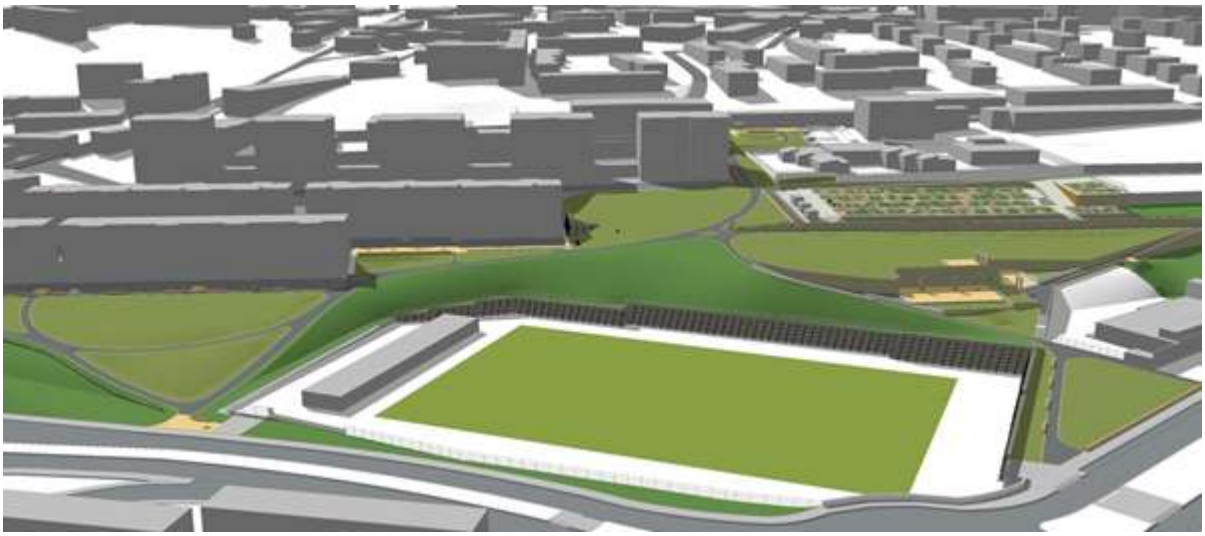

Figure 13. Slope stabilization around the football field

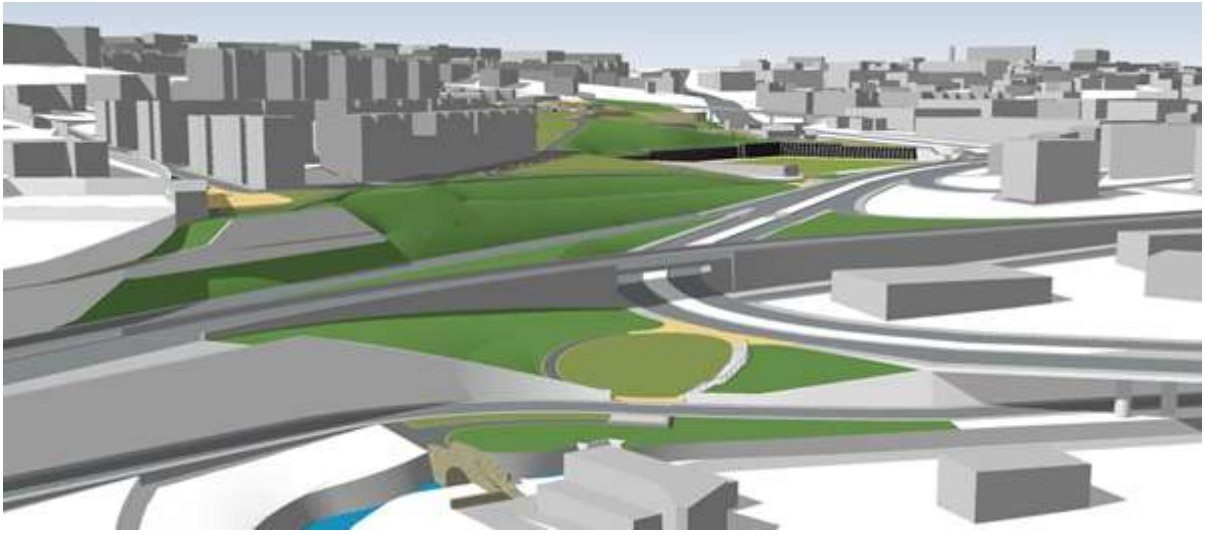

Figure 14. Visual clearing obtained with the proposed terrain modelling

Figure 15. Before and after the removal of landfills and slope reprofiling

Pedestrian network

Figure 16. Current pedestrian paths and their conditions

This area is extremely relevant for its residents in their daily routine due to the connections provided by the existing pedestrian network (Figure 16). However, many of these paths are informal, with steep slopes, without artificial lighting, too exposed to sunlight and showing serious erosion problems. Even though these paths represent a real danger to its users, they are used every day, even when it is wet/slippery or is too dark to even see the path itself.

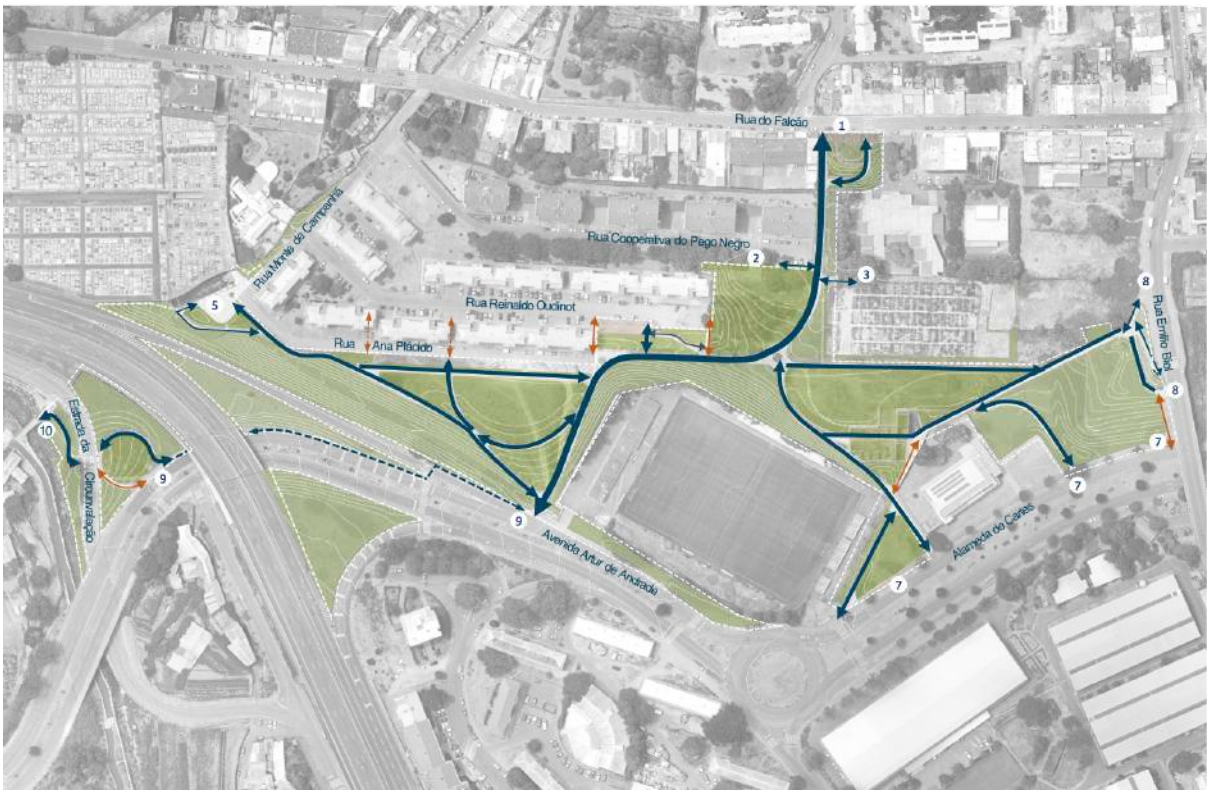

Figure 17. Proposed paths and connections.

The design respects and consolidates the already established informal paths and opens up new connection opportunities (Figure 17), according to the needs identified.

Through terrain modelling design it was possible to obtain a set of pedestrian paths with smooth to moderate slopes. The main path (Rua do Falcão-Avenida Artur de Andrade) will present slopes of about 11%, much lower than the current situation. Along the paths there are small paved areas with sitting opportunities, opening the park to the community.

The layout of these new paths provides contemplation opportunities, framed by new scenarios created through a careful planting design. The comfortable pavement and the amenity provided by the vegetation offer opportunities for circulation and enjoyment, promoting the well-being of its users. This is an important achievement that resulted from a sensible process of enquiry on the needs and expectations of the local population and as a response to the health and safety recommendations proposed by municipal entities.

In circulatory terms, the path system follows a well-defined hierarchy:

a) The main path linking Rua Artur Andrade and Rua do Falcão. This path will be 3,5 metres wide to accommodate the high pedestrian use levels and grant emergency vehicles' access.

b) Ramifications of the main path that enable the establishment of a complementary access network and an enhanced flow of users into the various areas. These paths will be 2,4 metres wide.

c) A third category of narrow paths (1,6 m) allow specific connections more suited to peripheral or less used spaces of the Healthy Corridor.

Vegetation and irrigation

Figure 18. Current vegetation present in the intervention area

The intervention area lacks tree cover (Figure 18), particularly between Alameda de Cartes and Falcão Housing, except on the slopes surrounding the football field where the vegetation is composed of invasive species, such as *Acacia melano*xylon (Australian blackwood). Apart from the ecological and environmental problems, these dense clusters are a source of insecurity, compromising intervisibility between spaces.

The main species in the intervention area with ecological value are the cork oaks (*Quercus suber*), an olive tree (*Olea europeae*) near Oliveira urban garden, and a line of plane trees (*Platanus x hispanica*) along the sidewall of the Falcão primary school.

Figure 19. Proposed vegetation for the intervention area

The planting design (Figure 19) is based on composition strategies to: a) promote biodiversity and ecological value of the urban landscape; b) provide aesthetic quality with panoramic views; c) create scenarios; d) promote comfortable microclimate by creating areas of sun, shade and semi-shade.

The proposed vegetation is structured in clusters carefully distributed and articulated with the pedestrian circulation network to ensure intervisibility, sense of security and well-being. To speed up the establishment of the green structure, the plating design combines fast and slow-growing species, ensuring interesting scenarios throughout the first 20 years. The native species will dominate about 2/3 of the vegetal composition, being complemented by non-invasive exotic species of great ornamental value, in areas with greater social function (entrances).

The intervention area will be composed of irrigated meadows, in the recreational clearings, and dry meadows (without any artificial irrigation system), in the steepest slopes. This distinction allows for water management optimization and adds aesthetic value to the floristic composition, through colour, texture and seasonality. The dry meadows will be revegetated through hydroseeding and combined with a mixture of deciduous and evergreen trees, all of which are drought-tolerant and predominantly fast-growing: *Cedrus libani* (Cedar from Lebanon), *Cupressus macrocarpa* (Monterey cypress), *Populus alba* (White Poplar), *Pinus pinea* (Stone Pine), among others. In the irrigated clearings, the trees will be organized in clusters composed of medium/slow growth trees, and preferably deciduous, to ensure comfort to the pedestrians during the winter. In the entrance areas (Rua do Falcão and Avenida Alameda de Cartes), the planting design includes mostly ornamental species to provide colour, smell and textures, such as: *Betula celtiberica*

(Birch), *Ginkgo biloba* (Ginkgo), *Magnolia* denudata (Yulan Magnolia) and Camellia japonica (Japanese Camellia).
On the steepest slopes, an attempt was made to implement a low maintenance regime, with a predominance of perennial species, as requested by Infraestruturas de Portugal.

Built structures, pavements and urban furniture

Figure 20. Built structures that can currently be found in the intervention area.

The intervention area has many built structures with high value, such as the granite masonry walls, mostly located between Oliveira urban garden and Alameda de Cartes (Figure 20). However, to overcome topographic discontinuities caused by urbanistic interventions, several concrete walls with high visual impact on this landscape can be found. There are also gabion walls next to Falcão Housing and around the football field.

Figure 21. Proposed built structures and pavements for the intervention area

The proposed built structures and pavements (Figure 21) follow a simple and functional approach to respect the agricultural past of the area. The vernacular walls in granite masonry will be the target of a restoration project that will ensure structural stability and the replacement of missing stone blocks and caps. To enhance the memory of this space, the proposal includes the reconstruction of a pergola that may have existed along Oliveira urban garden. Its construction will be inspired by ancient techniques, as they are both reliable and appropriate to the character of the place. All granite elements obtained from fallen walls and the old ruin of Falcão farmhouse will be reused in new walls, pavements and urban furniture. The circulation network will be built with porous asphalt pavement delimited by a double row of granite cobblestones, a comfortable solution for pedestrian circulation in an urban park. The access and entrance areas to the Healthy Corridor will be paved with sawn granite cubes. This will shape them into transition areas and stopping points with a greater formality and richness of detail. The intervention area currently doesn't provide any benches, litter bins nor lighting, even though it is in need, as it is confirmed by the territorial analysis and the results of the survey to the users. The proposal for the Healthy Corridor includes the construction of granite seating walls along the pedestrian network, a complete light system and litter bins that will be installed on the main entrances (Rua do Falcão, Rua Monte de Campanhã, Rua Emílio Biel, Alameda de Cartes, Avenida Artur de Andrade and access to the extension of the Oriental Park). To prevent the improper circulation of vehicles inside the park, retractable bollards will be placed near the access ramps to only allow the access of maintenance and emergency vehicles.

3.2 People places

Porto's Healthy corridor develops along 4 hectares, being composed of several areas with different needs and different solutions. These solutions were designed according to the diagnostic studies developed and the co-creation process implemented.
This subchapter describes those areas (Figure 22) designed to address the needs of the community and the territory itself.

Figure 22. The different areas of the Healthy Corridor

1 - Entrance Garden at Rua do Falcão

During the participatory activities, this area was highly discussed given its current state of abandonment and its potential relation with Rua do Falcão and Falcão Primary School (Figure 23). Citizens and teachers shared the desire to see this vacant lot turned into a meeting spot associated with a sensorial garden. Currently, Falcão Primary School and Rua do Falcão lack conditions for students/families to gather, forcing them to wait outside the school under dangerous conditions (lack of space, proximity to cars and others).


Figure 23. Current condition of the entrance garden seen from the side building and the school's gate.

The proposal turns this vacant lot into the main access point of the Healthy Corridor (Figure 24). It is intended to extend the upper sidewalk on Rua do Falcão to create a small square with significant social impact, given its relation with Falcão Primary School. The main access path remains close to the building, but it's now wider due to the demolition of the pre-existing wall, improving not only pedestrian circulation but also allowing access to emergency vehicles. On the other side of this garden, a path was designed on a softer slope, providing faster and more comfortable access to Falcão school.


Figure 24. Aerial views of the proposal for the entrance garden

One of the biggest challenges concerning the design of this space had to do with the existing topographic difference (around 5 metres). To overcome this issue, the space was developed as a partially terraced structure composed of a sloping lawn for recreational activities with access from the square. This lawn is crossed by a pedestrian path that starts about halfway of the previously mentioned path, allowing access to a small retaining seating wall for passive recreation and contemplation. To the south, the proposal includes two grassy areas with moderate slopes, whose terrain design allowed to overcome about 1,5 metres of topographic difference.

As it is one of the entrances of the Healthy Corridor, it was enriched with ornamental vegetation, such as *Betula celtiberica* (Birch), *Ginkgo biloba* (Maidenhair Tree), *Magnolia denudata* (Lily Tree) and also *Camellia japonica* (Japanese Camellia). The combination of these species adds colour, smell and texture to this entrance, giving it a sensorial garden character. The planting design along the school was studied to guarantee visibility for the green roofs that will be installed under the *Life project* (another Nature-based solution project).

2 - Open woodland of ornamental species

This area is currently marked by the presence of a large landfill, which creates topographic differences of about 9 metres and lateral slopes greater than 200%. In the areas closest to the residential buildings, the slope ends at the top of a gabion retaining wall with a topographic discontinuity of about 3 metres. During participatory activities, namely the walkthroughs and the survey, it was understood the urgency to intervene in this area. The current state of the path (pavement and slope) and the lack of visibility (due to lack of lighting and the presence of too many visual obstacles) compromise users' safety and comfort, being an obstacle to pedestrian circulation (Figure 25). Even though the users and the participants refer to the presence of natural elements as a positive aspect, also confess that the density of trees and the low level of maintenance performed as negative aspects that should be solved.

Figure 25. Precarious conditions of the paths and its surroundings

It is proposed the reprofiling of this landfill, designing a softer and more suitable area for users, both for passive and active recreation (Figure 26). With the removal of the existing landfill, there will be better visual relationships with the surrounding areas. This space was modelled to channel rainwater to permeable spaces and then to the existing retention basins that promote soil infiltration. Oliveira urban garden entrance will also be requalified. Vegetation-wise, ornamental species such as *Celtis austra*lis (Mediterranean Hackberry), *Acer rubrum* (Red Maple), *Pinus pinea* (Stone Pine), *Cedrus libani* (Cedar of Lebanon), *Cupressus macrocarpa* (Monterey Cypress) predominate.

Figure 26. Views of the open woodland proposed for this area

3 - Main pedestrian path

Currently, this path is mainly informal and overcomes significant topographic differences, starting at Rua do Falcão, at 64m elevation and ending at Avenida Artur de Andrade at 36m elevation. It is composed of steep slopes, bad pavement conditions and lack of lighting, performing as an unsafe path to its users (Figure 27). During the winter it becomes impossible to cross, making the citizens choose alternative paths.

Figure 27. Precarious conditions found along the current paths.

With this proposal, the main path will lay on a more comfortable slope, with qualified pavements, a lighting system and a green structure design that will ensure better visibility between spaces, while providing amenity, aesthetic and sensory quality (Figure 28).

Despite the topographic constraints, it was possible to model a new path with maximum slopes of 11%, articulated with 4 small intermediate sections with smoother slopes. Being a territory with slopes currently over 20%, it is a very significant improvement. Occasionally, benches can be found along the path, allowing users to rest along the way. The modelling design also took into account the preservation of existing species of high ecological value, such as the cork oaks (next to Oliveira urban garden) and the plane trees (next to Falcão primary school).

Figure 28. Proposal for the main pedestrian path

4 - Active recreation clearing

Next to Oliveira urban garden, there is a clearing currently occupied by high meadows and informal paths (Figure 29). The current state of pre-existing built structures such as granite walls and ruins of an old Farmhouse reflect the urgency to intervene in this area, to solve its safety and connectivity problems.

Figure 29. Current condition of the clearing next to Oliveira urban garden

The intervention in this space intends to preserve and respect the memory of its agricultural past, preserving and improving existing granite walls, respecting the terraced layout and reconstructing a pergola path (Figure 30). Through terrain modelling, a clearing space will be developed, promoting outdoor physical exercise and allowing for the development of recreational activities and socio-cultural events.

Figure 30. Active recreation clearing proposed for this area

5 - Slopes contiguous to the football field

The slopes surrounding the football field exhibit erosion and instability problems due to their height and presence of invasive exotic vegetation (namely *Acacia melanoxylon* and Eucalyptus sp.) (Figure 31).

Figure 31. Current state of the slopes surrounding the football field

The proposal aims to redesign these slopes, making them softer by turning them into s-shaped slopes. This will improve the quality of this space and the visual relationship with the surrounding landscape. On the southern side of the football field, a new path will provide accessibility for mobility-impaired pedestrians.

6 - Old ruin square

The existing ruin in the former *Logar do Falcão*, an old farm building, is part of the local collective memory. This was proved by the ideas proposed by the local citizens and the debate developed about it. In the existing 19th century cartography and in the few written references, this construction seems to be pointed out as the main farmhouse, whose property occupied almost the entire intervention area. Currently, it is used as a precarious settlement for homeless people and drug users, behaving as a source of insecurity for pedestrians (Figure 32).

Figure 32. Current state of the existing ruin

As a consequence of budget restrictions, this proposal aims to partially dismantle the existing buildings. Through some minor terrain modelling design and partial removal of the upper part of the existing walls, this intervention aims to transform the old farmhouse into a new public space (The dismantled stones will be reused on-site for paving, walls and street furniture. (Figure 33).
Using part of the spatial qualities of the old building and its relationship with existing features such as walls, stairs, terraces and existing paths, the proposal will try to create a space that contributes to pedestrian mobility and new uses (such as Campmarket or a natural amphitheatre, proposals by citizens within URBiNAT project). (Figure 36).

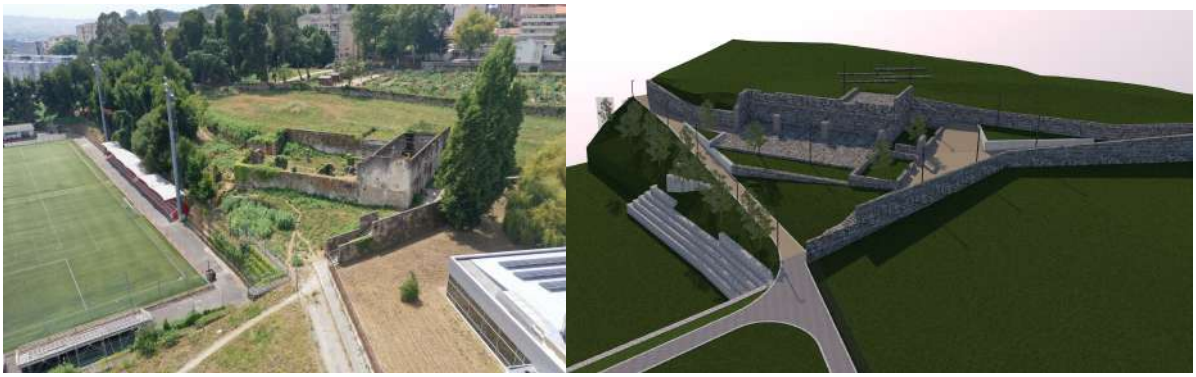

Figure 33. Aerial views of the ruin before and after the dismantling intervention.

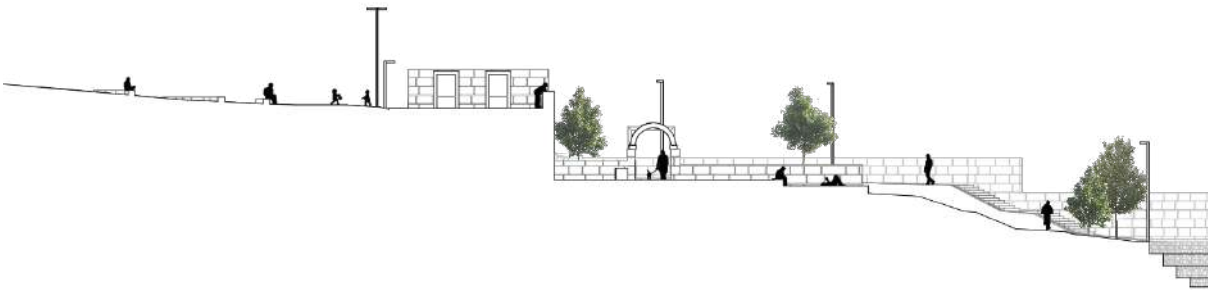

Figure 34. Section on former logar do Falcão after the dismantling intervention.

Figure 35. Proposal for the old ruin paths and uses.

Figure 36. Proposal for the old ruin and its potential use.

7 - Pedestrian connection to Rua Emílio Biel

Rua Emílio Biel is an important pedestrian connection given the presence of a bus stop and the possibility to connect to Rua São Roque da Lameira/Corujeira Square and Rua Nossa Senhora do Calvário (Cerco do Porto, Ilhéu and Secondary school). Currently, the connection to Rua Emílio Biel is only possible through stairs, being an obstacle to citizens with reduced mobility and cyclists (Figure 37). Given the current topographic difference, there is no intervisibility between Rua Emílio Biel and the path inside the intervention area, which turns into an insecurity factor for the users.

Figure 37. Current pedestrian connection to Rua Emílio Biel

The proposal creates a new connection between the intervention area and Rua Emílio Biel, through a path also accessible to people with reduced mobility. Through terrain modelling design, it will be possible to create intervisibility between these spaces from the beginning of the path, improving safety perception. In terms of planting design, the existing tree layer will be reinforced to improve bioclimatic comfort, using *Populus alba* (silver-leaf poplar) *Celtis australis* (Mediterranean Hackberry), *Acer rubrum* (Red Maple) and *Pinus pinea* (Stone Pine).

8 - Vacant lot contiguous to Alameda de Cartes

There is a large vacant lot between Cartes Municipal Swimming pool and Rua Emílio Biel (Figure 38). Given its location, dimension, and relation with Avenida Alameda de Cartes/future subway stop it will play an important role on local pedestrian mobility.

Figure 38. Current vacant lot and its surroundings

Given the constructive potential of this area, a minimal intervention is envisioned to qualify and manage this space while awaiting future use. The intervention (Figure 39) consists of preserving existing vegetation and some new plantings: an alignment of *Populus nigra 'italica'* (Black Poplar) along the path leading to Alameda de Cartes. Next to the parking lot of Cartes Municipal Swimming pool, a new path accessible to people with reduced mobility enables a connection between the Alameda de Cartes and the Park in a smoother way and free of barriers, contrary to the currently existing connection made with stairs.

Figure 39. Proposal for the vacant lot

9 - Entrance garden at Alameda de Cartes

Currently, this space is a vacant lot marked by an informal path that proves its importance on the pedestrian network, however, it lacks vegetation and comfort for its users (Figure 40). In the future, this area will be near an important subway stop that will revolutionize pedestrian connections and the user's experience when arriving at Campanhã.

Figure 40. Existing green area and its informal path

The urban project will formalize an important entry point in this space (Figure 41). Currently, the discontinuity of the gabion wall on the football field generates a space with irregular slopes. Thus, through terrain modelling design and the levelling of the gabion wall next to the football field, it will be possible to create a flatter area that works as an entrance and meeting garden. Also concerning the terrain modelling design, the existing platform will be designed to partially hide the cars that circulate in Alameda de Cartes, contributing to a greater feeling of comfort for its users. The space was designed to be multifunctional and to be able to host temporary events and cultural activities, such as the Campmarket, proposed and co-codesign with the citizens. Along the edge of the football field, it is proposed to plant *Populus-alba* (Silver-leaf Poplar) and *Populus nigra 'italica'* (Italian Poplar). Along the new lawn area, it is proposed to plant a cluster of *Betula celtiberica* (Birch).

Figure 41. Entry garden proposed for this vacant lot

10 - Recreational clearing with panoramic views

This area is located along Falcão housing and is marked by several pedestrian informal paths that connect to neighbour facilities (cemetery, housing, Rua Artur de Andrade, Urban gardens …). When the meadows are grown it is difficult and even dangerous for the pedestrians. It is an area with a high need for tree cover due to the excessive solar radiation, which compromises the user's experience (Figure 42).

Figure 42. Informal paths and lack of vegetation in front of Falcão housing

The proposal aims to formalize the existing pedestrian paths used by the resident population in their day-to-day lives (Figure 43). The layout of the paths reflects the connection needs identified during the diagnosis phase and the walkthroughs with the citizens during participatory activities. It ensures connection to important points in this territory, such as the side entrance to Campanhã's Cemetery, the several entrances to Falcão housing and Rua do Monte from Campanhã. It was possible to create a clearing with moderate slopes (4-6%) which, given the proximity to residential areas, can perform as a multifunctional recreational area. The modelling design included the re-profiling of the terrain to not only provide more comfortable slopes but also to control soil erosion.

The improvement of its bioclimatic quality is achieved through strategic planting design, with trees organized in carefully studied clusters to provide shade and visual quality. In these clusters, there are examples of *Pinus pinea* (Stone Pine), *Quercus suber* (Cork Oak); *Celtis australis* (Mediterranean Hackberry) and *Acer rubrum* (Red Maple).
Along Rua Ana Plácido, new parking lots are created, answering the needs identified and allowing access to the park for non-residents. The relationship of this space with the clearing is ensured by alignments of *Betula celtiberica* (Birch) along with a peripheral path and benches.

Figure 43. Proposed recreational clearing from its paths and from above

11 - Access area for the future crematorium

Near the secondary entrance door of Campanhã's cemetery, there is a large paved area with no particular use but with interesting views of Campanhã's rural landscape and Oriental Park (Figure 44). However, given its location near A43, it is a very noisy area. During the participatory activities, it was mentioned many times by the citizens the desire to see this area requalified and greener. Recently it was announced the construction of a crematorium near the secondary cemetery's door.

Figure 44. Current paved area with a panoramic view next to Campanhã's cemetery

Considering these restrictions, the space was redesigned considering the implantation area of the future crematorium. It is proposed to reduce the paved area and to formalize an exclusive parking area for vehicles supporting the crematorium (Figure 45). A path that allows access to an area of contemplation of the surrounding landscape was also included in the proposal. The path was strategically designed 6m away from the retaining wall that separates this space from the accesses to the A43 to visually and acoustically ease the highway's presence. With this proposal, it is possible to renaturalize a low qualified space, by integrating it into the pedestrian network of the park. This area will be another entrance to the park for the users who arrive by Rua Monte de Campanhã. The proposed planting design includes ornamental species such as *Ginkgo biloba* (Ginkgo) and *Acer rubrum* (Red Maple).

Figure 45. Proposed access area for the future crematorium seen from its paths and from above

12 - Connection to Cerco do Porto neighbourhood

During the diagnostic phase, a problematic situation was identified in terms of the safety of pedestrians crossing Avenida Artur de Andrade towards the Bairro do Cerco do Porto. This crossing is frequently done near the entrance of the football field, directly into the path that goes into the neighbourhood. However, the existing crosswalks are not aligned with this pedestrian connection naturally made by citizens (Figure 46).

Figure 46. Current lack of crosswalks in the vicinity

Improving the quality of walking routes is one of the main objectives of this intervention. In articulation with Domus Social, EM and the design team responsible for the future public space project in the Cerco do Porto neighbourhood, a new crossing is being designed to formalize this important pedestrian connection.

13 - Sloped grove of indigenous trees

Along Avenida Artur de Andrade, large slopes were built as a solution for topographic discontinuities (Figure 47). Currently, they present erosion problems, obstacles to pedestrian connection and lack of vegetation.

Figure 47. Large slopes next to Avenida Artur de Andrade

The proposal foresees the reduction of the perception of the vertical scale of these large slopes through strategic planting design, to improve quality and comfort for pedestrian circulation (Figure 48). The spatial distribution of the vegetation, in clusters, ensures full visibility of the circulation axis and promotes synergies in terms of biodiversity and ecological potential, strategically planted to enable observation lines between high and low levels. Mostly native climax species will be used, with a prevalence of perennials, such as *Pinus pinea* (Stone Pine), *Quercus suber* (Cork Oak) and *Celtis australis* (Mediterranean Hackberry). This solution will also mitigate the visual impact of large walls created to solve topographic discontinuities during the construction of road infrastructures such as A43.

Figure 48. Proposed vegetation distribution to reduce slopes' vertical impact seen from the sidewalks and from above

14 - Connection to Oriental Park

Between Avenida Artur de Andrade and the new walkway along Tinto River, there is a vacant lot composed of high meadows and very steep stairs that connect to the walkway. This space plays a strategic role in connecting the surrounding residential units with the expansion areas of the Oriental Park. However, the vegetation grows and compromises safety and intervisibility (and sometimes burns during the summer), and the stairs are an architectural barrier to pedestrians and cyclists. On the other side of Estrada da Circunvalação, another flat vacant lot connects directly to an ancient bridge that intersects Tinto River walkway. Currently, this area serves as an informal parking lot with no formalized path (Figure 49).

Figure 49. Current vacant lot with high meadow and stairs leading to an informal parking lot

To promote a visual relationship between Avenida Artur de Andrade and Tinto River walkway, a re-profiling of the slope is proposed, lowering its maximum height (Figure *50*). Therefore, from the exit of the underground passage, it will be possible to notice the bridge and the pedestrian path that are part of the newest intervention of Oriental Park. Besides the redesign of the existing stairs, a new ramp is also part of the proposal to allow accessibility to all citizens. The planting design foresees the mitigation of the visual impact of A43 walls through the reinforcement of native and ornamental tree vegetation.

The proposal for the plot along Rio Tinto bank includes the formalization of the pedestrian connection from Estrada da Circunvalação to the existing bridge. In terms of planting design, given its role as a leisure and connectivity area, it will be composed of ornamental trees, such as *Ginkgo biloba* (Ginkgo) and Acer rubrum (Red Maple), similar to the other entrances/exits in the Healthy Corridor. A stone bench will be built to prevent the users from getting too close to Rio Tinto bank.

Figure 50. Proposal for the connection to Oriental Park seen from its paths, from above and from under the A43

3.3. Nature-based solutions

The Healthy Corridor, being developed under the URBiNAT project, is a combination of different Nature-based solutions co-created with the community. During the participatory activities in Porto, the URBiNAT NBS catalogue was shared with citizens and inspired them to develop and suggest their proposals ("New NBS"), presented in Deliverable 4.2 (Workpackage 4 - Nature-based solutions). To these "New-NBS" were added other territorial Nature-based solutions that address specific needs from the territory itself, also discussed during the participatory activities (Figure 51).

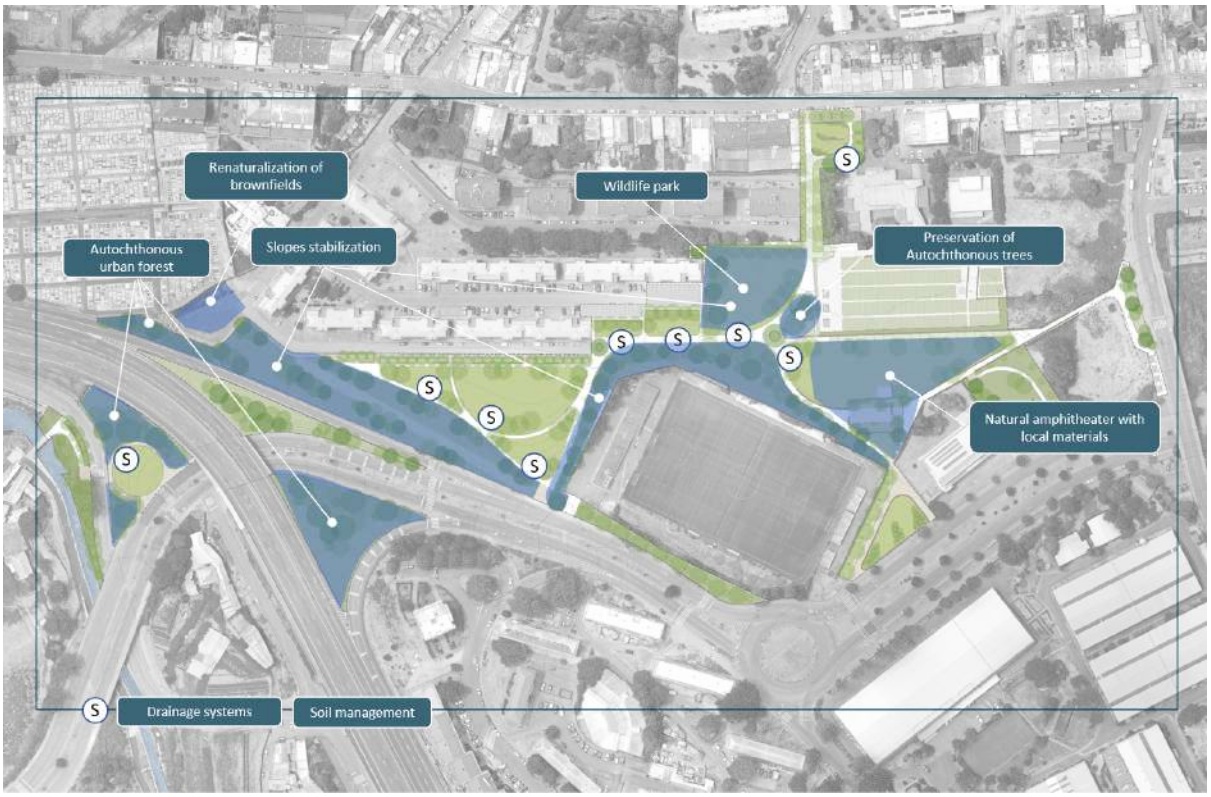

Figure 51. Nature-based solutions specific to this particular territory

Drainage systems

Figure 52. Drainage systems

At the moment, the intervention area shows serious problems related to superficial drainage due to the existing topography and lack of proper design. The slopes reveal erosion problems, which worsen every year. During the winter, the muddy paths become even more dangerous forcing the residents to look for alternatives. One of the most important goals of this intervention is for all rainwater that falls directly into the intervention area to be managed and infiltrated internally, following sustainable drainage practices. The Healthy Corridor was designed to promote soil permeability. Through micro modelling of the terrain, the rainwater is sent to retention basins (**Erro! A origem da referência não foi e ncontrada.**). In situations of greater slopes and along the paths, micro modelling of natural drainage ditches is foreseen, followed by small stone dams, which not only control the speed of water descent in the sloping areas but maximize their permanence, thus promoting its infiltration. The solution to be implemented is inspired by the ones already tested and whose effectiveness was demonstrated in the London Olympic Park Project and Quinta de Lamas Park (**Erro! A origem d a referência não foi encontrada.**).

Figure 53. London Olympic Park drainage system; Quinta de Lamas Park retain basin

Drainage ditches will be placed at the top of the walls and seating walls to ensure their correct drainage, water infiltration, and routing excess water to retention basins. A shallow drainage half-cane will be built on the back of the Salgueiros Football field wall, which aims to collect the surface water from the surrounding slope. These waters will also be sent to retention basins.

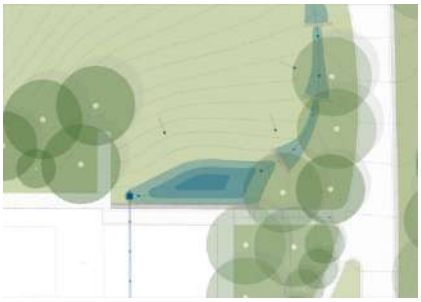

Figure 54. Drainage system plan on the corridor.

Autochthonous urban forest

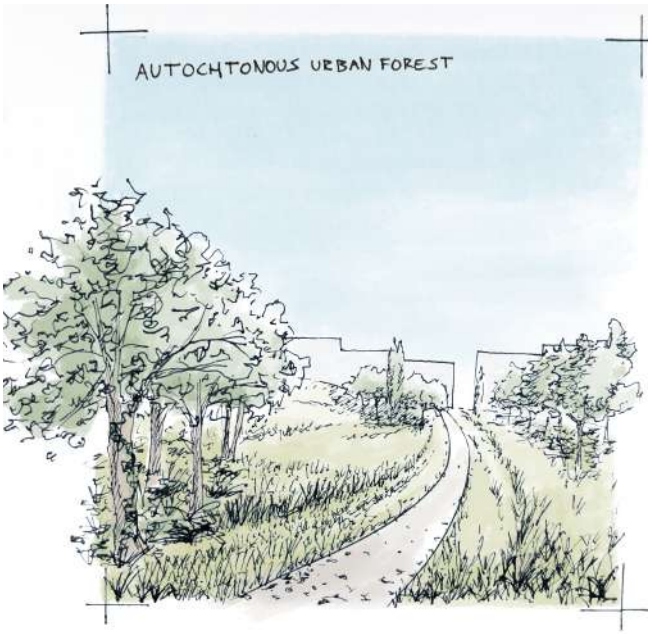

Figure 55. Autochthonous urban forest

The intervention area is located in a strategic point in what concerns local green structure. It is surrounded by formal green spaces whose connectivity is underdeveloped. The intervention area, when redesigned will be an important ecological stepping stone, contributing to local green structure (Figure 55).

The urban woodland created in the Healthy Corridor was designed and will be managed according to ecological, aesthetic and sustainable principles. The planting design will promote the use of autochthonous species that will contribute to carbon and pollutants sequestration. Together with contiguous street tree alignments and other formal green spaces, such as Corujeira square and Oriental Park, will generate a new green corridor.

A key design decision was related to the preservation of existing vegetation with ecologic value (olive tree, oak trees and poplars). These pre-existing trees are one of the biggest assets identified by the citizens, who value their shadow and natural/fresh environment when compared with the surrounding urban areas. To ensure their preservation the terrain modelling design had to take into consideration their location and influence radius.

The autochthonous urban forest in this new Healthy corridor will be composed of pre-existing trees with ecological value already, combined with new ornamental clusters of trees, street trees and autochthonous trees planted in the existing slopes. This urban forest will connect with the public space of Falcão housing (under intervention) and of Cerco do Porto's housing (project stage), as well as with the Oriental Park.

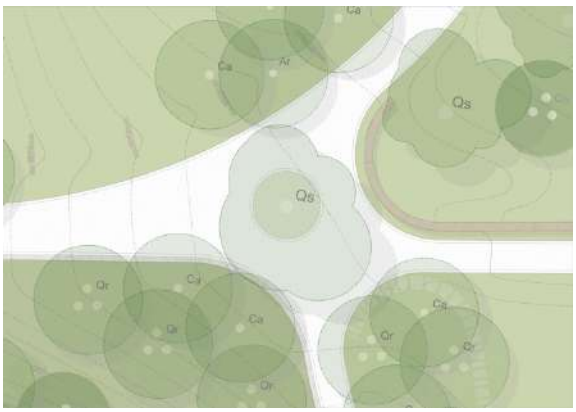

Figure 56. Autochthonous urban forest on the corridor.

Slopes stabilization

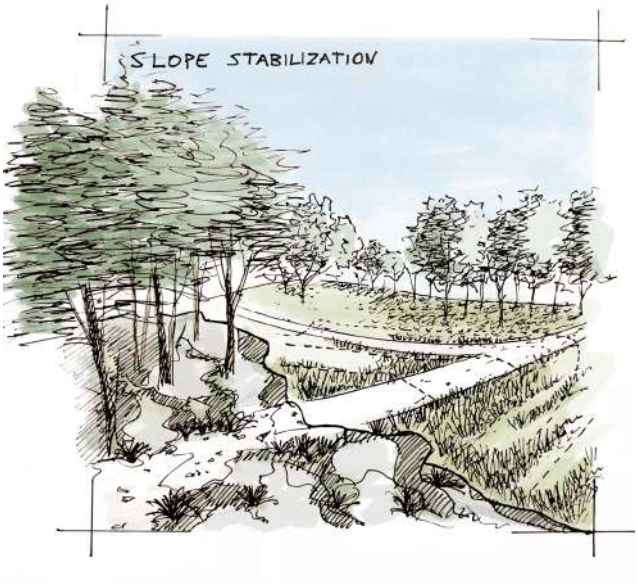

Figure 57. Slope stabilization while maintaining its character

A landscape's identity is largely a product of its topography.
As evidenced by the process of analysis and user inquiry, the difficult topographic conditions are the main obstacle to the good functional performance of the space.

However, it is equally relevant that topographic manipulation is seen as an exercise in modifying the perception of spaces, which can provide coherence and balance, or create compositional highlights that attribute interest, diversity and singularity.

The application of this NBS in the context of the Healthy Corridor resolves the pungency and insecurity of the slopes but also safeguards a large part of the topographical identity of the site: the slopes are smoothed, remaining as slopes, and the flat areas or relevant pre-existing landmarks are highlighted, in a search for consistency and character (Figure 57Figure *57*).

Figure 58. Slope stabilization on the corridor.

Natural amphitheatre

Figure 59. Proposed natural amphitheatre

The existing slopes and terraces are part of this landscape's rural ancient history and dictate its design. The need and calling of this territory for having a natural amphitheatre were mentioned many times during the participatory activities.

The natural amphitheatre (Figure 59) will be designed through micro-terrain modelling near Oliveira Urban Garden and will incorporate pre-existing rocks/stones that will result from the partial demolition of walls and the Old Ruin of Falcão.

The opportunity here is expressed by the territory and a need for a multifunctional Healthy Park was shared by the community. This structure will be harmoniously integrated into this landscape and will respect its rural style.

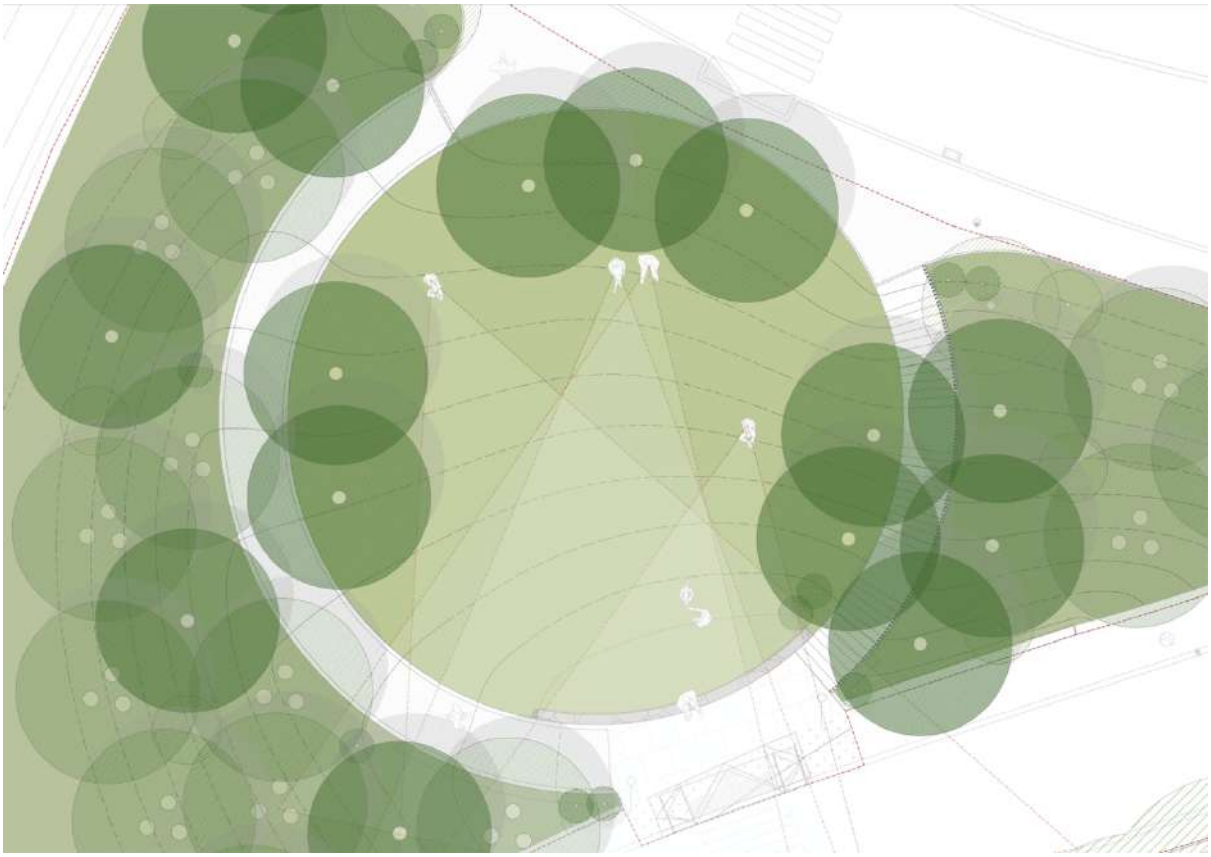

Figure 60. Proposed natural amphitheatre on the corridor.

Soil management

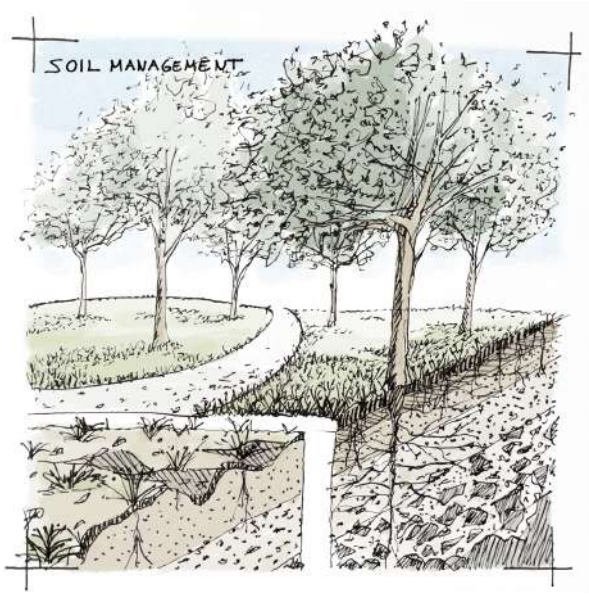

Figure 61. Soil management

Soil quality and characteristics are key aspects in what concerns green structure development and ecological services. Also, soil movements and improvement are actions that always have a relevant role in terms of budget.

Soil management will be a solution implemented during the construction of the Healthy Corridor (Figure 61Figure 61). It will be a technical procedure applied to the existing soil removed from the intervention area at the beginning of construction works. The first layer of soil will be removed and stored in a specific location. During that time the removed soil will be planted with regenerative species to improve soil internal qualities.

After this procedure, the soil will be distributed to new permeable areas providing better conditions for plant's development and drainage. This strategy will avoid soil importation from outside the intervention area, reducing construction costs.

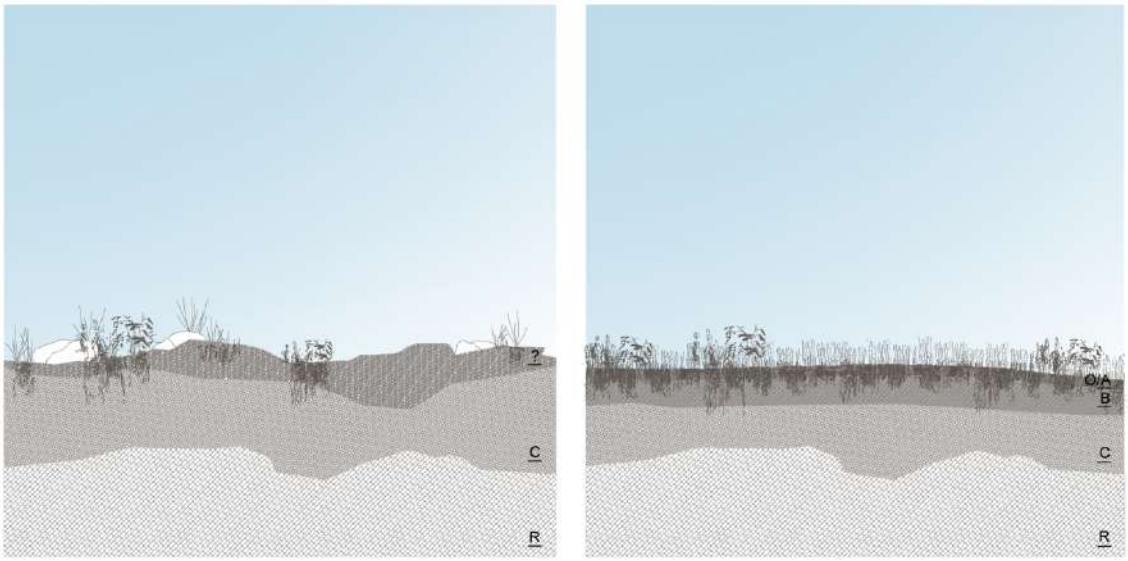

Figure 62. Soil management of the corridor.

Wildlife garden

Figure 63. Wildlife garden

A truly multifunctional park is one that addresses different aspects of urban environmental challenges. Porto's Healthy corridor aims to promote citizens' quality of life, urban regeneration but also biodiversity. A wildlife garden will be another solution to be implemented given that it is a multifunctional solution itself (Figure 63).

It will be integrated as an open space composed of autochthonous species that will promote urban biodiversity through criterious planting design strategies and specific management guidelines.

As all other territorial NBS it will be tailored according to site's characteristics and climatic conditions, favouring native plants, and allowing for natural ecologic succession to unroll. Given that it will be part of a multifunctional park, this space will have closer relationship with recreation areas and lawns. Also, this wildlife park can be seen as an opportunity for the surrounding schools. It can be used as a learning space and an open-air living laboratory.

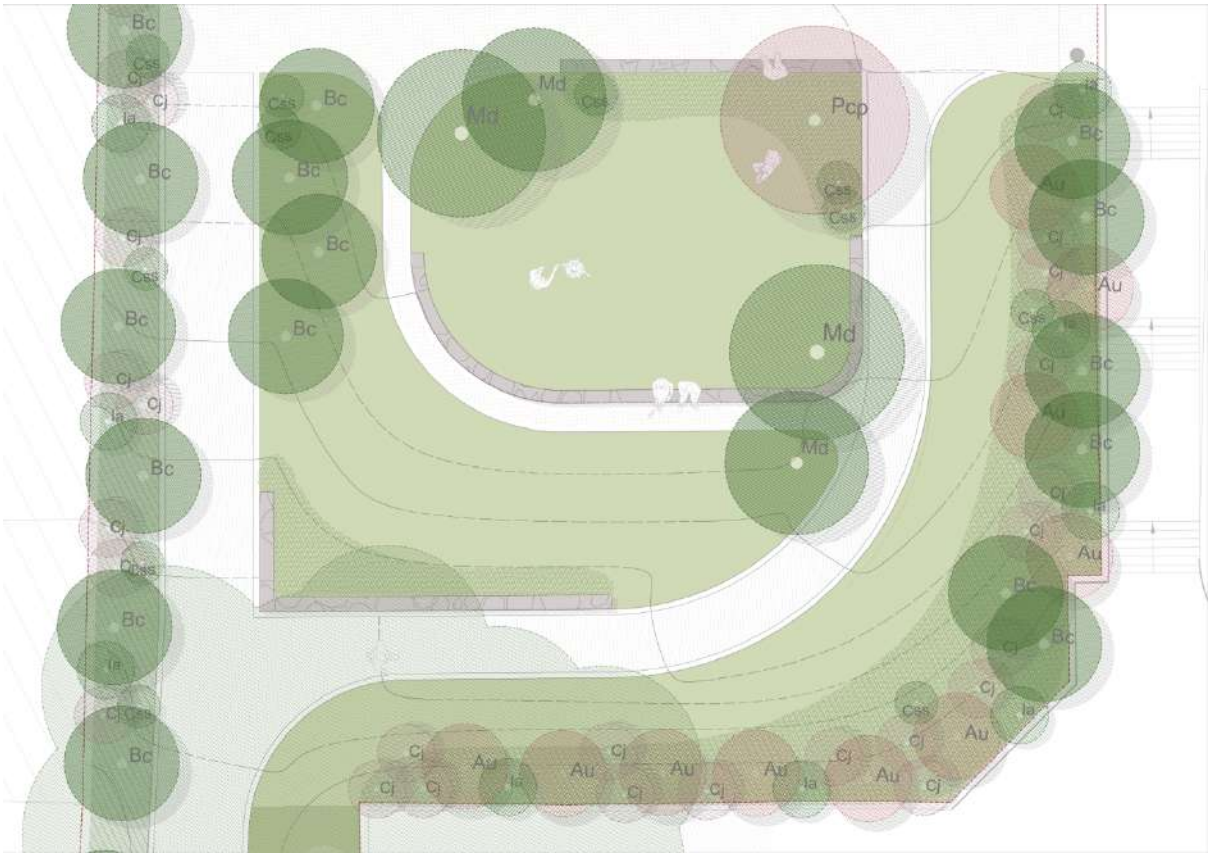

Figure 64. Wildlife garden on one of the entrances of the corridor.

Renaturalization of brownfields

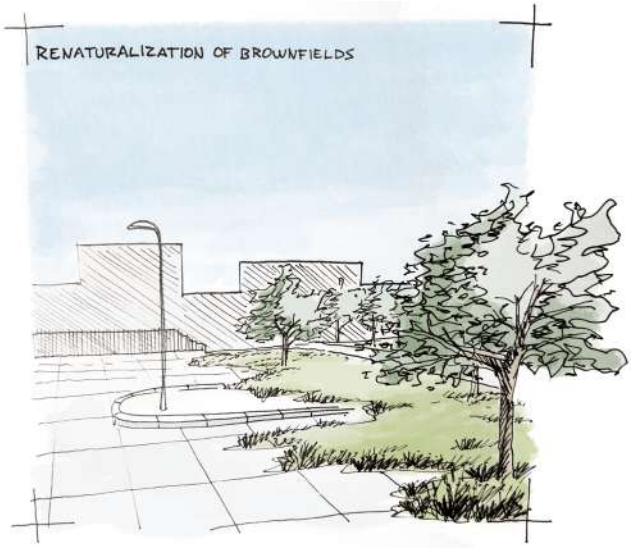

Figure 65. Renaturalization of brownfields.

Urban areas are many times characterize for being unbalanced in what concerns permeability. The intervention area and its surroundings are no exception. Therefore, the need for permeable spaces is urgent and will be addressed through the renaturalization of brownfields (Figure 65), a nature-based solution already present in URBiNAT's NBS catalogue. In Porto's Healthy Corridor, this solution will be implemented in locations, where oversized impermeable areas can be found, showing no apparent use or justification for such characteristics.

On top of that those areas are contributing to drainage problems and site's downgrading due to lack of use/local appropriation. This solution will be implemented in order to remove excessive surfaces and turning them into permeable green areas. These new areas will improve local drainage but also provide relevant ecological and social functions, as part of a multifunctional park.

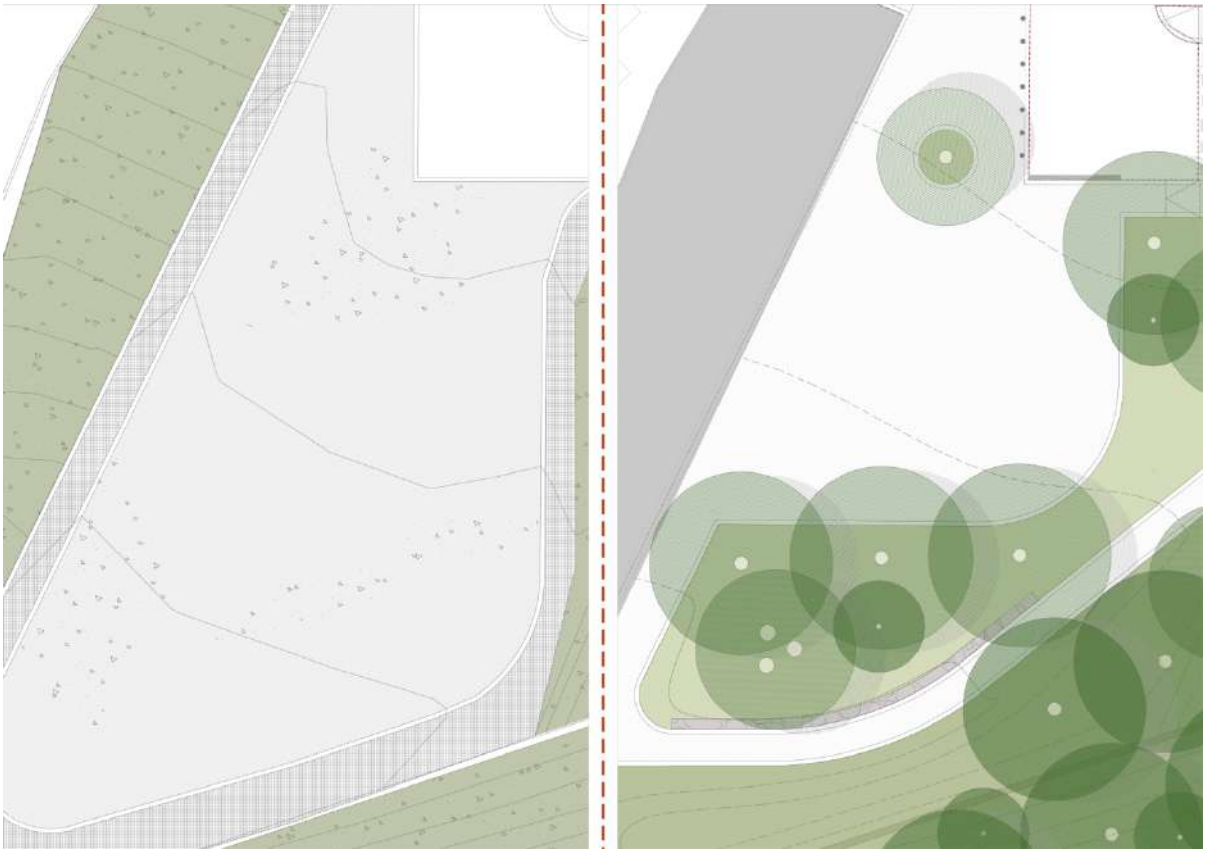

Figure 66. Renaturalization of brownfields on one of the entrances of the corridor.

4. Conclusion

The current urban plan for the Healthy Corridor was properly presented and discussed with the different involved actors (citizens, associations, municipal technicians and political representatives) in a common online session, giving them the opportunity to provide direct feedback to the task force team, in order to make last adjustments and integrate other suggestions that were received (session available - HERE).

While the urban plan is currently undergoing the licencing phase, meaning that the task force team is now focusing all efforts on the development of the execution project, it is important to note that it will be complemented by other NBS that are not territorial related, but rather represent more immaterial solutions that aim for the sustainable activation, use and appropriation of the Healthy Corridor in time, way beyond URBiNAT's lifetime.

Such solutions are being further developed with the local community, while the project licencing process evolves, each one with its own stage of planning and implementation. As so, the task force team has the challenging task of not only following-up on the next steps of the licencing process of the urban plan and its implementation, but also the development, planning and testing of the (immaterial) solutions that will activate it, by continuing the participatory process and keeping the involvement of the different local actors.

Such an involvement of different actors proved to be key for the accomplishment of the urban plan presented not only for the identification of local opportunities and challenges, but also to guarantee that the developed solutions were truly fitting the existing needs of the local community. Moreover, the development of innovative methodologies for the identification of such opportunities, challenges and needs were crucial to reach the level of detail and rigor that the urban plan delivers.

Finally, the active involvement of the political representatives of Porto Municipality led to the proper identification of the Healthy Corridor potential to achieve the municipal goals for Campanhã Parish and the decision to guarantee a percentage of municipal own investment in the urban plan, complementing on the available budget from URBiNAT, assuring the implementation of the project as a whole and amplifying its impact in the region.

With this, the team aims to achieve a successful implementation and proper integration and appropriation of the Healthy Corridor in Campanhã Parish, guaranteeing that all URBiNAT's goals are achieved.

5. References

URBiNAT (2021). Deliverable 4.1, New NBS Co-Creation of URBiNAT NBS (live) Catalogue and Toolkit for Healthy Corridor

URBiNAT (2021). Deliverable 4.2 Healthy Corridor Concept

D2.4 Urban Plan Nantes

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Document history

Date	Version	Author	Summary of change
14th june2021	V1	Philippe Bodénan, Alain Yvrenogeau	Analysis of the document plan
21st june 2021	V2	Philippe Bodénan, Alain Yvrenogeau	Identification and collection of relevant documents
27th july 2021	V3	Laurent le Gall	Additional information Amande park design
28th july 2021	V4	Philippe Bodénan	Development on document contents

Fonts

Montserrat	by Julieta Ulanovsky
Source Sans Pro	by Paul D. Hunt

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Part 3 - Nantes

1.Introduction to the intervention area

Urban context

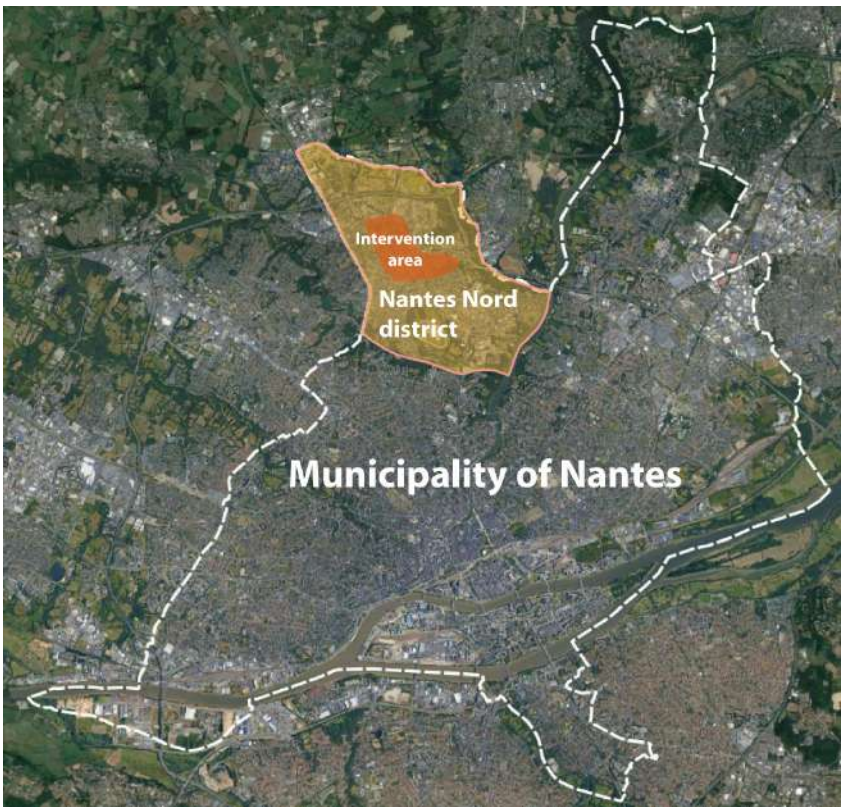


Figure 1 Location of study and intervention areas in Nantes.

“Nantes Nord” district is located in the northwestern part of the city. Nantes Nord is particularly well connected to the city centre via a tram line, several bus lines and secondary roads. The district is located inside the ring road.

It is composed of very different urban forms:

- low rise housing area or suburbs for the oldest parts (faubourgs);
- allotments (lotissements);
- New constructions, dead-end housing estates, business and commercial areas;
- Large social housing complexes, university campuses, urban facilities;

The district results now in an archipelago. Social housing estates created in the 1950s- 1970s were built according to a sector and residential unit logic (separation of car and pedestrian flows) leading to the reversal of the traditional block structure: in front the private residential parking lot, behind the green spaces. Social housing estates are therefore easy to cross on foot, with a very good pedestrian network, but difficult to cross by car.

The site

Between the valleys of the Gesvre, Erdre and Cens rivers and close to Orvault and La Chapelle-sur-Erdre, the Nantes Nord district is one of the greenest districts of the city (62m² per inhabitant).

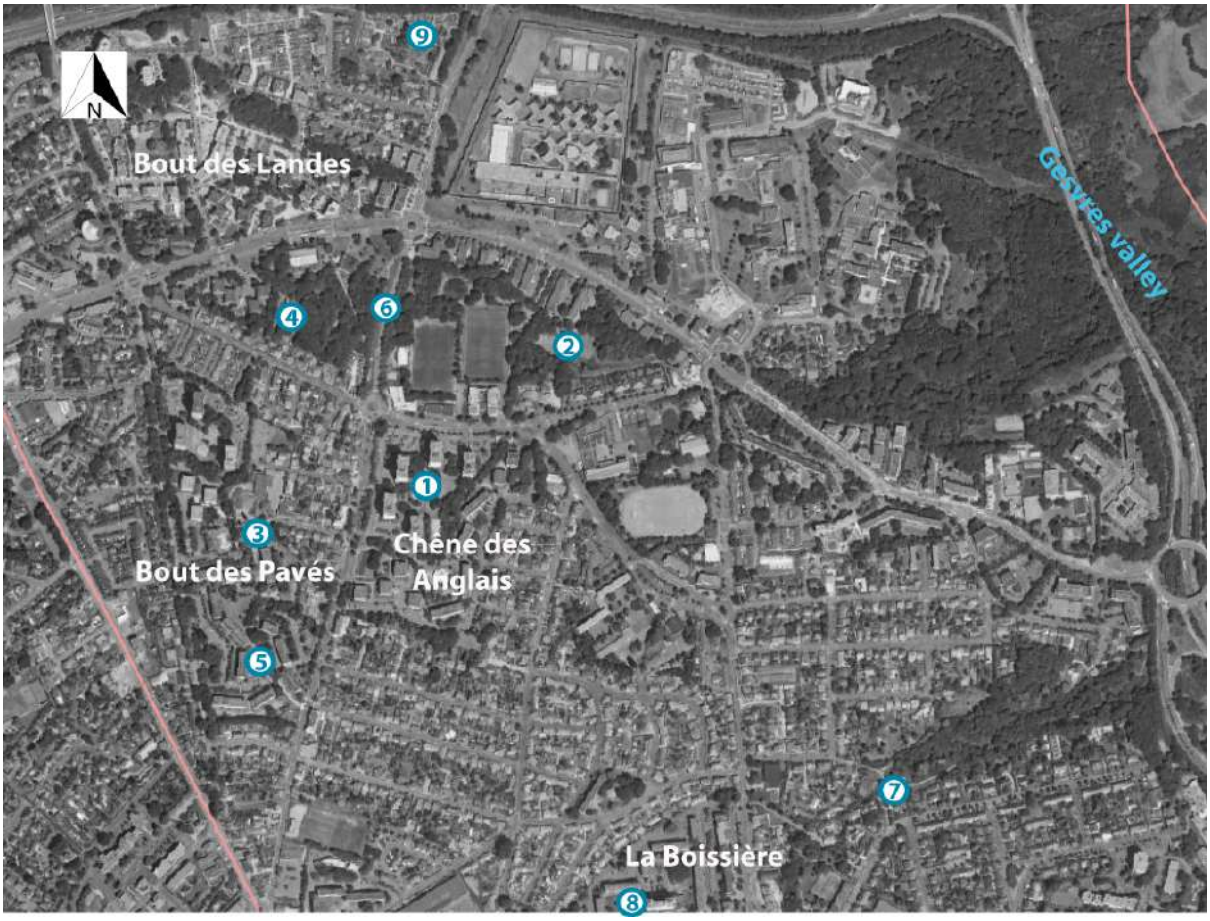


Figure 2 Existing situation (Aerial view).

1. Chêne des Anglais
2. Amande park
3. CUBE (“do it yourself center”) in the Bout des Pavés



4. Community garden - Amande wood
5. Bout des Pavés
6. La Chapelle Road crossing the Amande park and wood



7. Renard small valley
8. Central green space La Boissière
9. Les Eglantiers community garden

Needs and expectations

The participatory process and the local diagnostic allowed for the identification of several needs and expectations already listed in Deliverable 4.2 (Figure X). All these needs were identified with involvement of citizens, local stakeholders, municipal technicians and URBiNAT's taskforce. In coherence with the municipality's broader policies, expressed needs and expectations contribute to developing the healthy corridor strategy.

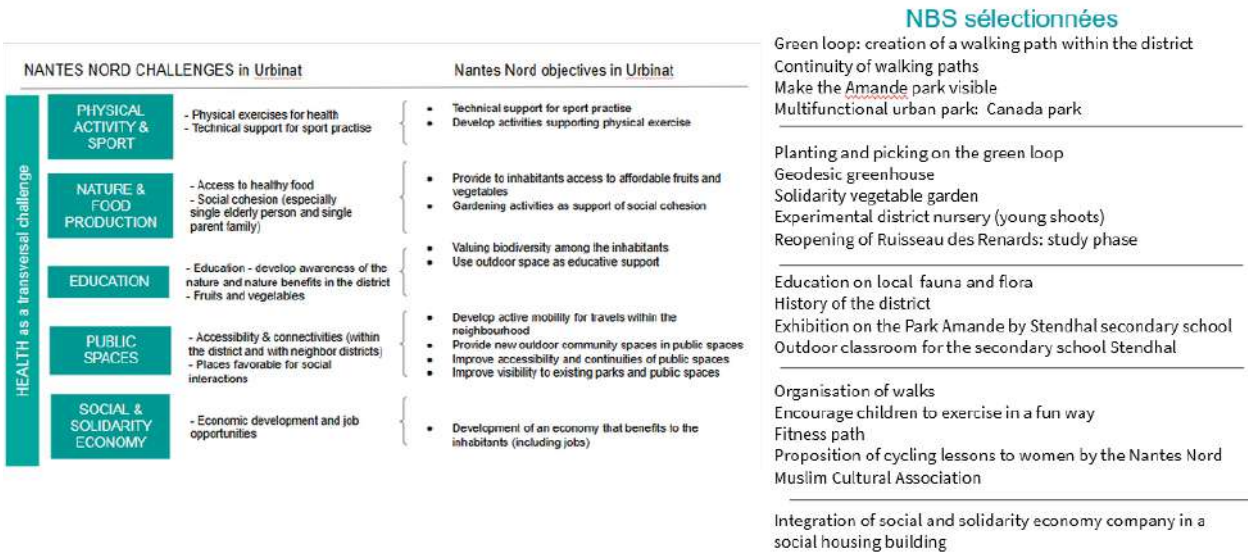


Figure 3 Healthy Corridor challenges and final selected NBS (cf. D4.2).

2. Nantes Healthy corridor

2.1. Masterplan

Currently, the URBiNAT project is leading in complementarity with the Global project and with the advanced stages of the Revers'EAU project (that will officially start in 2023). The URBiNAT Healthy Corridor strategy and developments are integrated into the PGNN, which is carried out on a wider spatial and temporal scale.

In this presentation of the Urban Plan, we will present the interventions linked to the Projet Global and the URBiNAT project by theme and geographical area. The interventions related to one or the other project will be clearly identified (give the weight of each of the two projects in the planned interventions). It might be thought that a specific focus on the URBiNAT interventions would have simplified and facilitated the reading, but this would not have made it possible to account for the logic and the interventions carried out within the framework of the Healthy Corridor. In fact, the scales of the PGNN are more adapted to apprehend areas such as water management and the continuity of the hydrological network or the integration of ecological and landscape continuities.

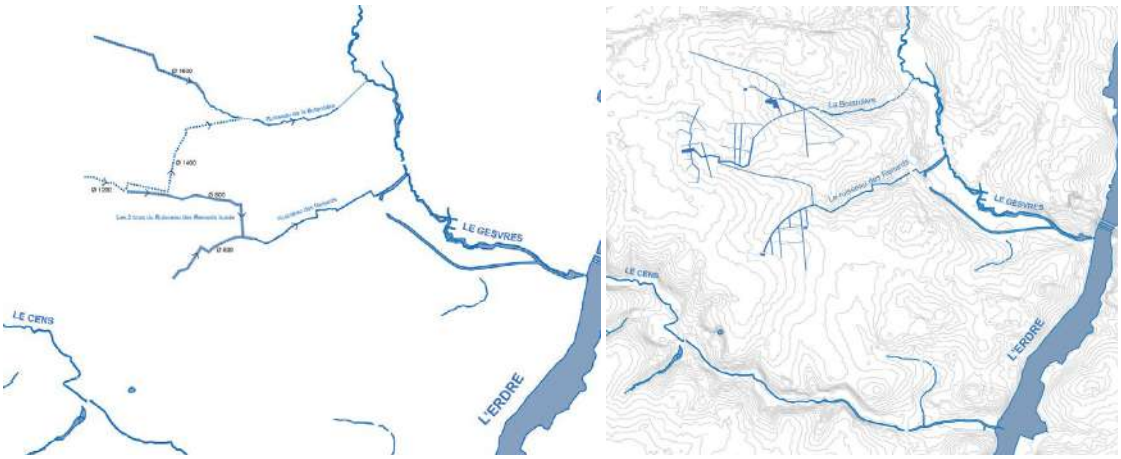
2.2. Thematic Analysis

Water (Rainwater management + reopening of streams)
Reopening of streams

Nantes Nord is located between the Cens and the Gesvres, installed on the talwegs of the Botardière and Renards streams. Part of the stream network was channeled when the district was built.
The project proposes to partially reopen up the stream network. It is not possible to recover these streams as they were before the construction of the districts, as the site has been strongly modified, but rather to make them present and structuring the neighborhood. This development aims to strengthen the link between the district and its geographical base on a local scale, but also on a metropolitan scale in connection with the "green star" of the Nantes valleys. The objectives are also to reinforce the urban lived environment and to benefit from the presence of water to limit the effects of urban heat islands and global warming.

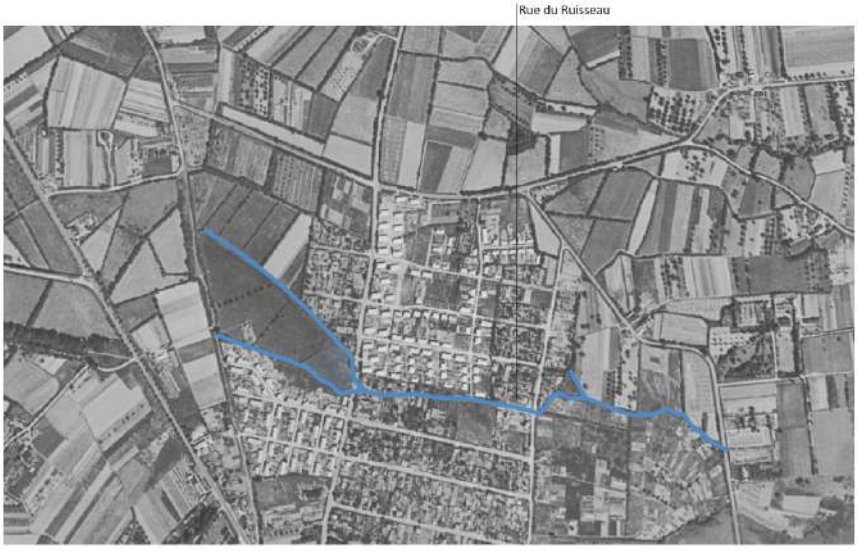
Rainwater management

Currently, the rainwater drainage in the district is based on a network of underground pipes. Part of this network is aging and needs to be renewed or repaired. As part of the urban redevelopment of the district, it was decided to develop an open-air sewerage system when possible.
Indeed, taking into account societal, environmental and climate change issues, this option provides several benefits for biodiversity, the resilience of the area and limitation of urban heat islands (these objectives are stressed in the urban master plan of Nantes Métropole, the "PLU"). In addition, it is proposed to make water one of the structuring matrices of urban space, in addition to the green framework.



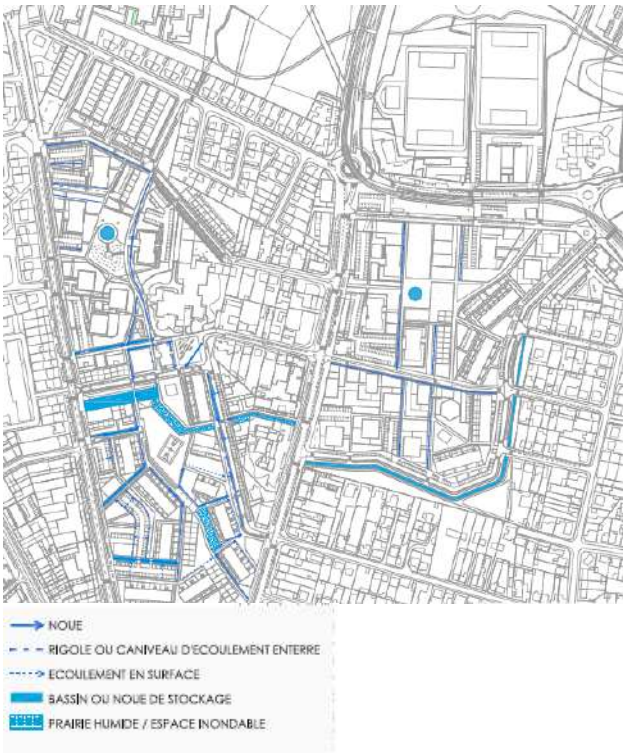
Source: Germe & JAM - Bruel Delmar - Mageo - Alphaville - Caudex - CDvia

Figure 4 Extension of the water network.

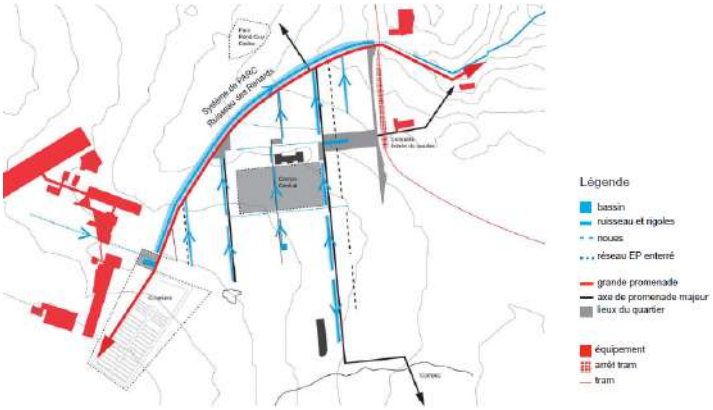


Source: Germe et JAM -BRUEL DELMAR MAGEO 2021

Figure 5 The Renard stream in 1950.



Bout des Pavés - Chêne des Anglais



Boissière

Figure 6 General hypothesis for water design issues (developed in the PGNN), including the Renard stream reopening project (developed in Urbinat).

This project principle regarding water management raises several questions:

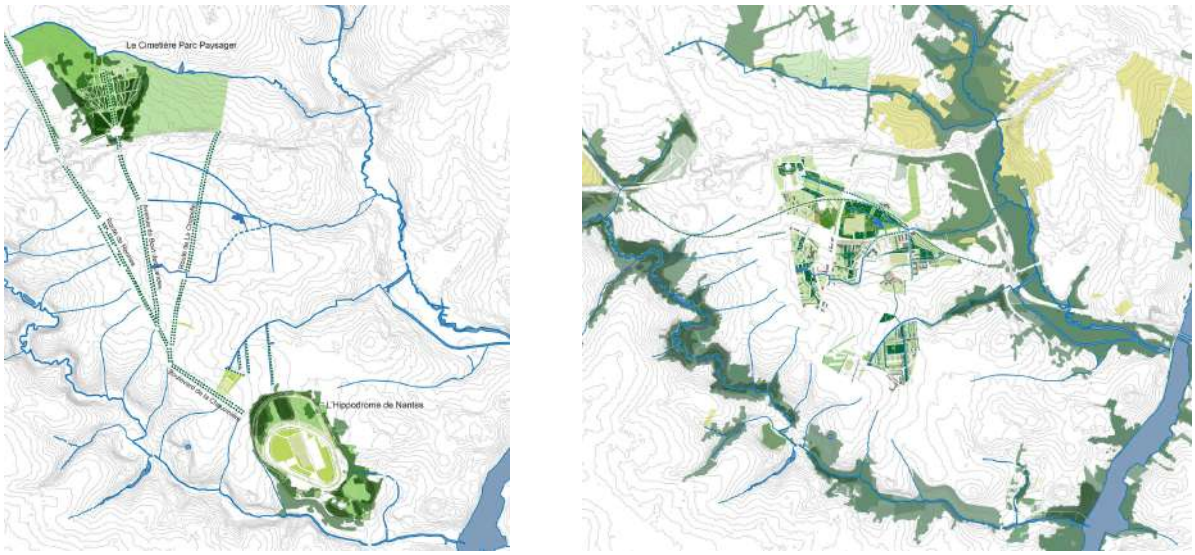
- The development of watercourses and wetlands is sometimes perceived in an ambivalent way by the inhabitants. There is a positive perception of the living environment, the possibility of contact with nature, etc., but there are also reservations/concerns about possible inconveniences (odours, mosquitoes) or about safety, especially for children.
  The municipality already has some experience of this type of project with the reopening of the Gohards stream as part of an eco-neighbourhood project.
- The reopening of the creek also raises many questions as it involves reclaiming surface areas (developments have been carried out above the channelled streams).

Planting principles

The green spaces (planted and natural) as a base to structure the urban space at the district scale

The network of natural spaces and planted areas is recognised for its role in structuring the city. of Nantes Nord. The natural space is considered as a "central value" of the "contemporary city" and of public space. the "contemporary city" and public space. (Guide Plan).

From this point on, it is not only a question of preserving the existing planted spaces as much as possible, but also of linking them and specifying their urban and natural consistency. The characteristic ecosystems of Nantes are still very present in direct contact with urban areas, but essentially on the fringes and on the outskirts. Similarly, a bocage network has become relict and illegible, copses of oaks from the former moorland, and pollarded trees in the Parc de l'Amande...) but are still too little known by the general public.



A) Structuring green spaces and planted boulevards b) Structure of parks and geographic components.

Figure 7. Green network as a structure of urban.

Preserve and improve green network

Although some trees will be removed to enable the construction of roads and certain facilities, the main part of the woodland framework will be preserved and, above all, supplemented by new planting. The objective is to reduce the mineral content of the area (Figure).

The bocage network, and more broadly the entire woodland framework of the district, was subjected to a diagnostic study to assess both its "heritage" value and its phytosanitary state with a view to establishing a strategy for its preservation, reinforcement and renewal in relation to the public issues of urban development (Figure). The woodland matrix thus becomes a valuable context whose knowledge is a prerequisite for any hypothesis of urban transformation.

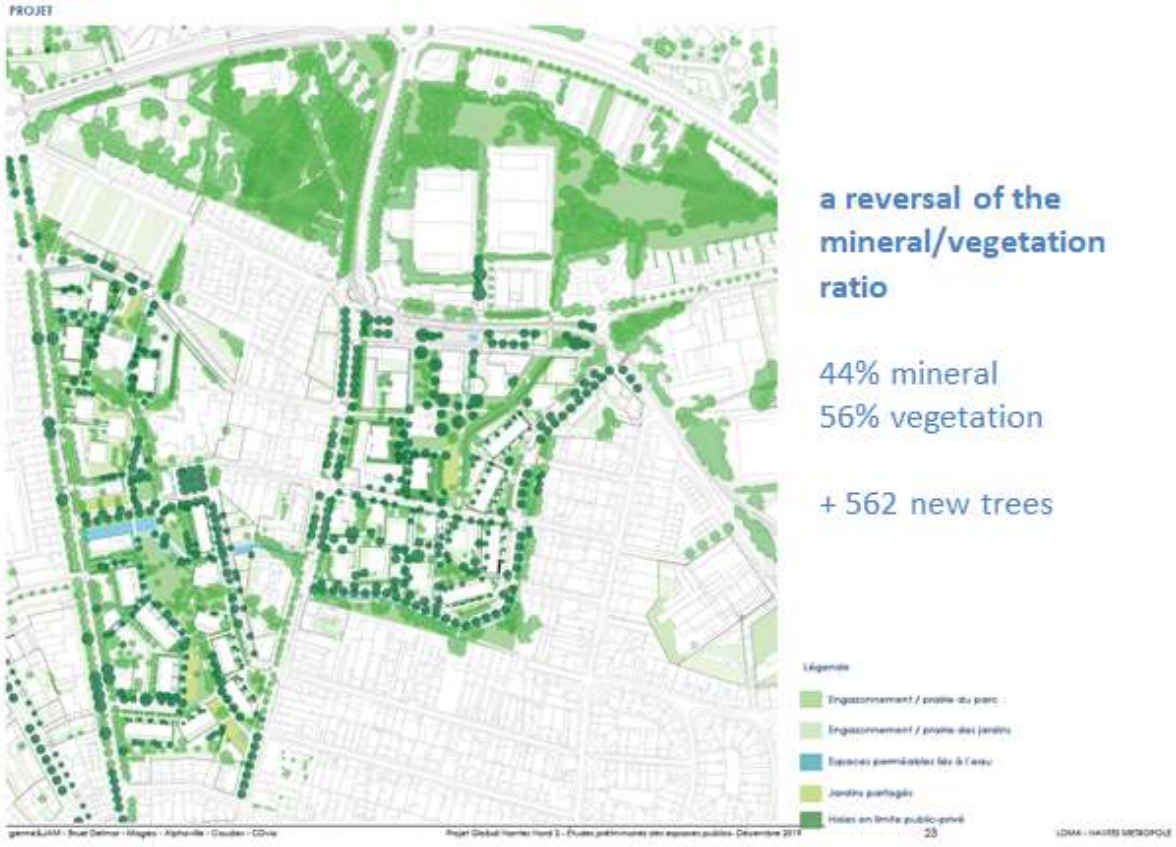


Figure 8. Improvement of the total surface of vegetation.

Figure 9.Extract of the tree inventory and diagnostic.

Figure 10.Project of tree plantation in the Bout des Pavés micro-district.

In order to preserve the most interesting trees and to limit the impact on the existing vegetation, the project was adapted.
To this end, several possible scenarios (alternative routes and/or construction options) were formulated and then arbitrated.

Figure 11.Exemple d'adaptation du tracé d'une voie pour permettre la conservation d'une cépée remarquable..

Figure 12. Evolution of the project to preserve a maximum of trees.

The ongoing questions/challenges for this issue:

- Finding the good balance between ecological issues and uses/accessibility for inhabitants

Food production - urban agriculture

Nantes Nord is considered to be the 'greenest' district in Nantes. The area of public space/green space in the district is now mainly composed of lawns with ornamental tree plantations. This 'green' has a lot of potential for the development of various forms of productive crops.

Agricultural and gardening aspects

There are already initiatives and forms of urban agriculture in the district: community gardens, “stations gourmandes”, etc.
The project reinforces and complements the various urban agriculture initiatives that are taking place in various forms and that cross several scales - from individual cultivation for the inhabitants to professional cultivation by establishing market gardens that generate economic activity within the neighbourhoods, social links, sources of supply in short circuits and uses in the public space.
The project aims to spread much more widely, as well as within the major landscape facilities such as the hippodrome, the cemetery park or even the Géraudière business park. It is above all a question of integrating into the residential areas (Chêne des Anglais, Bout des Pavés and Boissière) by incorporating them into the public space and participating in its animation. Several NBSs have been developed in this respect: Solidarity gardens' program, Symbiose project.
In the long term, the aim is to form a veritable network coordinated on the scale of the district and integrated directly into the public space.
The large surface area of public green spaces in Nantes Nord makes it possible to develop open soil production systems that other, much denser neighbourhoods in Nantes cannot afford to accommodate (using other above-ground and rooftop systems in particular).

The project relies on a network of actors who support this type of intervention, both in the technical aspects and in the animation. The following are involved: the municipality (CCAS, SEVE), NMH, associations (Accoord, BioTfull, etc.)

A full agricultural system

These different forms of urban agriculture and gardening are part of a more complete agricultural system when they are linked to other initiatives such as domestic composting and the recovery of biomass from the management of the neighbourhood's wooded and hedged areas (collected by green spaces department). This raw material could be reused for the management of green spaces to improve the transformed urban soils of these former moors, but it could also contribute locally to the production of wood energy necessary for the operation of nearby wood-fired heating systems.
There are also forms of animal farming with ecopatterning (by sheeps in Nantes Nord prison) or poultry farming (example in the Eglantiers garden).

The ongoing questions/challenges for this issue:

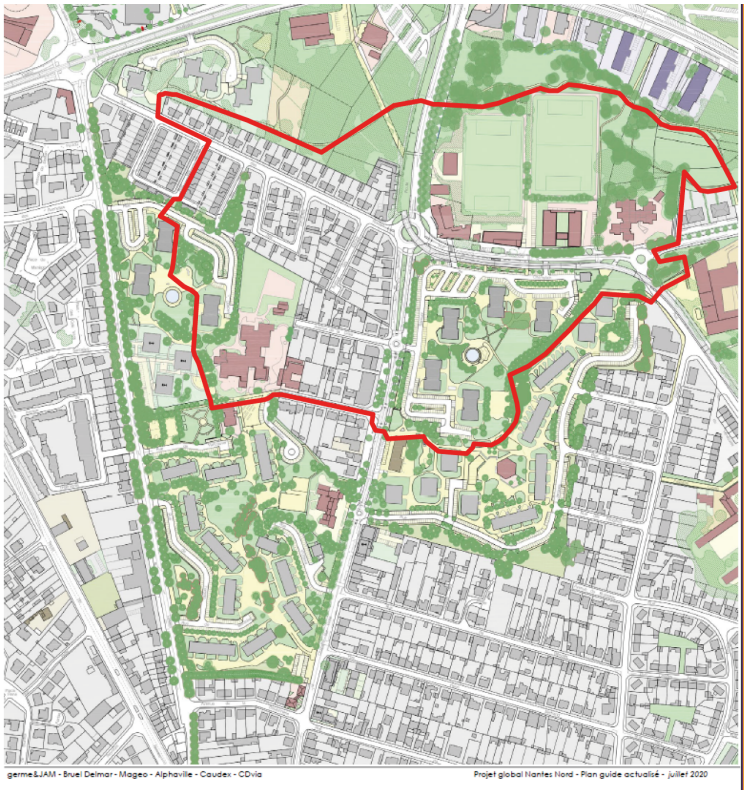
The implementation of various forms of urban agriculture raises several questions:

- Food production raises the issue of soil quality and pollution. In cities, soils can be polluted by metals (copper, lead, etc.), radioelements (uranium, tritium) or even pesticides. Their origin can be linked to human activities, but can also have a natural origin. These pollutants are potentially problematic for both environmental and human health. And if the concentrations are not always very high, they may be chronically toxic, with a cumulative effect over time and a possible combination of pollutants.
  In Nantes, the Eglantiers allotment garden was a particularly rich experience, both in identifying and locating pollution (in partnership with the IRSTV) and in finding operational solutions to remedy this type of case.

- The gardens and production plots also raise the question of the animation and sustainability of such projects over time. The management of these growing areas with gardeners is shared between green space technicians and socio-cultural facilitators, which requires good coordination between these different professions. In addition, the sustainability of these gardens depends on the involvement of the inhabitants with a certain degree of constancy (watering, etc.).

2.3. People places (area by area)

1 - Green loop and Amande Park



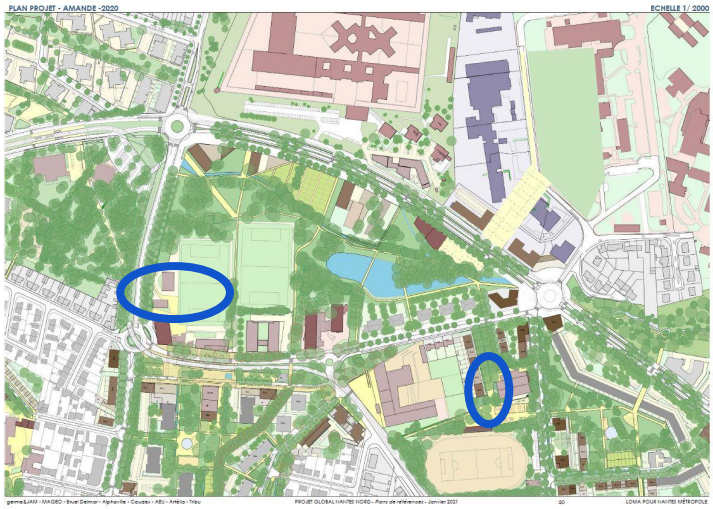


Figure 13. Major entries of the park of Amande.

2 - Canada Park

Canada Park is located in the central area of the Bout des Pavés micro-neighbourhood. The redevelopment of this space concerns the development of a public garden for the Bout des Pavés neighbourhood in connection with the existing facilities which are consolidated and sometimes extended (school group). The location of the current garden is maintained but its geometry is adjusted and articulated with the two structuring figures of the district:

- The East-West link, which is now accessible by car;
- The large linear North-South Garden that connects the Bout des Pavés to the Parc de l'Amande.

The Canada Park is itself composed of two sections (North and South) which will be designed and implemented in the URBiNAT framework (North) or in the projet global framework (South).

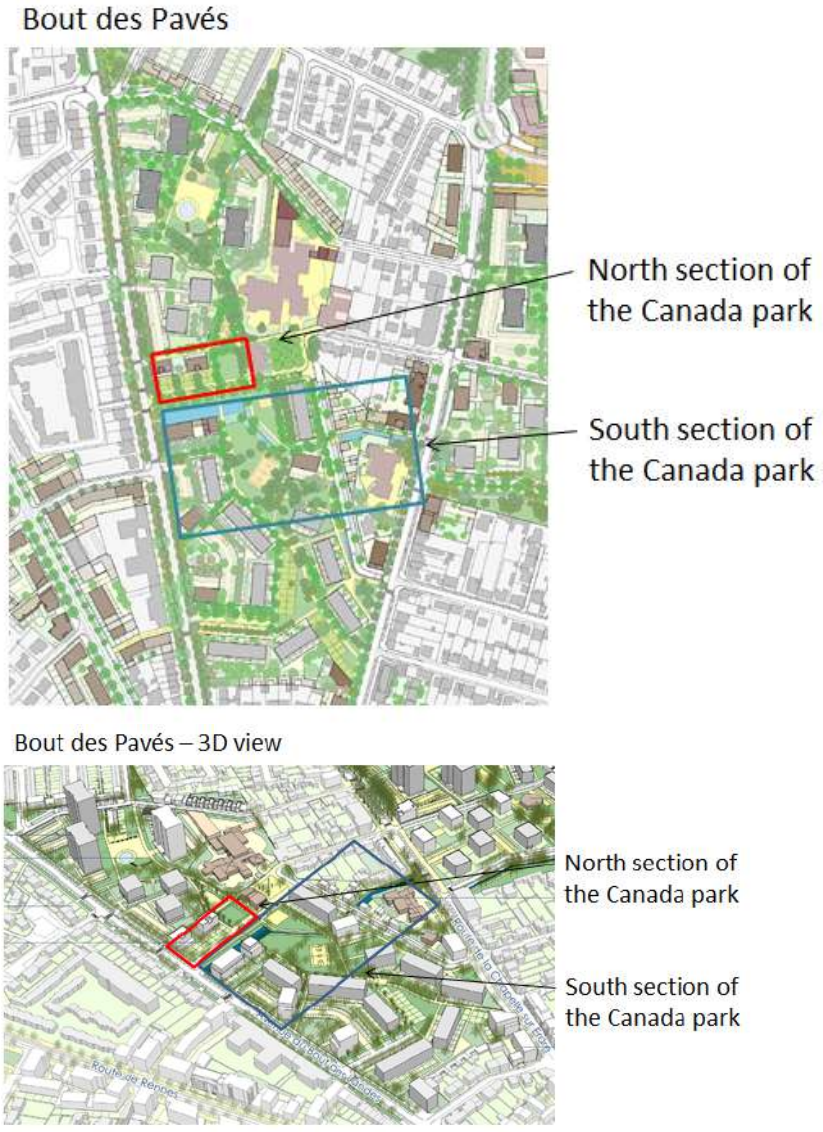


Figure 14. The two sections - North and South - of the Canada park.

North section of the Canada park:

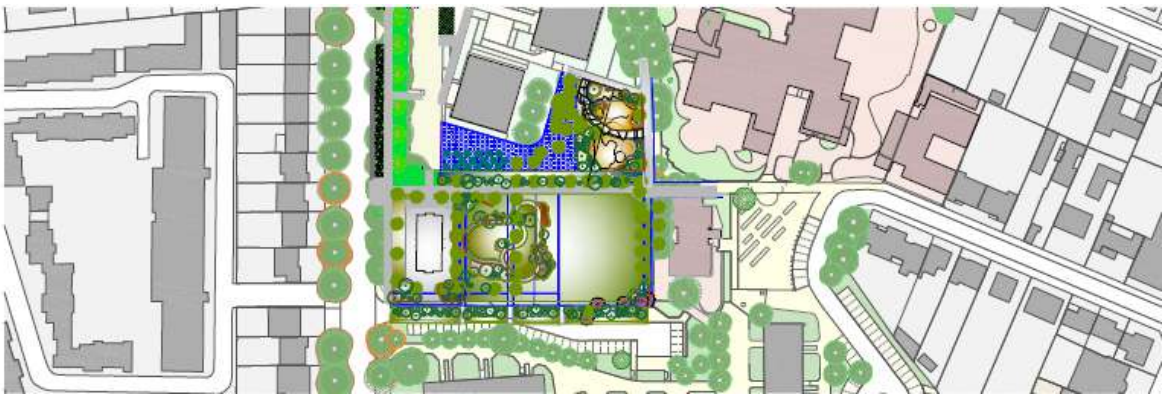


Figure 15. Design plan of the North section of the Canada park (part of URBiNAT project).

South section of the Canada park:

A large pond is proposed on the Avenue du Bout des Landes as a major central element structuring the district (Figure X and X). This basin is fed by the existing canalised stream under the avenue du Bout des Landes and by the neighbourhood's drainage basin. The stream structures the park as far as Route de la Chapelle and possibly part of Rue Jacques-Cartier. The stream is returned to the open air, replacing the existing network on this section.

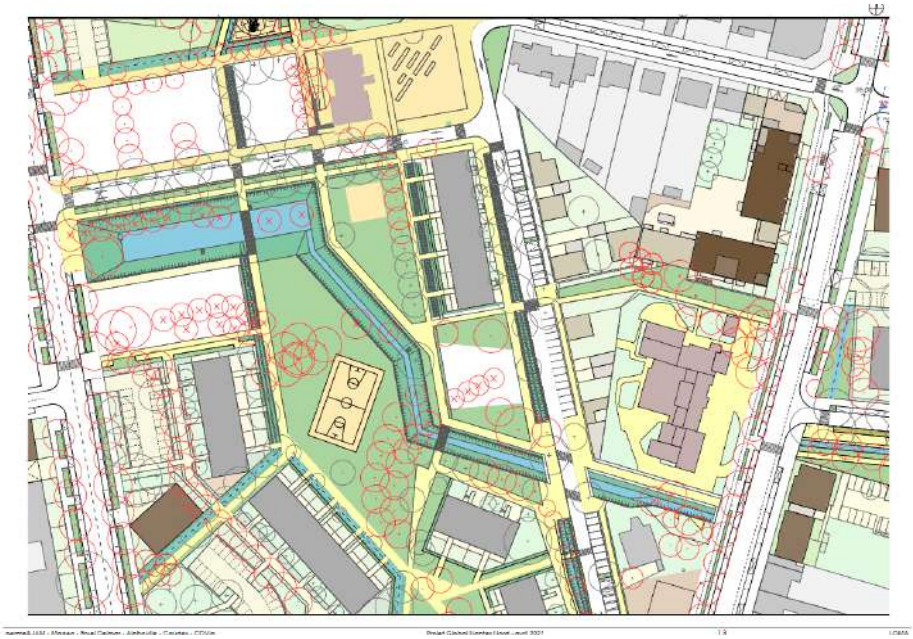


Figure 16. Design proposed for the south section of the Canada parc.

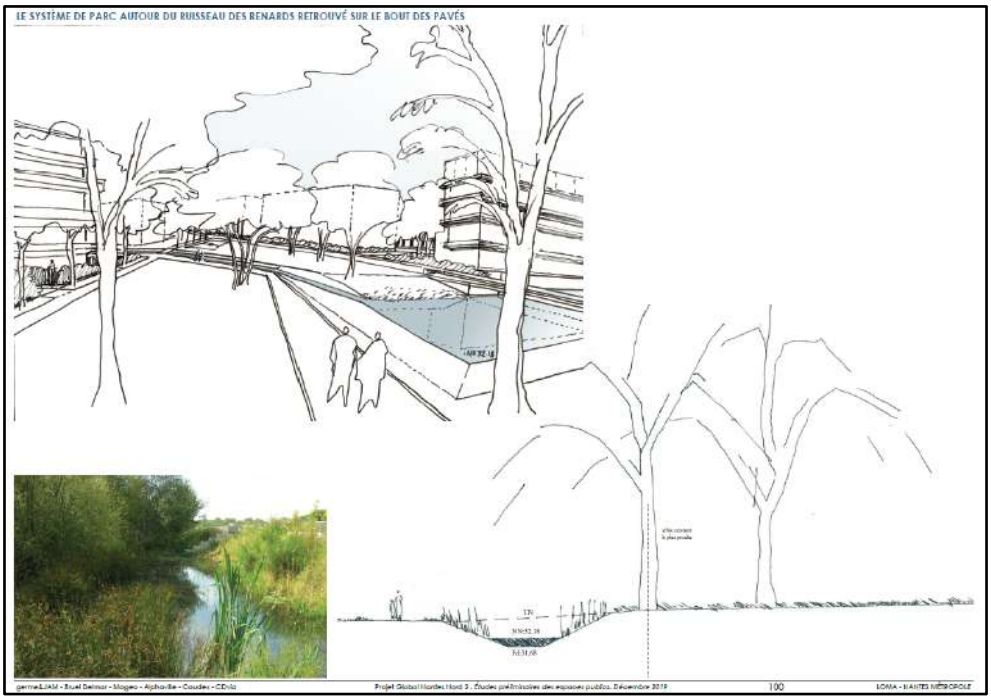


Figure 17. Focus on the new designed pond planned in the south section of the Canada park.

3 - La Boissière - Reopening of the Renard Stream

In this area, the reopening of the Ruisseau des Renards is the main development that will be carried out as part of Urbinat.

Figure 18. Current situation in La Boissière micro-district.

Figure 19. Planned design in La Boissière micro-district.

2.4. Nature-based solutions

Green loop: creation of a walking path within the district

The layout of the green loop was the first proposed by the municipality, the current layout integrates the feedback of the inhabitants, in particular resulting from the participative activities that took place during the summer and autumn of 2020.
The green loop is nearly 2158 m long. This represents a little less than an hour's walk (speed of an average pedestrian) without stopping. The walks organised during the various participation activities, which included stops for discussions or to observe the neighbourhood, generally doubled this time.

The loop has no specific start/finish point. The tour can be started at any point. However, the “Station gourmande” (edible garden) in Canada Park, near the do it yourself center (the CUB) is a good starting point for group walks. This place offers tables for picnics/snacks and is well identified by the inhabitants. Similarly, the parvis of the Stendhal college or the Dragon playground, because of their proximity to the tramway stop "Chêne des anglais" (Line 2) and because they are well identified places in the district, are other favourable starting points.

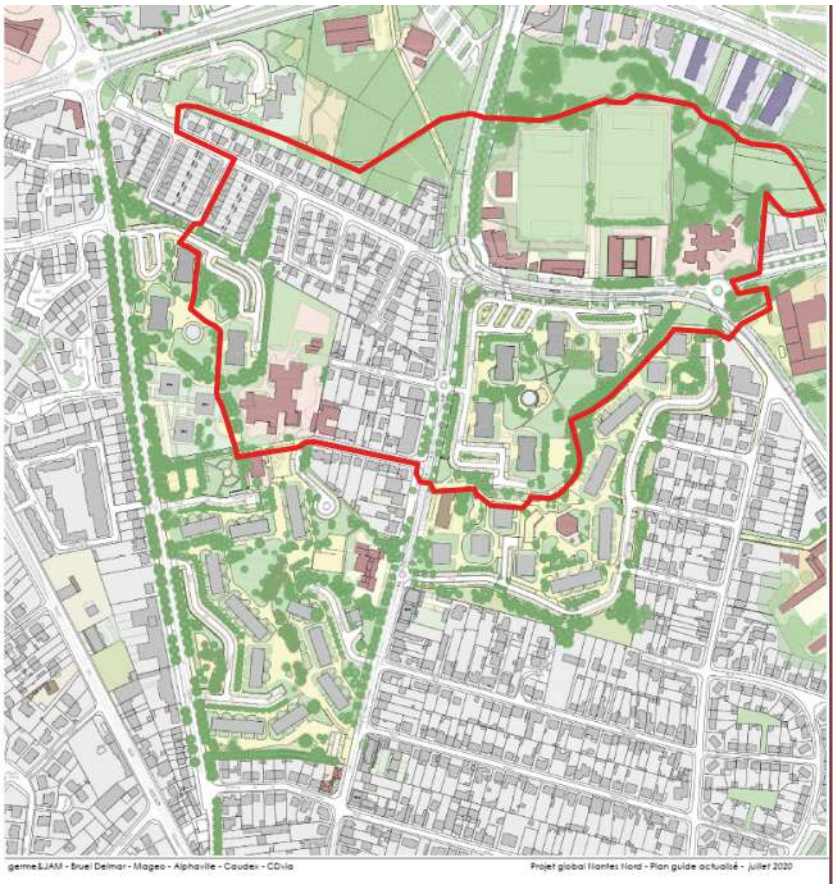


Figure 20. Layout of the Green Loop

Signage system for the green loop

The green loop connects different parts of the district with very different landscape characteristics: a park, suburban streets, green spaces associated with large social housing estates, etc. In addition, the green loop path tends to be cut off by road infrastructure. Following the course of the loop cannot therefore be based on a readability that would be given by a landscape continuity. The ability to follow the route of the loop will therefore have to be based on effective staking.

A first signage system was put in place during the summer of 2020 to support the participative activities and to share the route of the loop with the inhabitants. This temporary signage system was materialised by markings on the ground (Figure).
A permanent marking system is being studied. It could be based on signage, but also on street furniture with a specific identity. These elements, particularly the signage, will nevertheless have to be compatible with the broader framework used for the green spaces of the city of Nantes.

Figure 21.Temporary signage system (green mark on the ground) implemented for participatory activities.

Development of transport infrastructure crossings along the Green Loop

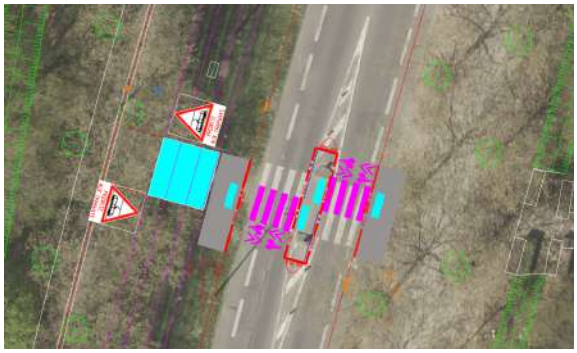
The Green Loop, developed on the district scale, crosses several roads and tramway tracks. These crossings require improvements. Their objective is first of all to ensure the safety of users of the Green Loop. Secondly, it is to ensure the continuity of the loop, by making it easier to cross, but also by encouraging users to continue their journey along the loop. Indeed, these roads must not constitute limits. The risk being that the roads contribute to segmenting the loop into several independent sections.

A) Crossing of the Roches Street

B) Crossing of the La Chapelle-sur-Erdre road and tramway track

Figure 22.Continuity of the green loop: the need to develop the road and tramway crossing.

A) Crossing of the Roches Street



B) Crossing of the La Chapelle-sur-Erdre road and tramway track

Figure 23.Equipments designed to ensure the continuity of the green loop.

Amande park visibility and accessibility

For the park to become a major element of the district's urban centrality, it is essential to create connections between the purely urban part of the district (activity, housing, transport) and the more natural character of the park. It is also necessary to position the park at the heart of daily travel and commuting, whether for the working population on the northern fringe of the park or the inhabitants of the southern fringe. Even though the park is currently open to the rest of the district, access to it remains largely confidential and not very attractive Figure 24.

The project therefore aims to improve the visibility of the park's entrances, and to improve the efficiency of the layout of the paths and the comfort of use of the walkways.

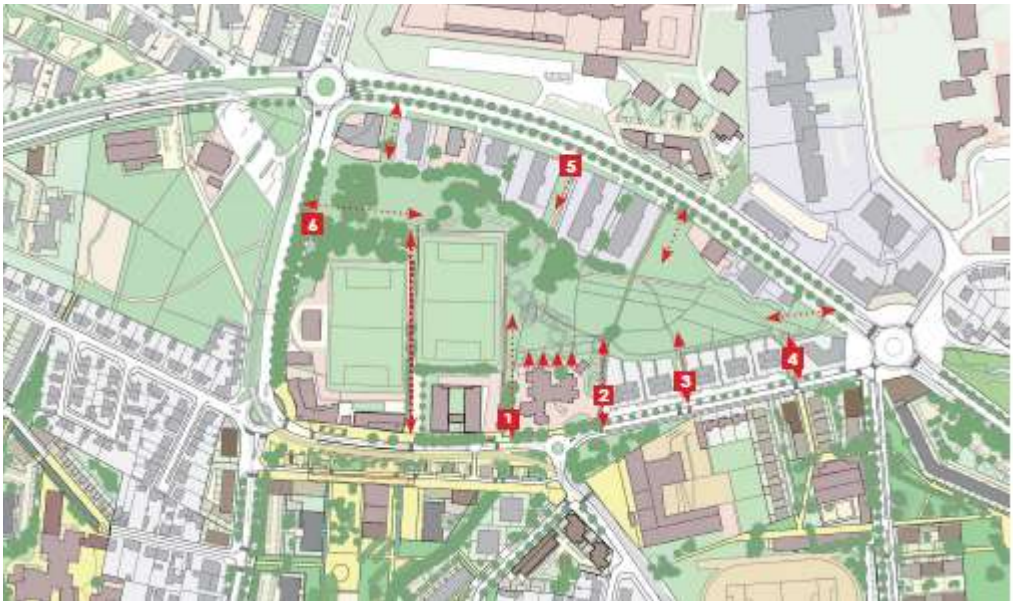


Figure 24.Inventory of the existing entrances of the Amande park.

Improve the visibility of the park entrances

The project aims to improve the visibility of the park entrances from the roads surrounding the park. The design of park entrances is still under development. This section will be completed later.


Figure 25. Enhancement of the western entrance of the Amande Park (design hypothesis: green spaces dpt. Nantes).

Paths inside the Amande park

The pathways within the Amande park will be redesigned. The paths are designed to support sports and daily activities and must also be easily accessible to all (parents with pushchairs, the elderly, etc.). The routes are better defined and the surfaces allow for better accessibility.

The exact layout of paths inside the Amande park is not designed yet.
Green space department of the municipality is still waiting for results of a hydrologic study.

The natural and undeveloped aspect of the park must be preserved both to preserve its ecological qualities and also because the natural character is highly appreciated by the inhabitants, as was expressed during the participative walkthrough. The project will not necessarily reproduce concrete pathways everywhere, other solutions are also envisaged with earth-stone surfaces or stabilised sand (Starmine®).

Multifunctional urban park: Canada park

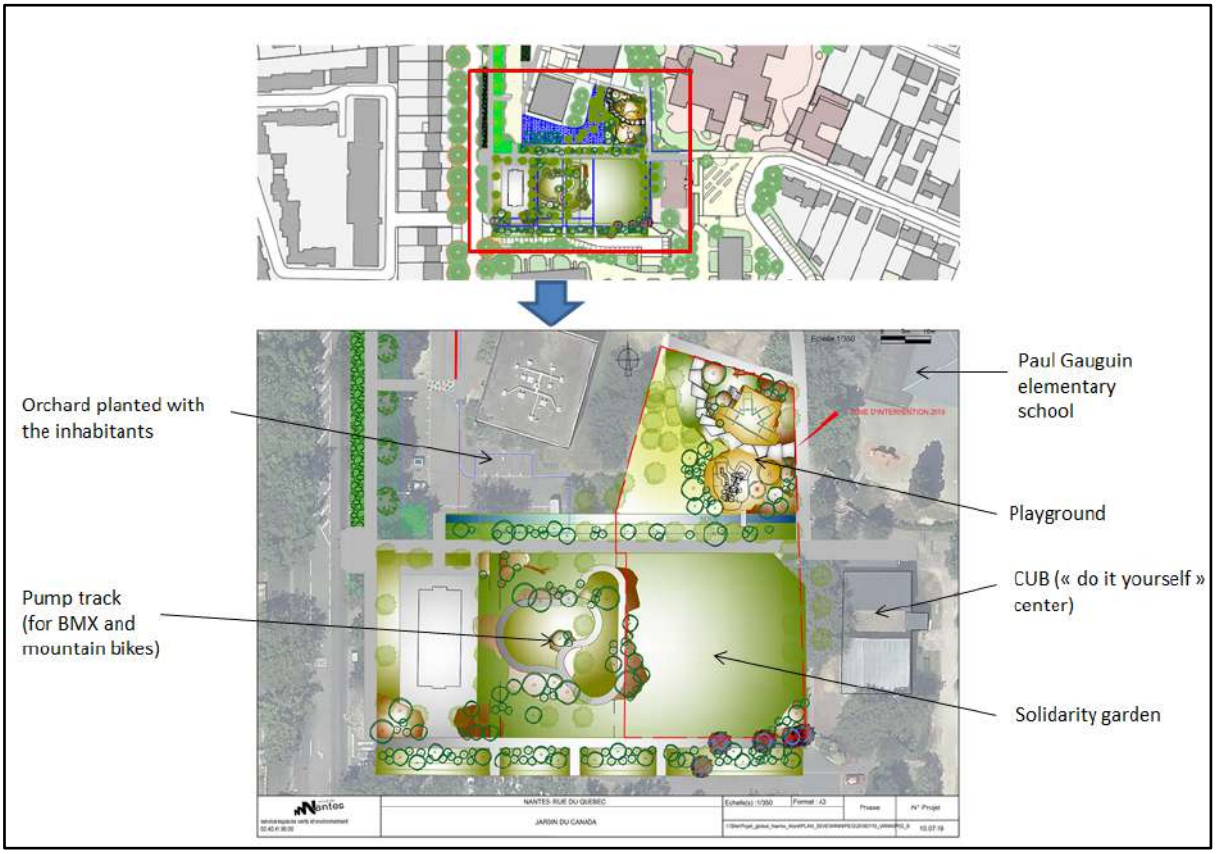


Figure 26.Overall plan of the Canada park.

Figure 27.Sketch presenting the design of the playground.

Figure 28. Playground implemented in winter 2021.

Planting and picking on the green loop

The green loop has a nourishing character by linking several areas with food crops (allotment and community gardens, “stations gourmande”). In order to further reinforce this nourishing character, it is planned to punctuate the circuit of the green loop with plantations of vegetable and fruit species.
In Nantes, this project is based on the experience of the “stations gourmande” (public green spaces planted with edible species, that people can freely harvest). The “Station gourmandes” were installed in the city in 2012 on the occasion of the "Voyage à Nantes" festival. But upstream of their implementation, this project had been the subject of several studies by the City of Nantes' Green Spaces Department. A first test garden (Square Marcel Launay) had notably made it possible to test the provision of vegetable gardens to residents, their use and respect for the planting. This initial work was accompanied by a participatory dimension with an active role for citizens and residents.

This experience in Nantes, with the implementation of fruit and vegetable plantations in the public space, is itself inspired by the worldwide "Incredible Comestible" movement, an initiative from England that installs self-service vegetable gardens for passers-by to pick. The participatory approach is a citizen action to reconnect individuals with each other, with the soil and with nature as a source of food. Within the framework of the green loop, these edible plantations will take shape in edible hedges. This will allow the project to fit into the current landscape pattern of the neighbourhood, which includes more remaining bocage hedges, which characterized the agricultural area prior to the development of the neighbourhood.

A study of plants for the edible hedge was carried out by the city's green space department.This study proposes plant species adapted to the local geo-climatic context and following several strata, herbaceous, shrubby and arborous.

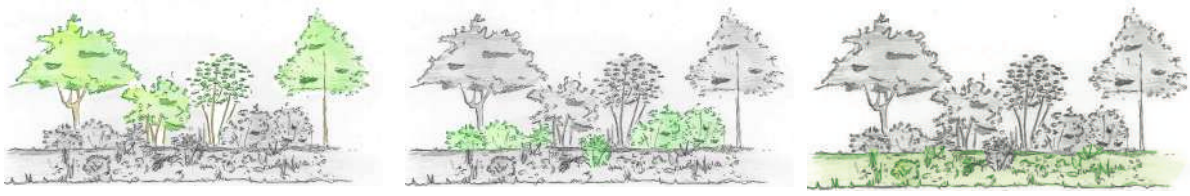


Figure 29.Herb, shrub and canopy layers (source: green spaces dpt. Nantes).

Rubus idaeus
Raspberry

Ribes
Redcurrant

Mespilus germanica
Medlar tree

Sambucus nigra
Elder

Prunus tomentosa
Nanjing cherry

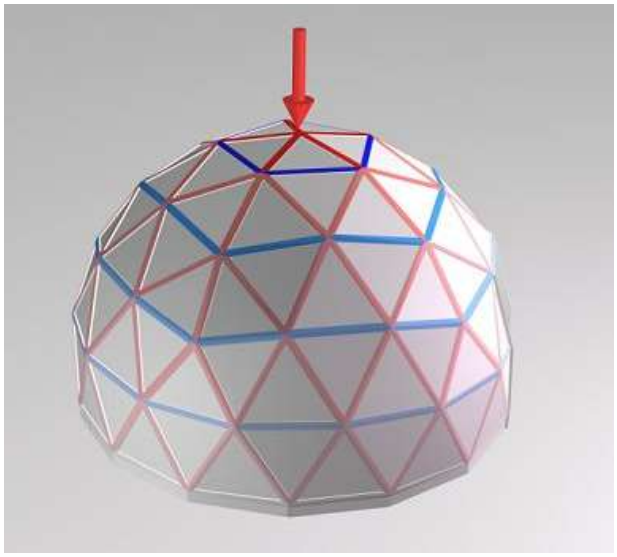
Fragaria vesca
Wild strawberry

Figure 30. Selection of different species for the edible bocage.

Geodesic greenhouse

The geodesic greenhouse is an architectural structure with a spherical shape, composed of triangles that are connected to each other. This shape allows the loads to be redistributed, which makes the structure self-supporting. Geodesic structures are the strongest structures known, in relative to the quantity of materials used.

Conceived in the 1950s by the American architect and designer Buckminster Fuller, the geodesic dome has since spread throughout the world for many uses: exhibition halls, auditoriums, sheds, agricultural shelters or even unconventional housing.



The dome distributes the force of its weight (red arrow) throughout the structure with compression (red) and tension (blue).

Figure 31. Structure principles of the geodesic glasshouse (Source Bio-T-Full).

For use as a greenhouse, this shape offers several advantages. It allows for optimal light exposure and better ventilation and heat distribution. In addition, the wind exposure is also limited, which protects the structure from the hazards of the weather.

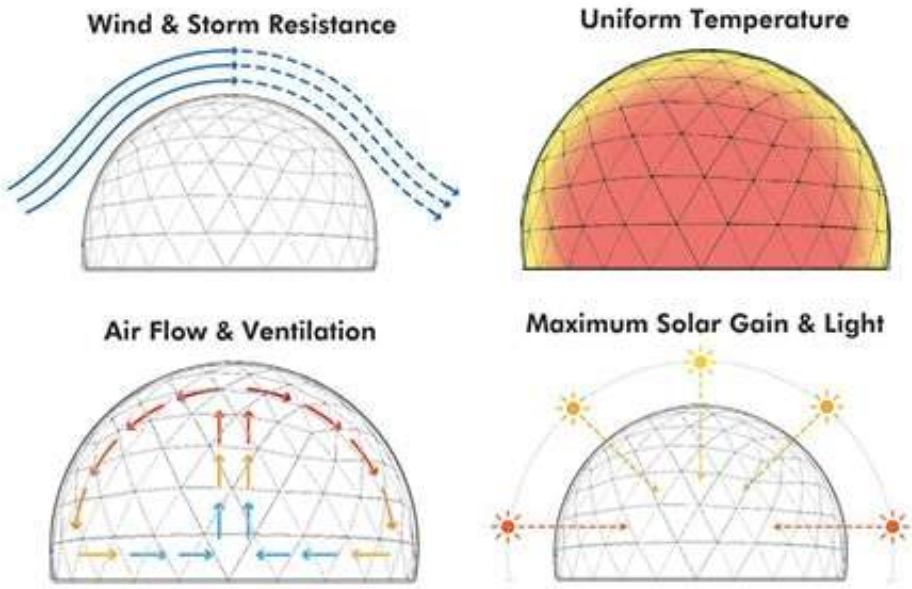


Figure 32. Advantages of the geodesic structure for a use as a greenhouse.

The construction was carried out by a team composed of both members and workers of the association Bio-T-Full and volunteers.

The geodesic greenhouse was prefabricated in the association's workshop in the Solilab.
The design required the addressing of several issues such as the choice of the geometric shape, the choice of the calculation software, the types of materials, the choice of the junction / fixation systems.

Figure 33. Prefabrication of the greenhouse in the association's workshop (Source: Association Bio-T-Full).

Figure 34. Greenhouse construction in Nantes Nord on 5th June 2021 (Source: Bio T Full).

Solidarity vegetable gardens

As part of the "solidarity garden" operation carried out at the level of the Nantes municipality, two plots have been set up in Nantes Nord. One plot is located in the Canada park, the other in La Boissière. The two plots located in Nantes Nord refer to the two types "productive" and "participatory" vegetable gardens.

The productive garden has a surface area of approximately 200 m^2. It is cultivated by the city's green spaces service. It aims to produce vegetables that will be distributed to inhabitants with difficulties. It also will be a support of pedagogic activities by welcoming schoolchildren from surrounding schools for educational activities on the themes of gardening and biodiversity.

The participatory vegetable garden has a surface area of approximately 100 m^2. It is cultivated by volunteer inhabitants, with the help of local coordinating associations (the CSC Boissière (Accoord) is the referent in Nantes Nord), and in collaboration with local actors. This garden is also a means of revitalising the neighbourhood and raising awareness and education for healthy food.

At the municipal level, 10 productive vegetable gardens and 12 participatory vegetable gardens have been set up. In addition, 1 wide production site (3500 m2) located in the municipal nursery will provide a complementary harvest to support neighbourhood production.

The choice of the site for the productive garden was determined according to the availability of the teams on the one hand, and technical feasibility criteria on the other (access to water, exposure, access to trucks, soil quality in terms of risk of contaminants). For the participatory gardens, the plot was also chosen according to the anchorage in the neighbourhood and the existing dynamic (or to be encouraged) with the intention of involving the beneficiaries of the vegetable production as much as possible in the cultivation and harvesting phases of the gardens.

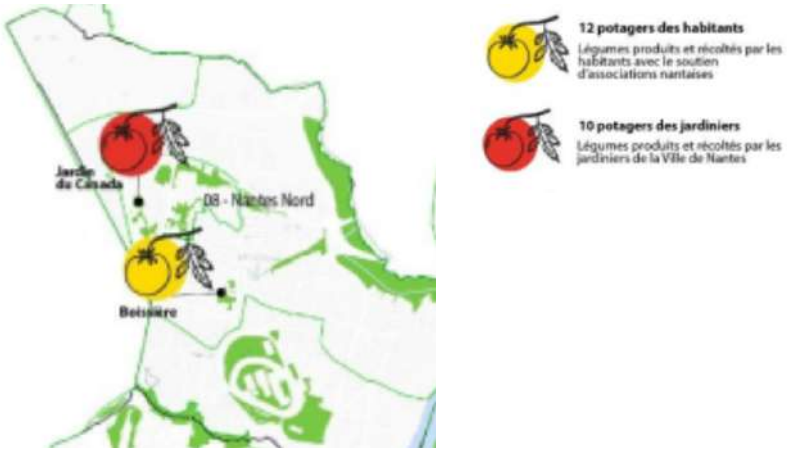


Figure 35. Location of the two gardens in the Nantes Nord district.

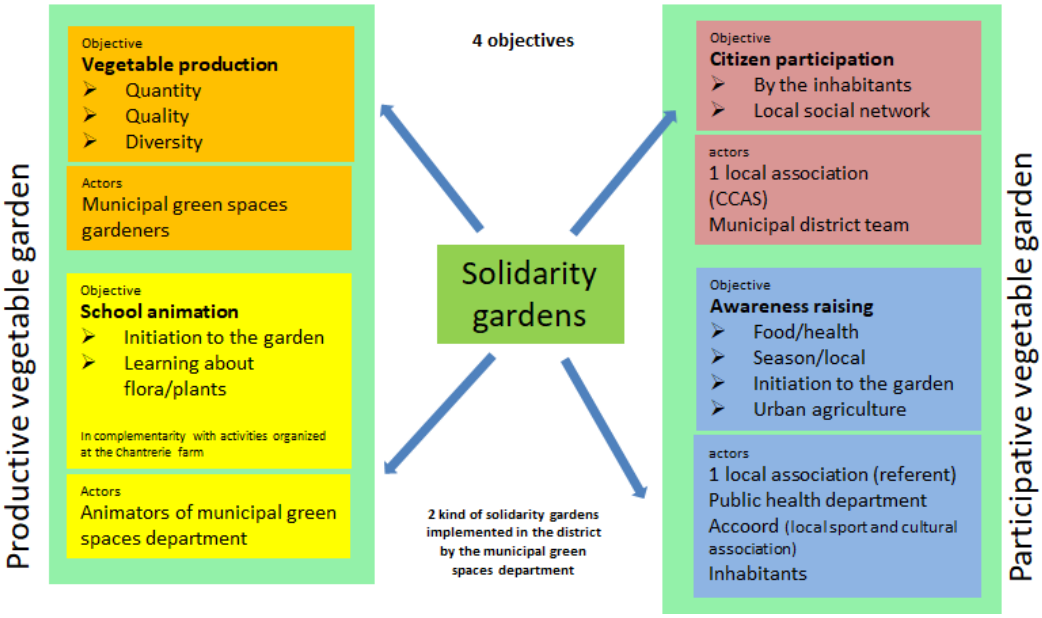


Figure 36.Objectives and distinctions between productive and participatory vegetable gardens (source: SEVE).

Solidarity garden design:
The common elements that identify solidarity gardens:

- a peripheral strip of culture that overhangs the fence: transition between the outdoor space and the indoor space of the vegetable garden the fence accommodates climbing vegetable plants (beans, squash, cucumbers), herbs, flowering companion plants...
- This strip of cultivation could be freely harvested by the inhabitants.
- Growing beds in the form of mounds
- the same basic plant range
- straw mulch (1 bale of straw provided for 4m²)
- bamboo stakes to guide the plants, assembled in tripods for example (1 stake/tomato plant + 10 for climbing structures)
- signage identical to that of 2020: wooden boxes fixed on bamboo tripods with a printed wooden panel and slate to display the quantities of vegetables harvested.

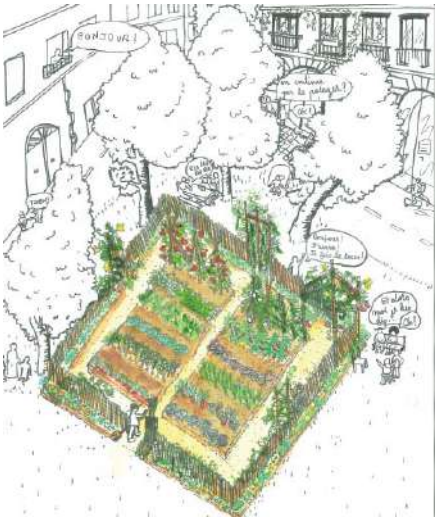
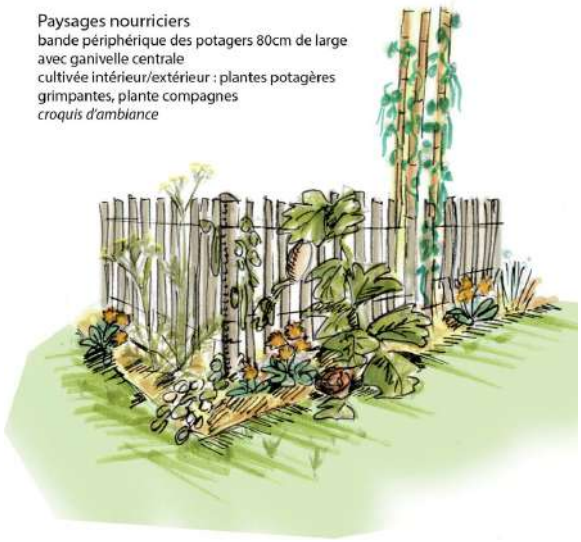
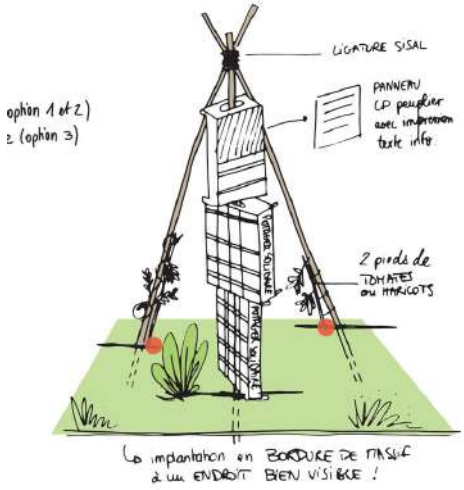


Figure 37. Sketch presenting the general design of solidarity gardens (source: green spaces dpt. Nantes).



Source: Green spaces dpt. Nantes.



Source: green spaces dpt. Nantes.

Figure 38. Fence design for solidarity gardens (figure on the left) / Signage system for solidarity gardens (figure on the right).

Experimental district nursery (Symbiose project)

The Symbiose project consists of the installation of a greenhouse on the roof of an existing building of 24 dwellings built in Nantes Nord in the 1970s.

The objective is to capture heat from the greenhouse to preheat domestic hot water, thus complementing the thermal rehabilitation of the building. This greenhouse will also provide tenants and local residents a new 400 m^2 space to invest for urban agricultural initiatives.

Another objective of this greenhouse is to improve the image of the district by drawing a new urban silhouette. To this end, the project promotes the vitrine aspect of an innovative project.

Figure 39. Planned design of the greenhouse.

Figure 40. Urban context of the building.

Figure 41. Current state of the building.

Symbiose project includes a technical dimension and a social and economic dimension.

Technical dimension

The triple chapel greenhouse is made of polycarbonate and glass. The project is intended to provide access to the greenhouse via a specific entrance and lift (different from the access used by the inhabitants of the flats).

The main innovation is the integrated approach that enhances the greenhouse and the building:

- the greenhouse helps to heat the building in winter and provides a buffer space on the roof that reduces heat loss
- the recovery of heat lost through the roof of the building contributes to the conservation of a temperate climate in the greenhouse in line with the planned agricultural activities

The predictive management of this greenhouse-building complex is carried out by an artificial intelligence system that relies on weather forecasts, knowledge of the building's thermal behaviour and the climate required by the crops to adjust the operation of the ventilation system, the heat recovery system and the openings.

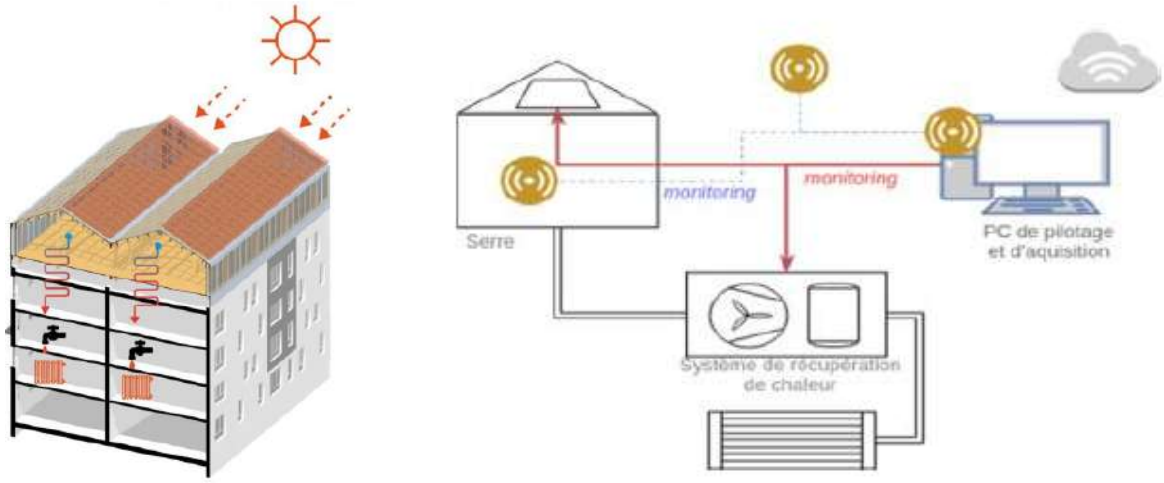


Figure 42. Smart control based on energy forecast.

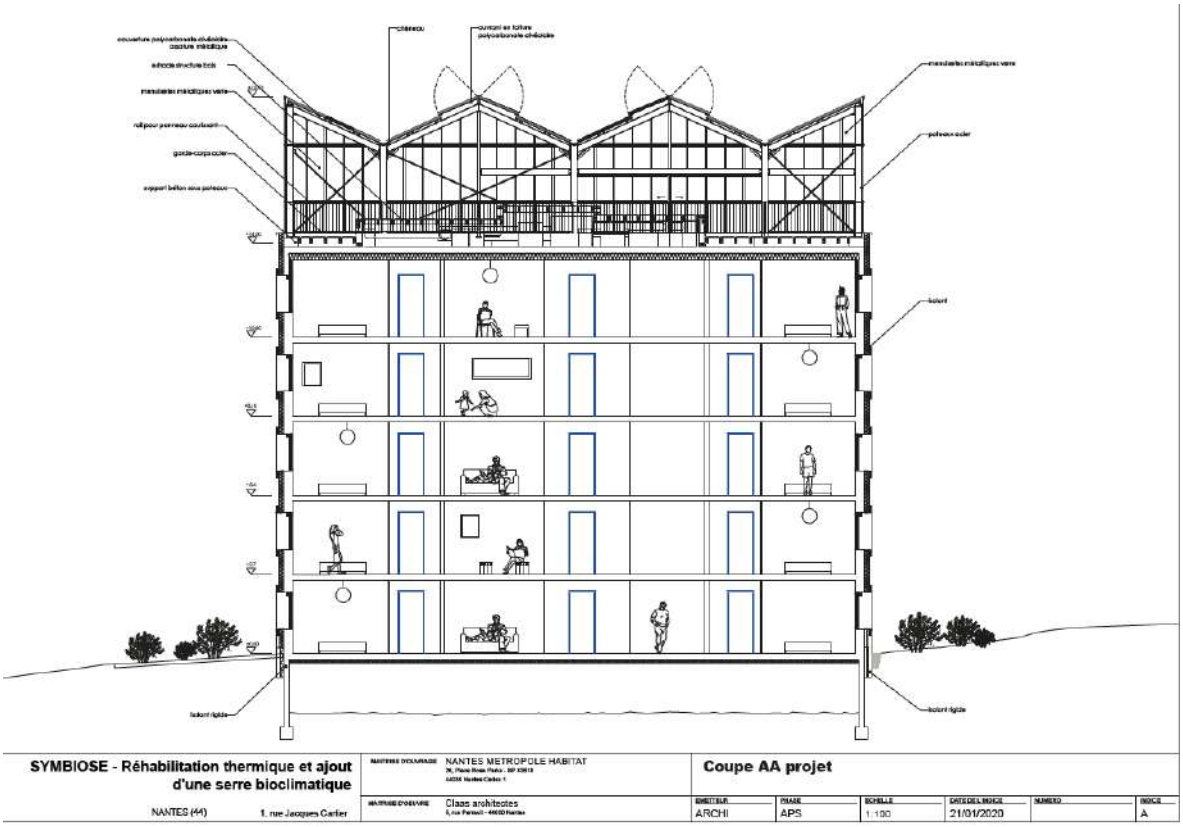


Figure 43. Building section.

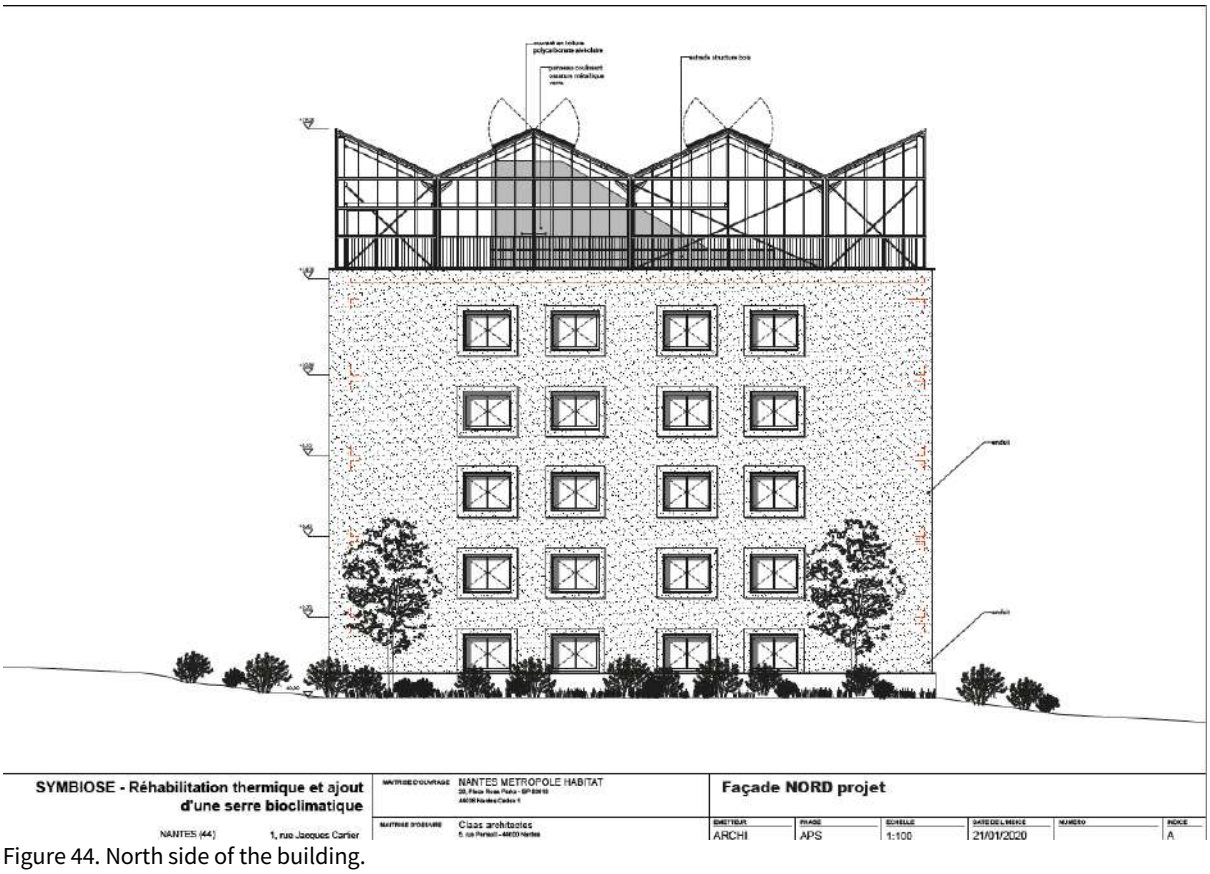


Figure 44. North side of the building.

Social and economic aspect

From 2022 onwards, the greenhouse will be dedicated to the production of young plants (vegetable and aromatic plants). The greenhouse will provide all the young plants needed for the newly created allotment garden plots in Nantes Nord (at the foot of the building and as part of the future urban project), and those existing in other districts (21 garden plots for tenants throughout the housing stock managed by the social housing landlord (NMH).

From 2021, a 300 m² plot at the foot of the Symbiose building will be cultivated. This plot, designed as a place of life, exchange and entertainment, will include various agricultural facilities. The scenography will be reinforced by educational panels that will enable the inhabitants to understand the overall approach (Figure).
The rate at which the plots of land are deployed will be determined by the urban development of the various areas of the district, in order to provide a minimum of 2,000 additional square metres.

The economic model of the agricultural system (greenhouse and plots at the foot of the building) has not yet been fully defined. Several hypotheses have been explored:

- The installation of an independent private farmer. In partnership with the Pays de la Loire Chamber of Agriculture, a project partner, a test of the production capacity of the tool and a profitability scenario have been developed. The conclusions are encouraging but still require adjustments, particularly in the functional link to the Nantes Nord district.
- The possibility of production by landlord's technicians was also discussed. In this hypothesis, the project led by social housing landlords (NMH) would aim to create at least one sustainable job (market gardener/grower) for the agricultural/horticultural aspect and one volunteer (Service Civic program) for the animation aspect.
- Social housing landlords (NMH) would also consider setting up training courses, particularly in micro-gardening, in order to upgrade the skills of some of these gardeners, who are currently in charge of maintaining the green spaces.

The animation and transmission of agricultural and food know-how to the inhabitants of the district, through numerous thematic workshops offered by associations in the district;

Source: BioTFull

Figure 45. Container garden at the foot of the building.

Reopening of Ruisseau des Renards: study phase

The project proposes to reopen the stream along most of its course in the Blaise Pascal Street. It is an important project in symbolic and environmental terms (biodiversity, alternative rainwater management) for the Boissière micro-district.

The Promenade des Renards underlines a useful functional link for this area (comfortable connection for high school students from the tram to the Chauvinière-Monge high school), but above all it draws a large east-west link from the Bout des Pavés/ route de Rennes to the Gesvres valley.

The reopening of the Renards stream is a strong gesture for the renewal of the Boissière, a return to the existing by reintegrating the stream into the hydrographic network in a visible way, breaking with the artificial and isolated geography of the large social housing estate.

Figure 46. Planned design of the Renard stream reopening.

A) Open part of the stream

B) Underground part of the stream

Figure 47. Current state of the Renard stream.

The development of the Ruisseau des Renards aims to re-open the watercourse in the part that is currently canalized. It also involves reshaping the banks to allow the development of a riparian vegetation. While guaranteeing the safety aspects, the shaping of the banks would provide possible access to the water.

Studies on this part of the project are still in progress.

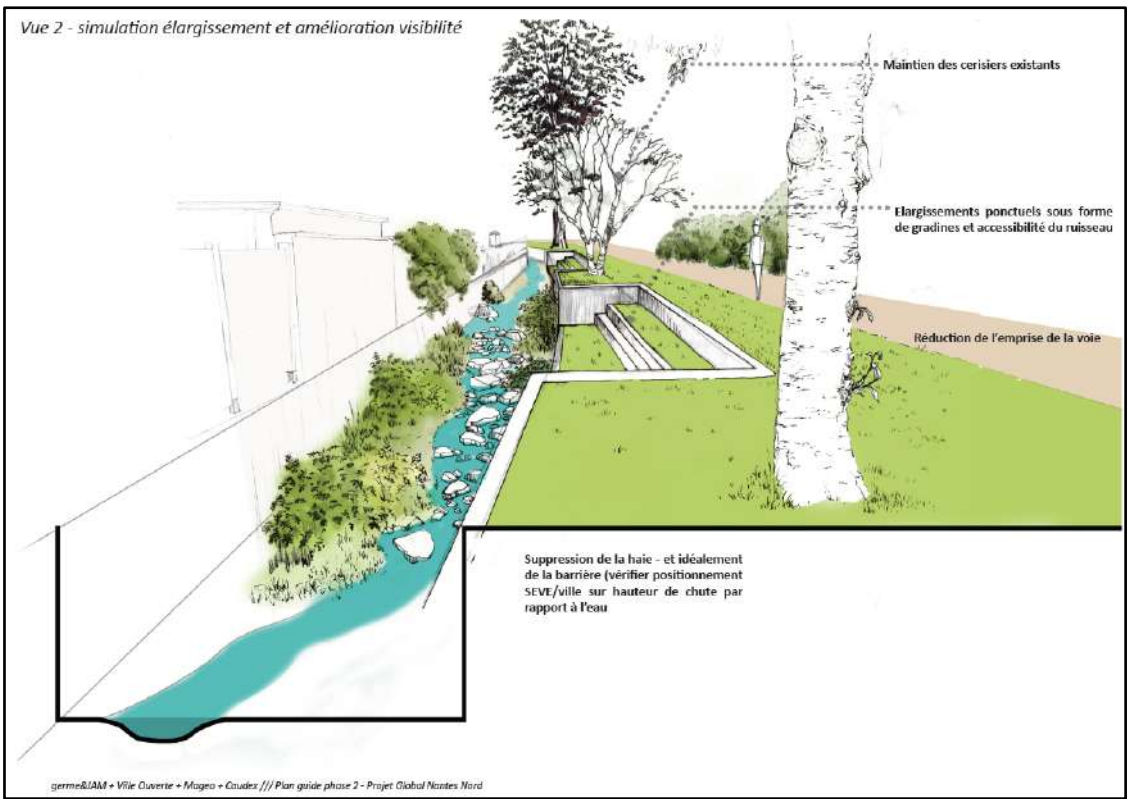


Figure 48. Design hypothesis for the Renards stream reopening.

Outdoor classroom for the secondary school Stendhal

Several technological NBSs have been proposed at Stendhal College. The outdoor pavilion had been selected by the teaching team to develop an outdoor classroom.

At present, however, there is some uncertainty about the final realisation of the project. The project is facing several difficulties:

- Need for planning permission
- Standards vs. experimental construction
- The college is managed by the Department and not the municipality. This requires longer administrative procedures

3. Conclusion

This document presented the urban plan of Nantes. At different spatial scales, it develops the different planning principles and urban design interventions involved in the construction of Nantes' healthy corridor, in line with the healthy corridor strategy.

The Nantes Nord global project, which is located on a wider perimeter and encompasses the healthy corridor, involves different deadlines and will take place in different timings. A numberof developmen ts have been planned, others are in the planning stages and others have been completed.

At this stage of the project, the planning principles, with for example the enhancement and conservation of the district's plant heritage, the development of urban agriculture in relation to the multiple health benefits are well defined and confirmed.

The various NBS projects are currently at different stages of progress. Some of them are very advanced, and it was even possible to present completed projects (playground in the Canada Park, Goedesic glasshouse). On the other hand, others are still at the design stage.

These different implementation deadlines can be explained not only by their length but also by the procedures required to implement them.

It should also be pointed out that the citizens' dialogue carried out during the preparation of the project sometimes leads to changes or enrichment of the programming.

The improvements already made are also the result of the citizen dialogue and meet the efficiency objective that is the project.

It is important to achieve the gradual implementation of the whole project and, where possible, already make a number of adjustments.

This corresponds to the desire to meet the needs of the inhabitants as quickly as possible and also to allow for a gradual appropriation of the planned developments.

This also allows users to begin to evaluate and thus to supplement or even correct the improvements made.

The implementation of the entire project for the transformation of the Nantes Nord district, which includes the Urbinat project, is a project that will take a long time to complete.

It is essential to support the inhabitants in a gradual transformation of their living area, in particular b y gradually implementing developments which, like the construction of the playground, meet their im mediate needs and constitute a real improvement in their living environment.

D2.4 Urban Plan Sofia

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The content of this report reflects only the authors' view and the European Commission is not responsible for any use that may be made of the information it contains.

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27.07	v05	B. Tsoneva and S. Novkov	Scheme amendments and translation of the document in ENG
28.07	v06	B. Tsoneva, Veneta Zlatinova and Velin Kirov	Scheme amendments and content of the document
29.07	v07	B. Tsoneva and Velin Kirov	Scheme amendments and content of the document
31.10	v08	B. Tsoneva	Amendments of the schemes related with the green corridor route
07.11	v09	Velin Kirov	Final review and proof-reading
21.11	V10	all	Some additions on the project development.

Fonts

Montserrat	by Julieta Ulanovsky
Source Sans Pro	by Paul D. Hunt

List of figures

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Part 4 - Sofia

1.Introduction to the intervention area

Urban context

The URBiNAT intervention area is located to the north of the city of Sofia and the south-eastern part of Nadezhda administrative district. The terrain is predominantly flat as the altitude varies between 530 – 550 m. The terrain displacement is insignificant and its level falls in the northern direction. Suhodolska River flows through its artificial canal-like river bed on the southern part of the territory, from west to east.

The housing estates occupy an area of 115,16 ha. They are represented by collective mid-rise (from 10 – 15 m height) and high-rise (over 15 m height) apartment buildings. The number of dwellings accounts for 17 069 and the number of their inhabitants reaches 37 770. Most of the buildings were built in the period between 50-80s.

Figure 1. Aerial view of the city and the study area.

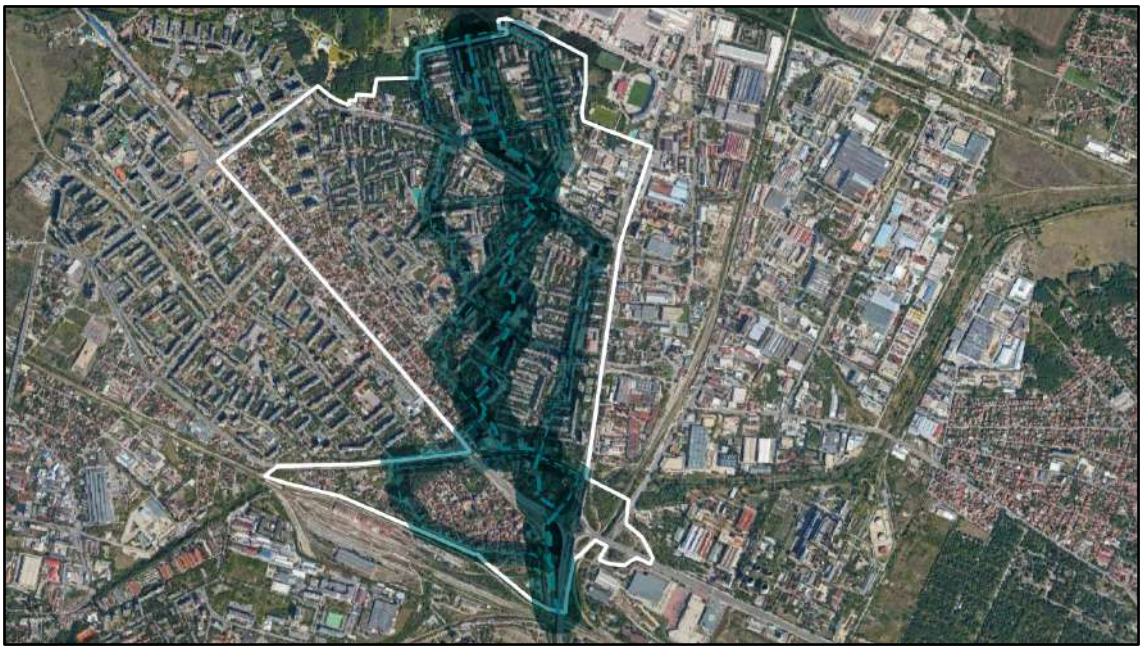


Figure 2. Aerial view of Nadezhda and the study area.

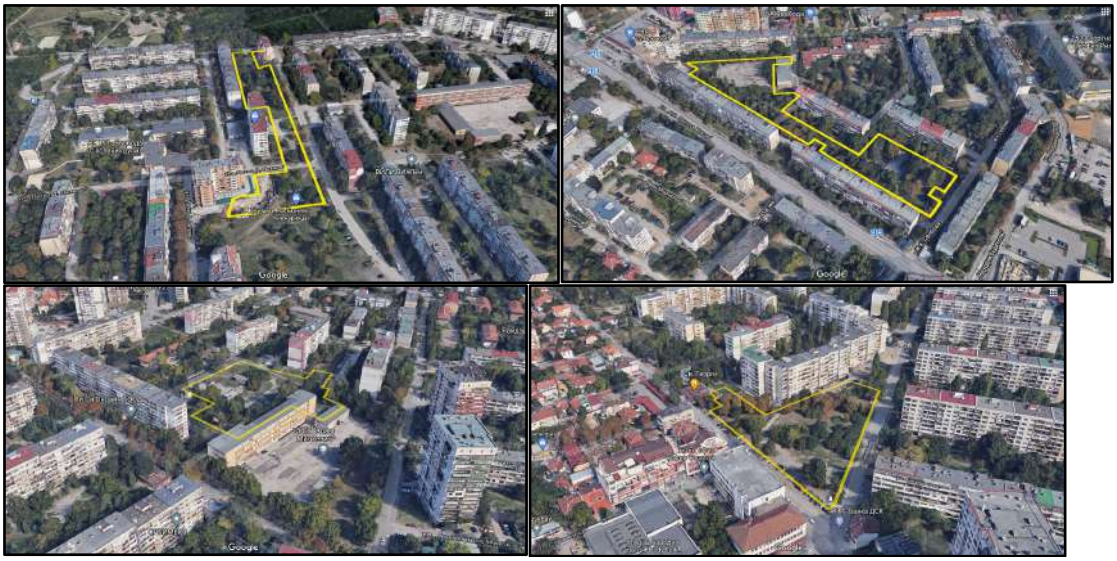


Figure 3. *Aerial views of Intervention zones*.

The intervention area and its integration on the city

Urban fragmentation, was identified at different levels:

. At the city level - although relatively close to the city center, the area is spatially isolated from the city centre and the whole southern part of the city due to the existing physical barriers such as railway lines, adjacent predominantly aread built up with warehouses (from south, east and north), multilevel junction (southeast of Nadezhda), and general lack of pedestrian friendly crossings.

. At the district level - Planned according to the concept of the microregion during the 1960-1980, the area nowadays suffers a major division due to the profile of boulevards (Lomsko shose, Rozhen and General Nikola Zhekov) and their inconvenient crossing leading to jaywalking at several points as well as scarce number of bridges providing the crossing of the corrected river bed of Suhodolska river.

. At the neighbourhood level - abundant interblock spaces which are pinched around block edges or next to high rise multifamily blocks of flats where parking space does not answer to the motorization rate. A much denser pedestrian network than the initially planned one responded to residents' diversified needs since the 1990s and searched for walking convenience. An increase of pedestrian flows between the neighbouring housing estates is now motivated by the diversity of services and personal motivations.

. Along the corridor axis - specific accumulation of all of the barriers mentioned above between park Nadezhda and Severen park and beyond, all of which are addressed by the concept of the route intended to link and bridge the divided parts through a walkable Healthy Corridor with four areas of intervention along its axis.

The site

The location of the specific interventions related to the co-implementation of the NBSs is in about 20 vacant lots provisioned by the plans as part of the green infrastructure and public spaces in the four residential estates, namely Lev Tolstoy, Nadezhda 2 and 4 and Svoboda. The 2,5 km long pedestrian axis of the Healthy corridor provides connection between North Park and park Nadezhda and integrates important available territorial resources related to the major themes of the URBiNAT project - mobility, energy, water and nature included in the implementation of the four zones of intervention.

Figure 4. A photo description of the Healthy Corridor in Sofia.

The Healthy Corridor in Sofia is a linear urban park with four areas of focused and thematic interventions and co-creation related to the URBiNAT thematic areas and a sequence of green spaces for active and passive recreation. The Healthy Corridor is a convenient, illuminated and a high quality urban green infrastructure that serves as a pedestrian connection between the two parks and stops of public transport, and is accessible to all groups of residents (children, adults, pensioners, people with disability, etc.).

The main concept of the interventions in the municipal plots is to create four different types of zones corresponding to the four main clusters of the NBS. Each of the zones is characterized by a passive and active subzone modeled after NBS - Urban Park. The passive zones are intended for family gatherings and recreation, and the active ones for outdoor games for all ages, sports activities and public events.

Description of the four intervention zones

The so-called **Green Assembly** zone is an underdeveloped and underused open public green space, located near some of the important pedestrian paths, public transport nodes, commercial, service and public buildings. It will be designed as an open green place welcoming formal and informal public events and activities, hosting the URBiNAT pavilion, social and solidarity economy events, and will demonstrate nature-based approaches towards design and maintenance of urban greenery.

The so-called **Aqua Vita** or (living water) zone is an underused space between a kindergarten and one of the largest schools in the district of Nadezhda where a natural source of underground thermal mineral water exists. Therefore, the intervention is thematically dedicated to the water. It will include three main spatial elements - an open classroom with a greenhouse in the schoolyard, a project for a public swimming pool with mineral water, and an open public space in between.

The so-called **Health Energy** zone is a wide green space enclosed between high-rising apartment buildings where a degraded savage playground and an abandoned building go along with social problems and crime. The aim of the intervention is to fight both physical and social degradation by attracting young and active people and engaging their energy in sports and encouraging healthy lifestyles.

The so-called **Co-Place** zone is an open space between the apartment buildings, recognized and appreciated by the local community. The aim of intervention is to strengthen the existing community and to activate participatory behaviour through the proposed new uses and facilities.

Needs

Based on the URBiNAT pillars inclusive urban regeneration, public space, nature, health and NBS marketable solutions, The Healthy Corridor in Nadezhda will focus on four specific objectives supported by different activities in meeting the identified needs during the co-diagnostic and co-design process: 1) Provide healthy and adaptive solutions in the neighbourhood; 2) Improve connections, access and porosity; 3) Cherish public space for all, diversify its use, and make it distinctive together; 4) Celebrate open space, provoke active life and fruitful community ties.

Along with the proposed opportunities for implementation of the main route and its connection with the green system, and the street network and public spaces on the territory, the preliminary urban project will be open and will be able to flexibly respond to changing natural and socio-economic conditions and community needs, as well as emerging ideas and innovative solutions, through changes in the set of functions, physical elements and modes of use.

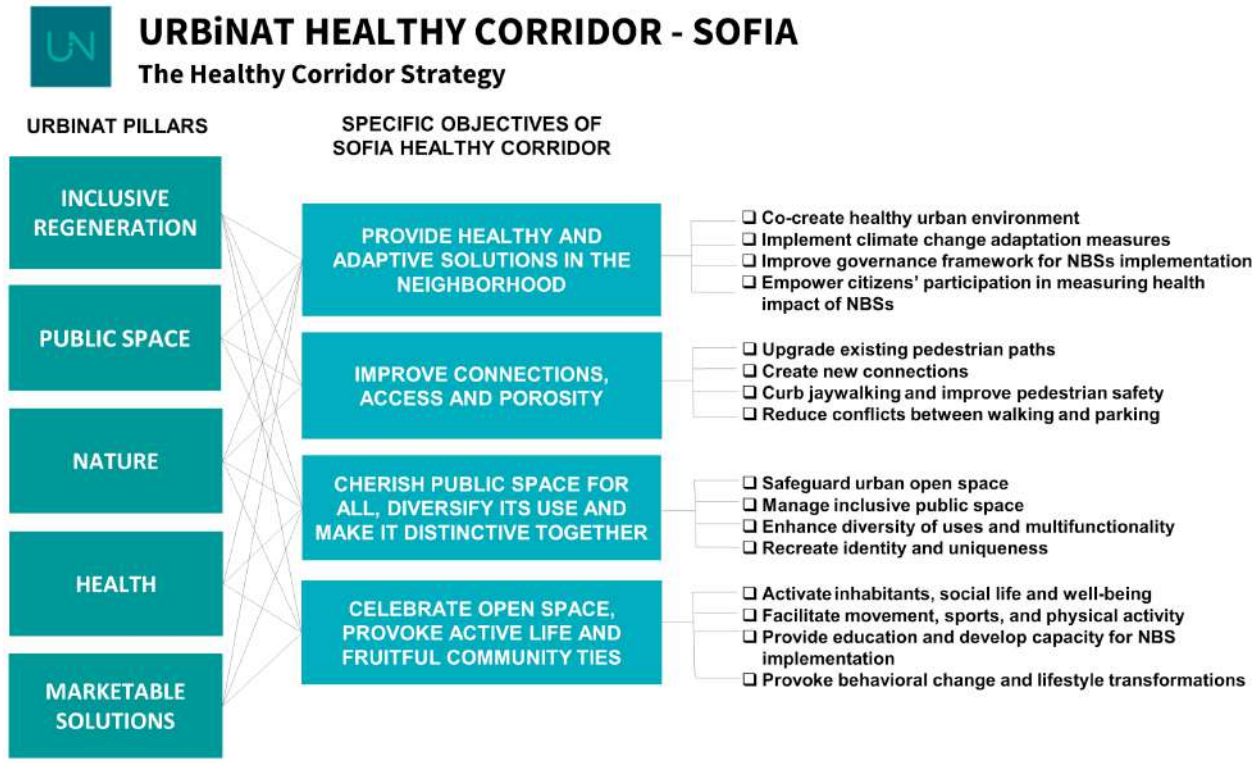


Figure 5.The Healthy Corridor Strategy. Specific objectives and measures related to the URBiNAT project pillars.

Expectations

The implementation of the planned co-creation activities and steps for Sofia Healthy Corridor will seek to achieve the following results:

. A functional spatial link between Park Nadezhda and Severen Park connecting a network of various NBSs, a socio-economic network uniting different communities and different possibilities for implementation of market-based potentials and synergies resulting from the application of the NBSs, an arena to change perceptions, attitudes, behavior, lifestyle and philosophy of life;

. Upgrading and achieving synergy with the activities already set in a number of planning documents, and expanding the territorial scope of the already started process of promoting the city as a "City for people" taking into account the investment initiatives implemented by Sofia Municipality;

. Reaching consensus and implementing innovations in public space management policy in the complex range of interests of different users and stakeholders;

. Establishing a process of inclusion of local communities in identifying and finding solutions to meet the diverse needs of communities and specific target groups in the neighborhoods of Triygylnika, Nadezhda 1, Nadezhda 2, Tolstoy and Svoboda through close cooperation with the local municipal authorities;

. Activating the pedestrian mobility as a key driver for urban regeneration;

. Improving the quality of public space, including development, maintenance, better accessibility for all citizens and providing opportunities for multifunctionality through tools offered by urban design, landscape architecture and architectural design;

. Development and establishment of a common, integrated and systematic model, which includes local actors and stakeholders from the city (NGOs, institutions, networks) in the process of co-creation of the Healthy Corridor in Sofia and implementation of the NBSs;

. Integrating new (business) models that make the active population, public goods and local capital sectors profitable.

Among the positive results that the project would like to achieve is the renovation of unused/ empty public spaces through the involvement of the local community, creating an interesting, accessible and diverse urban environment for sports, communications, knowledge exchange and entertainment of the local community.

In support of the area-based approach to urban regeneration, two main principles are applied: a) to provide actions that are expected to bring about a lasting improvement in the economic, physical, socio-cultural and environmental conditions of the area within; b) to combine diverse complementary NBSs in order to obtain synergetic effect and added-value within the defined timeframe and spatial planning framework. The concept integrates territorial and thematic approaches by introducing interventions to the four focus areas outlined by the findings from the multicriterial analysis performed during the local diagnostics stage. The four themes Co-place, Health Energy, Aqua Vita, and Green Assembly address the topics of the URBiNAT project and brand the uniqueness of each one of them.

The urban project of the Sofia Healthy Corridor focuses on building green connections, understandings, co-implementation and use of public spaces. The involvement of citizens in the creation of living public spaces is expected to contribute to overcoming urban fragmentation by removing physical and symbolic barriers to their use, protection of the environment and maintenance of inter-block spaces.

2. Sofia Healthy corridor

2.1. Masterplan

The Healthy Corridor in Sofia is a "green connection" designed as a pedestrian path in the public urban space that connects the neighborhoods between themselves and the surrounding urban environment. It connects different NBSs developed through collaborative practices and included in the catalog, as well as solutions proposed by the citizens in the co-selection process. In this way, the focus is on the quality of life of citizens in relation to energy, water, food, nature, mobility, participation, behavior change, digital democracy, social cohesion and the solidarity economy. The Healthy Corridor is planned and will be built by testing an innovative and inclusive methodology for renovation of the selected peripheral neighborhoods. The creation of the Healthy Corridor in Sofia through NBSs implementation will take place through creative thinking.

The implementation of the Healthy Corridor in Sofia will focus mainly on public works, placing movable objects in public space and the development of green areas along the corridor - planting of new vegetation and care for the soil and grass cover is foreseen.

The main opportunity is the implementation of major improvements in the large green open public space such as public works, playgrounds and social spaces that can help the area to overcome its long restructuring both in environmental and social-economic terms. Furthermore, stimulation of participatory culture and solidarity networks can have a synergistic effect when combined with the physical improvements based on the self-confidence of the inhabitants and their attachment with the place.

Aims and objectives

The main project aim is to improve the urban environment by building a **Healthy Corridor - a large-scale, nature-based innovative structure that integrates “physical” and “soft” measures to ensure sustainability and mobilize actors and resources to achieve social cohesion**.

Sofia Healthy Corridor encompasses parts from "Tolstoy", "Svoboda", "Nadezhda 2" between Nadezhda junction, Nadezhda Park and North Park, where all mandatory elements and requirements of the project can be applied. The aim is to provide a pedestrian connection between Nadezhda Park and North Park.

Interventions will focus on the innovative use of public space, creating together with citizens new urban, social and nature-based relationships in and between different neighborhoods.

Sofia Healthy Corridor includes an alley with four intervention zones: Co-place; Health Energy; Aqua Vita and Green Assembly, including the following subprojects: green amphitheater, forest of local species and places for social contacts and rest; greenhouse; places for social contacts and sports; new playgrounds; sports ground and place for cultural and social events; eco-parking and urban park - active and passive zone.

The project will fulfill the following main tasks:

. Development and application of innovative landscape solutions to create an individual look of the individual park elements and functional areas;

. Renovation of the urban environment through construction of green spaces, introduction of new vegetation in the existing green areas and etc.;

. Improvement of the accessibility through elements of the pavement or other facilities in the park environment;

. Building up a modern and attractive urban environment that provides the use of innovative materials and landscaping systems close to the natural ones;

. Security and safety improvement in the areas;

The following requirements are set for the design and construction of the Healthy Corridor:

. envisage interesting compositional solutions, using all the techniques of park art and modern technologies, the planting of groups of ornamental plants, considering the species composition with an interesting seasonal color;

. take into account the vegetation with the soil and climatic conditions of the place, preferring traditional ornamental species, mainly of local origin. The predominant species should be deciduous, without completely excluding coniferous and evergreen deciduous. The newly designed vegetation should be mainly drought-resistant, not requiring additional irrigation;

. provide efficient materials, reducing the costs of maintaining green areas and assuming proper technological implementation (root limiters, drainage fractions, etc.);

. envisage the functional zoning and area distribution with a clear organization of use of the territory;

. offer an interesting architectural and design solution for the group with public service functions, in accordance with its location in a green urban environment;

. study the possibility for construction of irrigation boreholes and the maximum use of rainwater. The detailed research and inspection should be in compliance with the latest modern technologies for irrigation in accordance with legal regulations, as well as with the various modern ways of managing the irrigation process. This will suggest **new solutions for control, monitoring and operation of the irrigation system**. Consideration of the existing and newly constructed underground communication and anticipation of conflict-free passages (by placing the necessary casing steel pipes) and connection of the irrigation system.

. design and build drilling wells for irrigation purposes along the route of the corridor;

. provide feathers for planting new vegetation, application of humus, leveling, grassing and other activities accompanying landscaping;

. set measures and activities for ensuring accessibility of the environment in compliance with the requirements of the current legislation;

. envisage the use of highly efficient materials, equipment, technologies to ensure efficient and trouble-free construction, operation, maintenance and repair - pavements, alley network, park development, architectural elements - light coatings, fences, sheds, pergolas, places for short-term rest and others;

. offer appropriate park furniture /benches, pergolas, waste bins/ and **large vegetation**;

. preserve the existing plants - forests and shrubs, single trees and shrubs, providing activities for their aesthetic design and improvement of their structure and health;

. ensure fast and high-quality drainage of the alley network;

. observe a natural style, close to nature, which fits well into the existing environment;

. park lighting with excellent design and extremely high technical characteristics, high energy efficiency and long-life cycle.

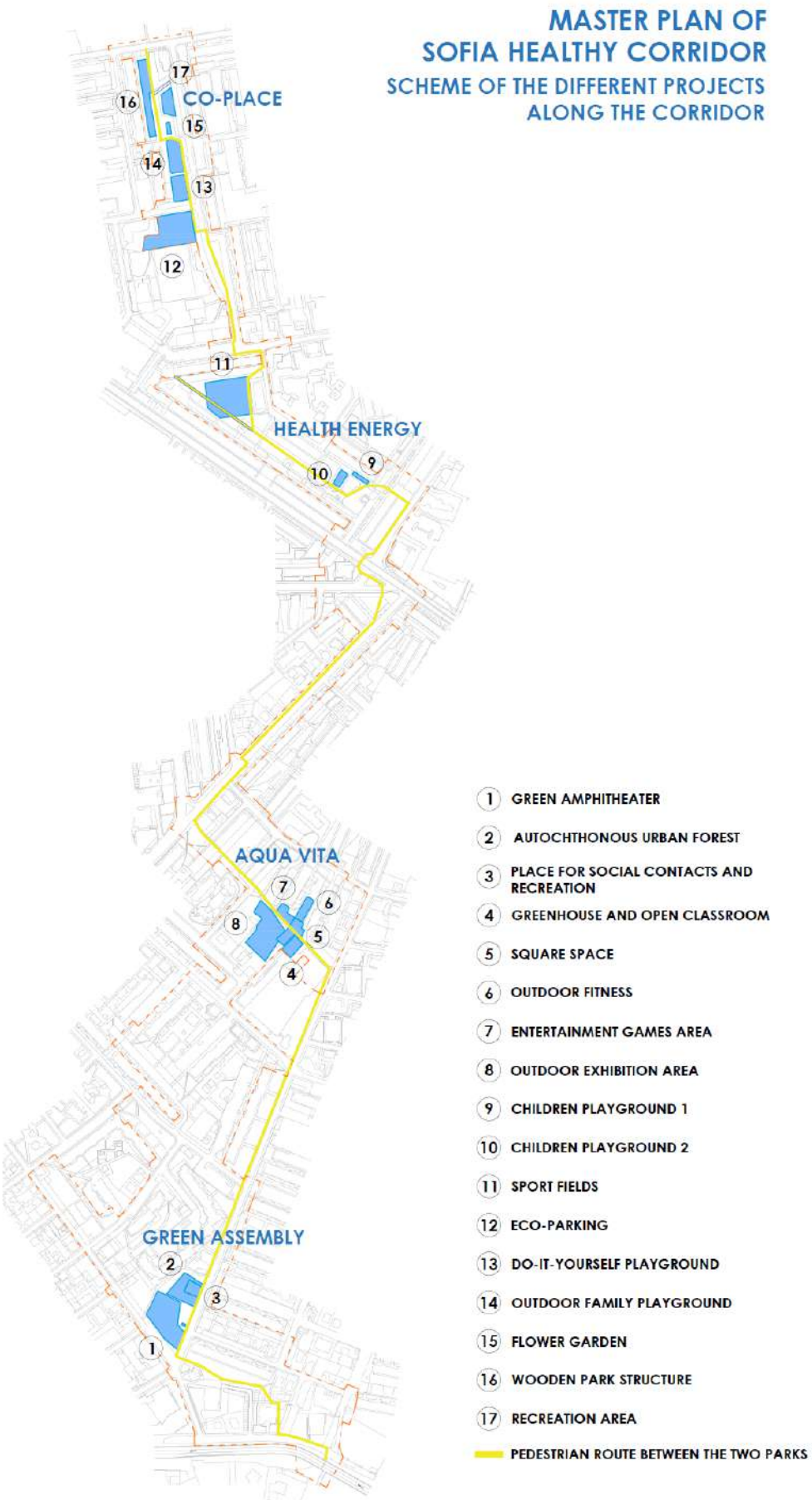


Figure 6. Masterplan of Sofia Healthy Corridor.

Thematic zones for focused intervention (Short descriptions of the four areas)

Green Assembly - The zone is located near the beginning of the Healthy Corridor.
Subprojects: Green amphitheater, forest of local species and places for social contacts and rest

The area is located near the beginning of the Healthy Corridor near the commercial center, metro station, cultural center, local post office and the park of "Nadezha". The vast green space is open to public access, easily accessible and currently underused. Planned interventions aim at creating an open, vibrant and green public space with possibilities to accommodate multiple functions and to serve both as a place for social interactions and as a small public square. It will also be the communication point for the URBiNAT project. The Green Assembly zone will be a connector for the cultural and solidarity institutions and initiatives.

Aqua Vita
Subprojects: Square space, outdoor fitness, entertainment games area, outdoor exhibition area

The area is located between a secondary school, a kindergarten, a children playground and a major pedestrian route, connecting two main streets passes through it. It is also easily accessible from the nearby inner-block green spaces. The plan upgrades and develops the existing pedestrian routes. A small public square is planned at the intersection of the two routes (north-south and east-west) and a large multifunctional public space that will serve as a rest place, playground, exhibition area. The Aqua Vita zone with the open classroom and the swimming pool will attract and connect the schools and kindergartens located near the Green Healthy Corridor.

Health Energy
Subprojects: playgrounds and sports fields

The existing playground is a popular spot for local families with children who are its main users. Nevertheless, the current facilities can benefit tremendously from an upgrade that will focus on creative spatial solutions to inspire children to develop a sense of care for the environment through interaction with natural materials.

The other major addition in this area of intervention will be a sports field suitable for different kinds of games. There is a pre-existing footprint that will be utilised as a starting point of the design. Unlike the playground, the field is currently out of use and is plagued by public perceptions of danger and criminal activities.This zone will be the focal point of the outdoor sports and recreation activities connecting young generations,

Co-place
subprojects:Eco-parking, do-it-yourself playground, outdoor family playground, flower garden, wooden structure and recreation area

The place is neat, communicative and easily accessible and is a series of inner gardens with asphalt pavement in good condition. The area offers great opportunities for situating the subprojects so as to make optimal use of the features of both the landscape and the sunshine. The Co-Place zone will connect the neighbours to the place they see from their windows and focus on social engagement and connectedness.

Additional points of small intervention - in the kindergarten in Nadezhda 4 - "Vesa Paspaleeva" where a new tasty garden is created as a prototype of URBiNAT project, flower beds and soil were purchased.

2.2 Thematic Analysis

Sun-lighting and shading of the zones

Green Assembly Zone

The zone is located near the beginning of the Healthy Corridor. After passing through several inter-block spaces, the Corridor touches a spacious open green area with the character of a meadow. In its southern part the green area is open and sunny all day, while in the central and northern part there are two groups of low trees - mostly wild plums and ash trees.

Figure 7. Plan and picture of the place for the green assembly zone.

Both groups are passable, but at the same time create enough shade throughout the day - especially on hot summer days when shade is desired.

All three subprojects are located in a way that the sun exposure and shading of the area can be used as advantages.

Of course, the amphitheater will be a hotspot on hot summer afternoons, but most of its performances on stage will take place in the morning or evening, when the sun will provide good natural light, strong but soft.

The forest of native species, on the other hand, will become increasingly dense and shady, but with sustainable maintenance it will retain its passable character without turning into a bush. At the same time (like a real forest) it will give coolness in the heat, a testament in the windy days and a small green oasis among the panel landscape all year round.

The place for social contacts and rest will combine the two possibilities - the proximity to a small forest of native species, and the freedom of open green space. The multi-layered meaning of the term social contacts allows the natural resources to be used more fully with minimal intervention in the landscape through the implementation of nature-based solutions.

The two streets that run along the area are busy, and Republika Street can be described as very busy, especially during peak hours. In order to create a certain isolation and intimacy of the area, it should be considered and proposed to build a kind of green barriers to reduce the negative effects of traffic without creating real barriers.

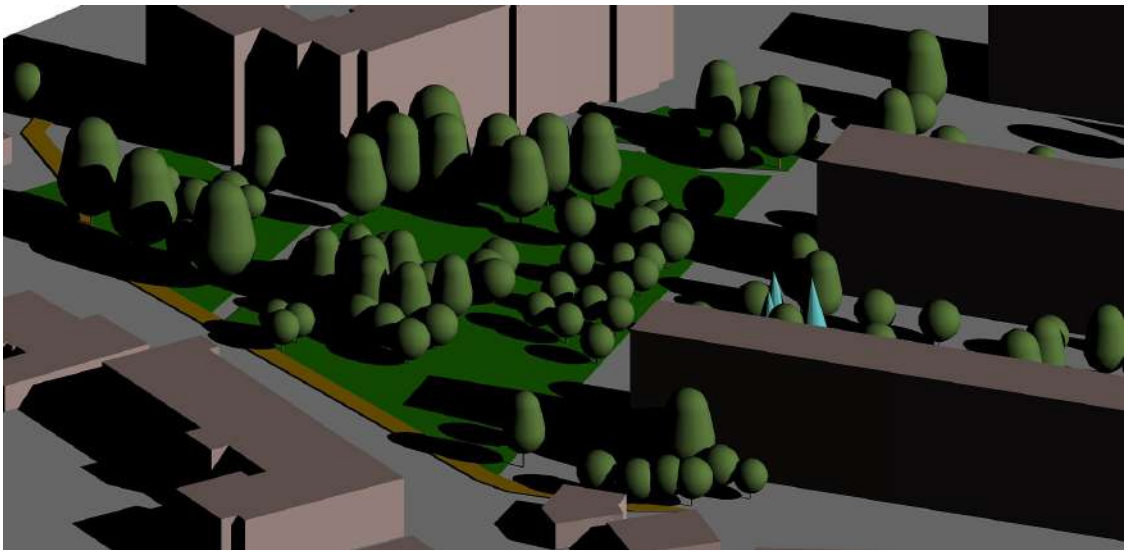


Figure 8. Sun-lighting and shading in the morning.

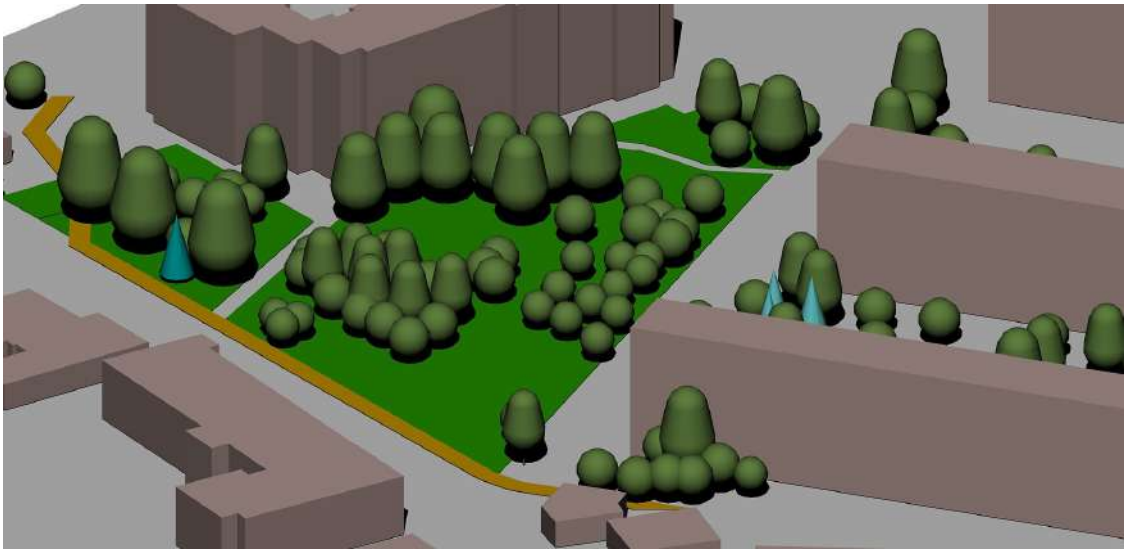


Figure 9. Sun-lighting and shading at noon.

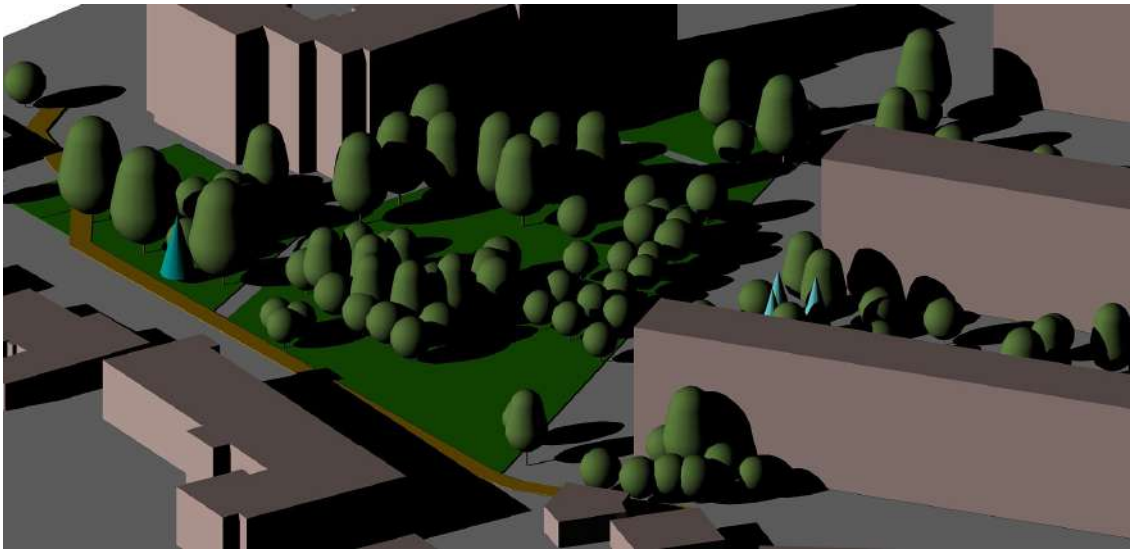


Figure 10. Sun-lighting and shading in the evening.

Aqua Vita Zone

Figure 11. Plan and picture of the place for the aqua vita zone.

Much of the area is sunny and bright, and in the summer months it is hot, with shade only in the morning thanks to the tall trees growing along the school fence. Combined with asphalt pavement, the direct sun reduces the opportunities for active park recreation and creates more prerequisites for the location of the square space, outdoor exhibition area, meeting places for locals in a kind of interactive workshops.

Such elements of the park environment in the neighborhood are completely absent, and this is a very good location for them - the area is located in the middle of the residential neighborhood and is accessible from all directions. It is worth noting that some of the best examples of outdoor exhibition areas in Sofia are in such open sunny places.

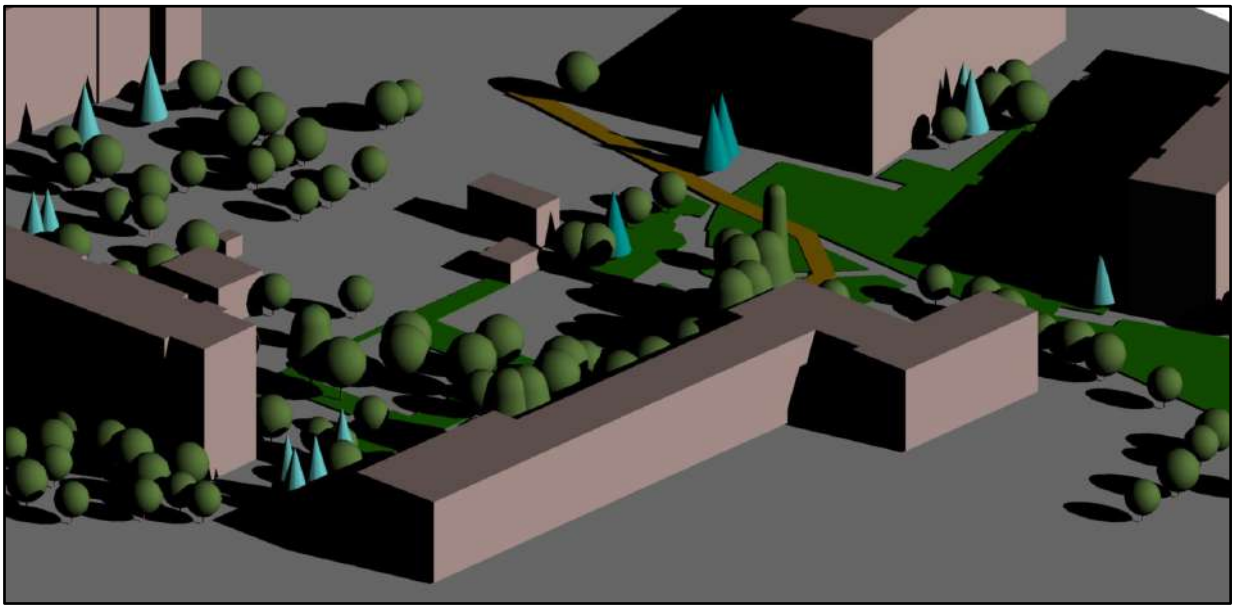


Figure 12. Sun-lighting and shading in the morning.

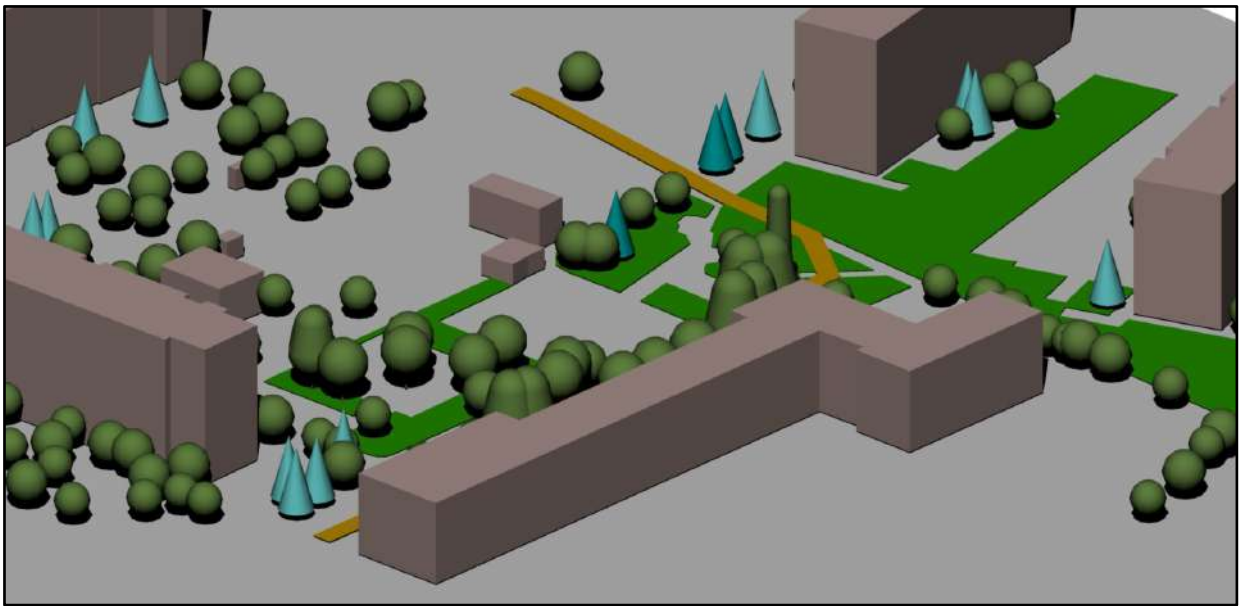
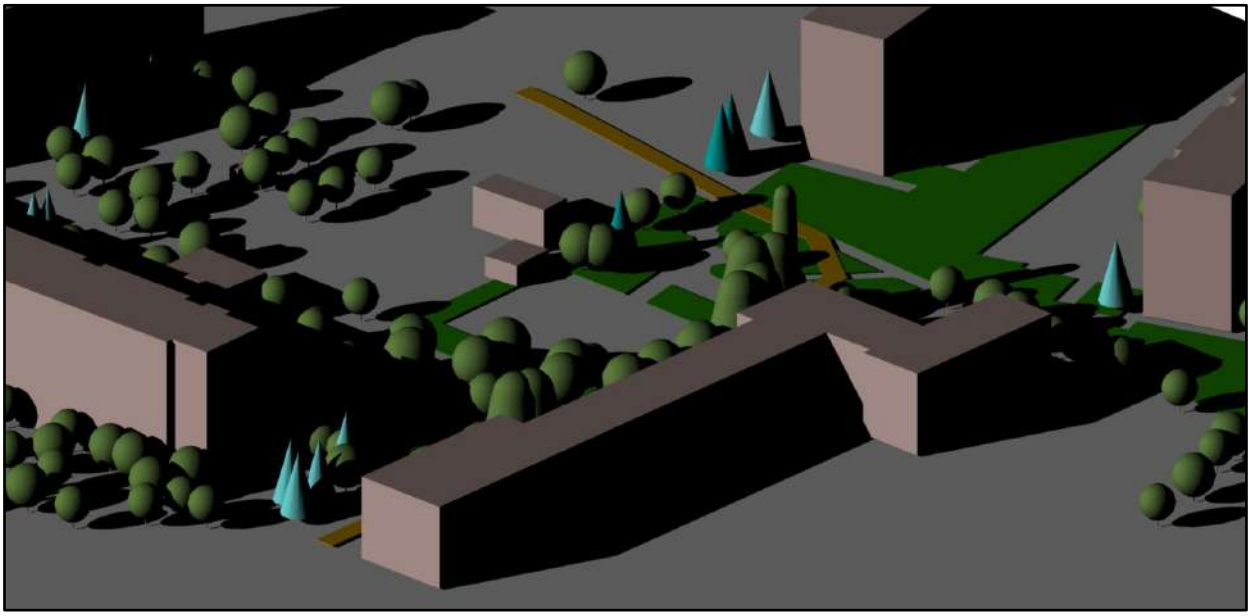


Figure 13. Sun-lighting and shading at noon.



Sun-lighting and shading in the evening

Health Energy Zone

There are many trees in the area, and around the playground they are small, young and mostly self-settled, while in the rest they are larger, older and planted as part of the park development of the neighborhood.

Due to the presence of so many trees, the whole area is shady and, in some places, even swampy. There are bright and sunny places only during the cold months of the year, when the trees are leafless. So, in the hot months, when sunshine can be dangerous, there is shade and vice versa - the rest of the time, when sunshine is desired, it is bright.

Figure 14. Plans and pictures of the place for the health energy zone.

In this part of the area there are trees mainly along the contour of the fence of the playground. These trees are self-settled and, although young and healthy, do not have much aesthetic value. It is recommended to prune these trees and embody them in a new protective fence, and if this is not possible, remove them.

Children's playgrounds

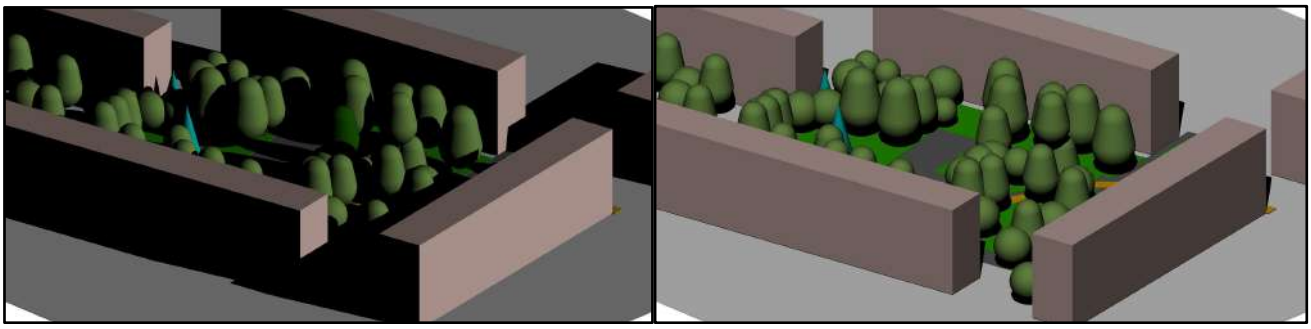


Figure 15. Sun-lighting and shading in the morning and at noon.

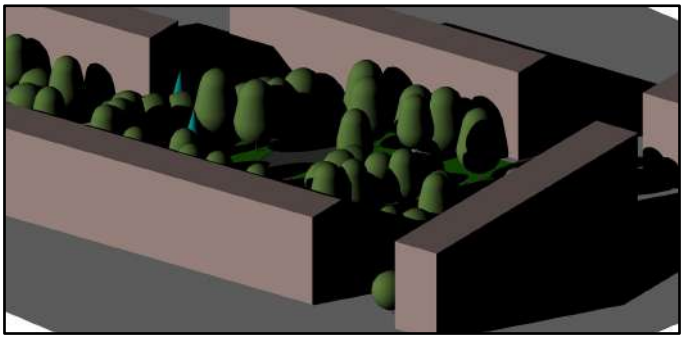


Figure 16. Sun-lighting and shading in the evening.

Sports playground

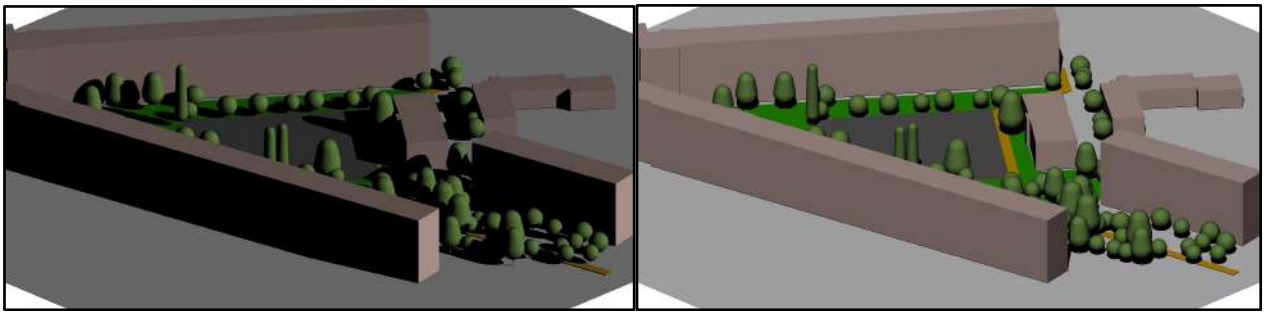


Figure 17. Sun-lighting and shading in the morning and at noon.

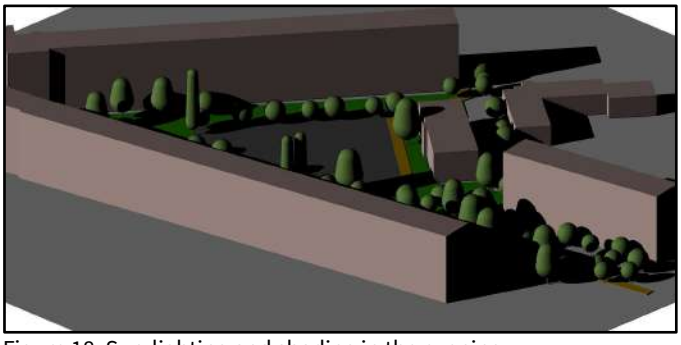


Figure 18. Sun-lighting and shading in the evening.

Co-place Zone

In terms of sunshine, the area offers a dynamic environment, with more sunny, shady and mixed areas. The sub-objects in the area are located linearly one after the other in the north-south direction, as in the southern and sunnier part there are two playgrounds, and in the northern and more shady part there are places for recreation and a flower garden.

Figure 19. Plan and picture of the place for the co-place zone.

Here is one of the few places along the Healthy Corridor, where direct sunlight and shade are in optimal balance. The existing deciduous trees create enough shade without forming dense and closed plantations, and between them there are open meadows that are sunny but not hot. On the other hand, during the winter months, when the trees are without leaves, the area is bright and cozy enough and suitable for short-term recreation and walks.

In this sense, intervention in the available woody vegetation is necessary only with regard to the removal of dry branches from the safety point of view.

The surrounding residential buildings are located so as to protect the area from strong winds and create a calm and friendly park environment.

Here is the end of the Healthy Corridor and north of it begins the wooded shady part of North Park. As a culmination of a picturesque and winding route between the inter-block spaces, this area is a kind of transition from the more urban environment of the residential area to the wooded nature of the extensive park plantations.

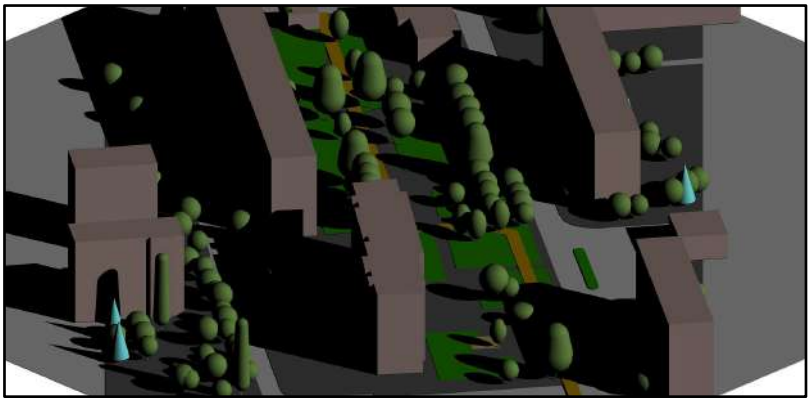


Figure 20. Sun-lighting and shading in the morning.

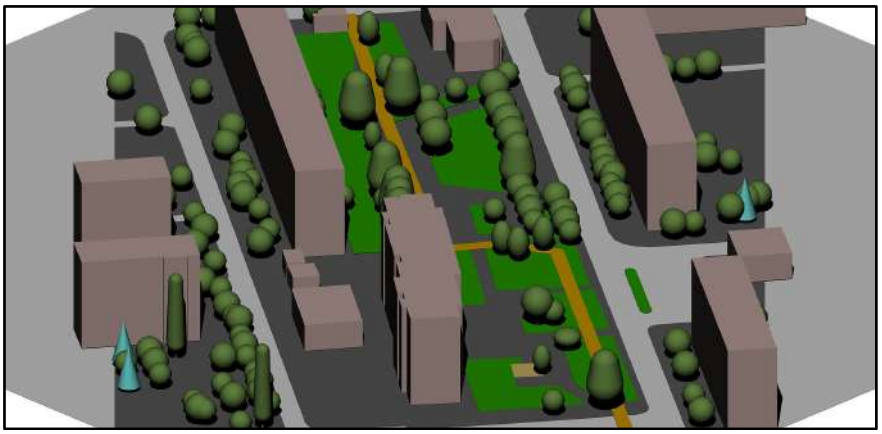


Figure 21. Sun-lighting and shading at noon.

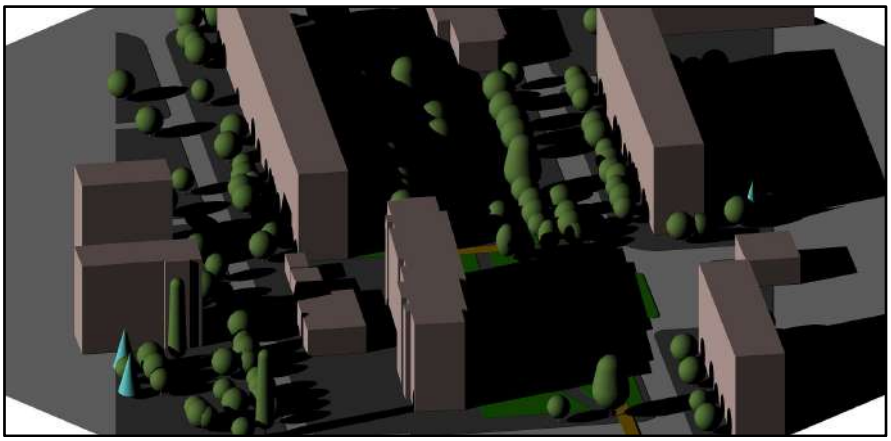


Figure 22. Sun-lighting and shading in the evening.

The green area designated for parking is small and open, with several self-contained low trees of fruit species, which during the implementation of the project do not need to be preserved at any cost, as they do not have a special decorative value.

The place has the character of a sunny meadow and is located at an inner crossroads between large apartment blocks. Here the direct sunshine is abundant and year-round, as the existing trees provide very little shade - which will make the parking lot unattractive during the summer months. The available trees create an atmosphere of a neglected orchard, and to achieve a representative character of the subproject it is necessary to rely on more exciting woody vegetation and greenery in general.

Figure 23. Plan and picture of the place for the co-place zone.

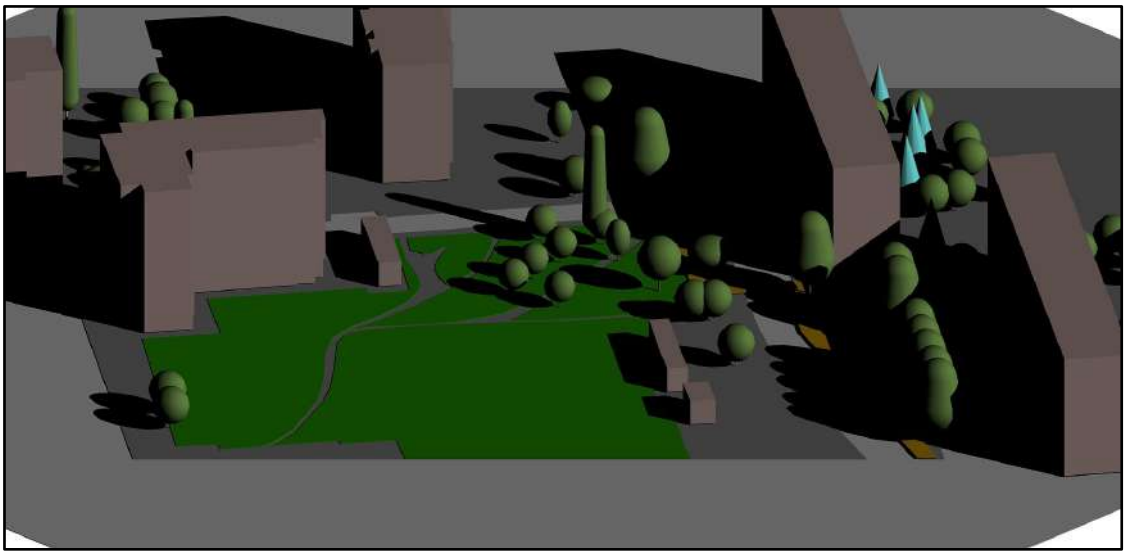


Figure 24. Sun-lighting and shading in the morning.

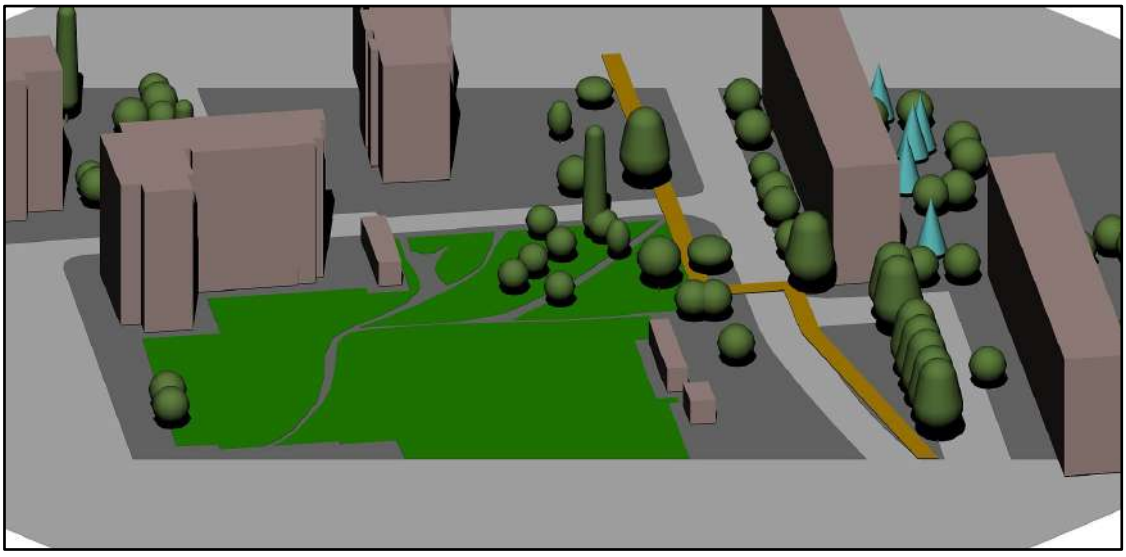


Figure 25. Sun-lighting and shading at noon.

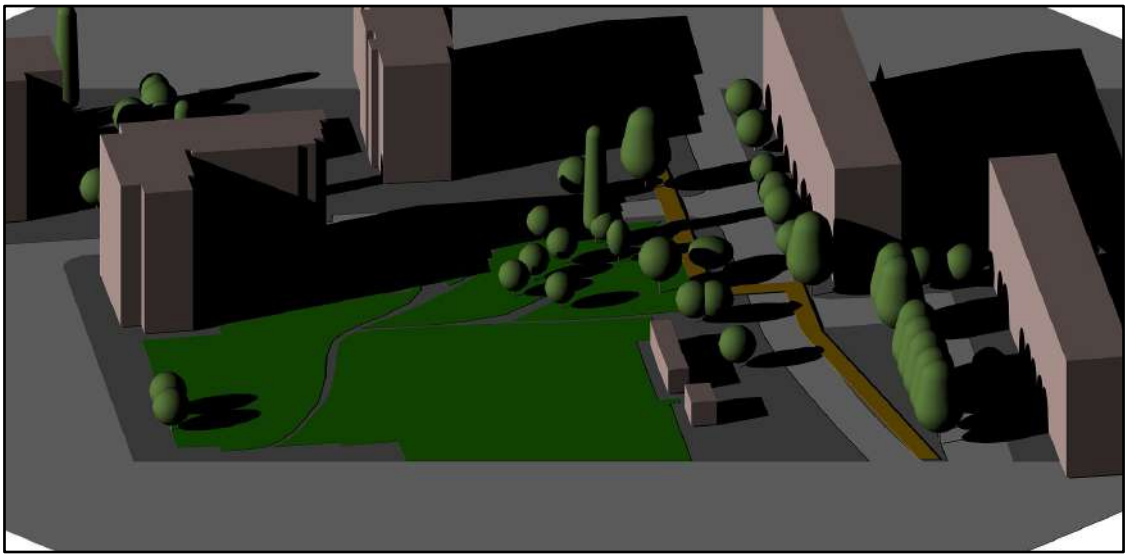


Figure 26. Sun-lighting and shading in the evening.

Pedestrian network - entire corridor

The pedestrian paths and open spaces vary in terms of actual and planned significance and use. Most often there are narrow streets and informal unpaved paths as well as inter-block vacant and partially underutilized lots.

Among the main constraints are the poor pedestrian connectivity and contested spaces due to high motorization rate and density of occupation as well as many abandoned, marginalized and unattended plots.

The Healthy Corridor will try to become a "green connection" designed as a pedestrian path in the public urban space, which connects the neighborhoods between them and the surrounding urban fabric. It connects various NBS developed by the project partners and proposed in the catalog, as well as supplemented by proposals from citizens.

The main opportunity is the implementation of major improvements in the large green open public space such as public works, playgrounds and social spaces that can help the area to overcome its long restructuring both in environmental and social-economic terms. Furthermore, stimulation of participatory culture and solidarity networks can have a synergistic effect when combined with the physical improvements based on the self-confidence of the inhabitants and their attachment with the place.

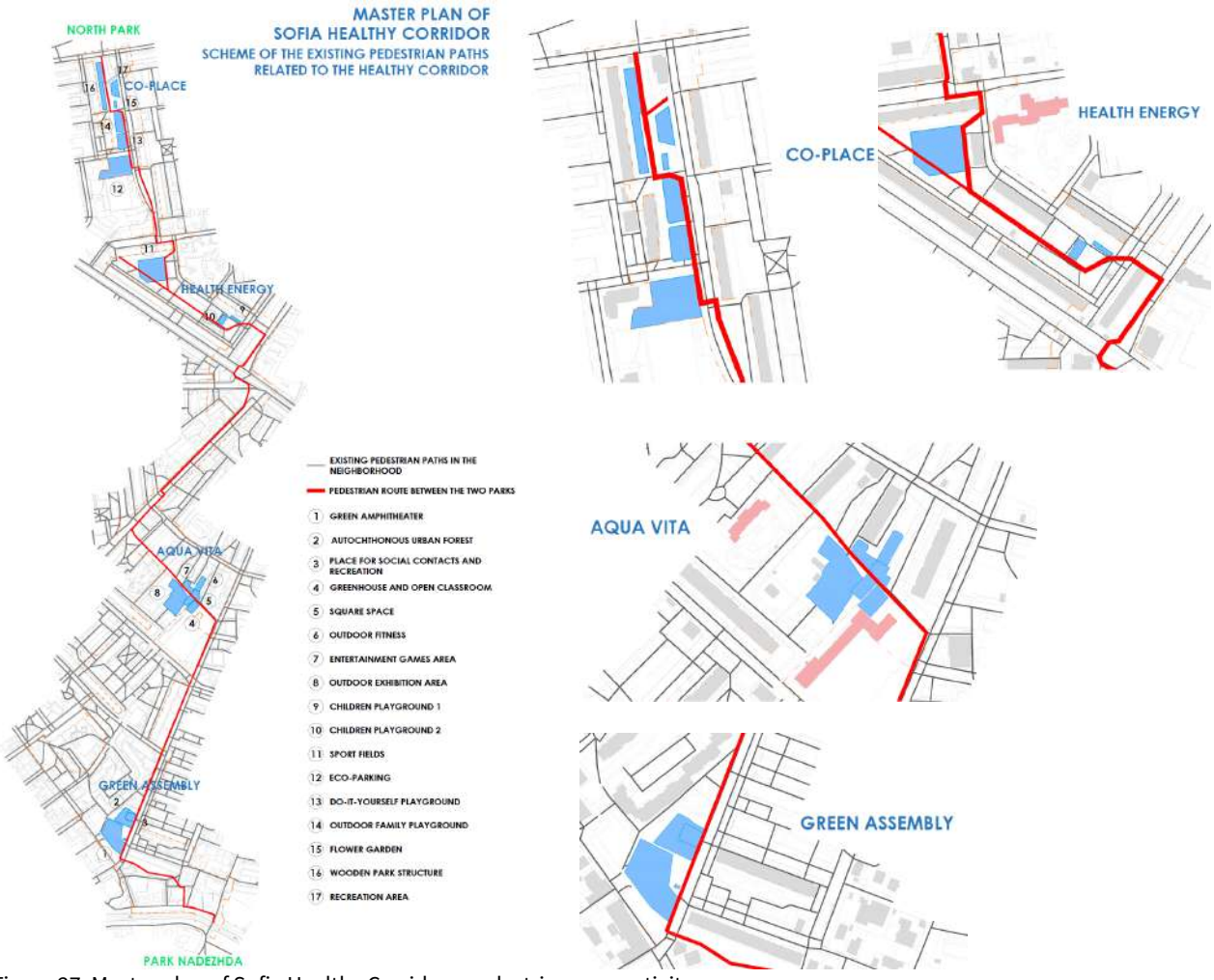


Figure 27. Master plan of Sofia Healthy Corridor - pedestrian connectivity.

Vegetation and irrigation

Vegetation

There are no preserved natural forests or spontaneous plantations of local species in the green parts of the project area. All available trees are planted over the years as part of landscaping activities - during the construction of residential complexes, streets and parks.

Most of the trees show good growth and relatively good health, although signs of deteriorating health begin to be seen atypically at an early age - probably in response to the reduced quality of environmental conditions. Often trees aged 30-40 already have a significant percentage of dry ends, stem wounds, hollows and frostbite - and at the same time there is a weaker foliage and early onset of deciduous trees. Insect damage is observed on the leaves, and fruiting bodies of fungi can be seen on the branches and stem.

The species composition of the tree-shrub vegetation is rich and diverse, composed of classic park species and modern varieties. There are more than 200 species of trees and shrubs in the developed area, including evergreen and deciduous and coniferous. There are both plants typical of the Bulgarian flora and popular European species. Representatives from all regions of the temperate zone can also be seen, and there are some exotic plants in the parks. The trees are planted in massifs and groups (in green areas) and in rows (along the streets), forming pure and mixed plantations with relatively high phytosanitary assessment and relatively sustainable development.

Study area is linear with a length less than 2.5 km and a width between 10 and 50 meters depending on the particular portion. A greater proportion of the trees are located in green areas and little trees are part of the street stands.

Most trees are typical ornamental park species and most of them were probably planted at the park development and public works. Only a small part of the trees - mostly of pioneer species - seem out of place and have probably settled themselves.

About 127 trees are in very good condition which is about 1/3 of all examined trees. There are 111 trees in good condition and 126 trees in average condition. Only 5 are described as bad (dried)trees.

There are 5 species of evergreen trees and 31 species of deciduous trees, represented by 19 and 350 specimens, respectively. Almost all trees are mature (between 15 and 50 years, and some of them more), with well-formed crowns with a typical common habit and structure of the species. The height of the trees varies between 4 and 20 m, with most trees in the range of 9 - 12 m.

Although many specimens show dry branches, stem rot, bare bark and traces of cut off main branches, the trees are generally in relatively good health. There are only 5 trees that have withered or are at a very advanced stage of desiccation. Another 42 trees have serious signs of deteriorated health, and all other trees can be defined as completely healthy or relatively healthy within reasonable limits.

The trees look fresh, healthy, vibrant and powerful, forming a specific (and strong) green appearance of the urban landscape along the Healthy corridor. In some sections the trees predominate as a component of the urban environment and dominate the local landscape.

Figure 28. Ailanthus glandulosa, Betula pendula and Prunus cerasifera.

Figure 29. Populus, Morus alba, Prunus cerasifera, Juglans regia.

Figure 30. Fraxinus americana and Fraxinus oxycarpa.

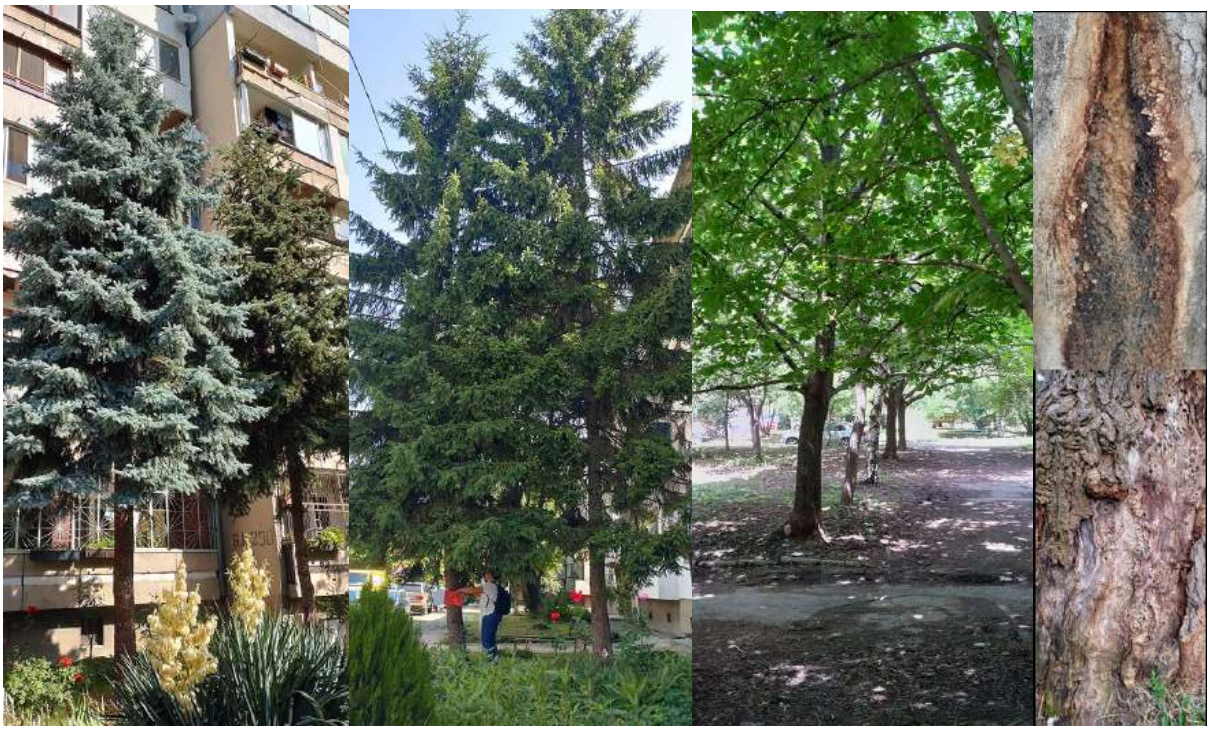


Figure 31. Picea pungens, Picea abies, Acer platanoides, Catalpa bignonioides and Betula pendula, tree trunks of Aesculus hippocastanum and Morus alba.

It is noteworthy that the trees in the neighborhood consist primarily of durable and sustainable communities. Typical aggressive pioneer species such as poplar, mountain ash, yarrow, white acacia and others here are presented quite modestly. However, the so-called native species have a scarce presence - and this is primarily due to the Polish ash. Not a single summer oak, cer, hornbeam, field maple, breccia, mekish or mistletoe can be seen throughout the site.

Also, it is interesting that six species represent about 65% of all examined trees, as follows: juniper - 81, American ash - 37, Horse chestnut - 33, Field ash - 30, Acer platanoides - 29. and small-leaved linden - 28.

Generally speaking, the ten most widely represented species make up three quarters of all trees, as follows: juniper - 8, American ash - 37, Horse chestnut - 33, Field ash - 30, Acer platanoides - 29 and small-leaved linden - 28, silver-leaved linden - 13, silver spruce - 13, common walnut - 11 and white mulberry - 11.

Nine species of trees are presented with only one specimen: white fir, blue Douglas fir, eastern thuja, common maple, Lankaran albicans, cherry, Kaleria pear, common pear and white willow. It is worth mentioning that the pear tree (Pyrus calleryana) is an extremely rare farm tree, and its presence in the inter-block green area here is unique.

In reference to the forthcoming landscaping and public works on the implementation of the Healthy Corridor, several trees will inevitably have to be removed, while the vast majority of plantations will be preserved in their current form, skillfully fitting into the design decisions.

Sanitary pruning should be carried out on most trees in order to remove dry and dangerous branches. Emergency healing procedures should be carried out on some of the trees: treatment of wounds on the bark, treatment of wounds from cut branches, plastering and filling of hollows in the trunks, control of

pests on the leaves; treatment of diseases and infections; hoeing of the soil layer around the stems; feeding with mineral fertilizers, etc. For some of the trees it is necessary to carry out formative pruning in order to optimize the crown.

The selection of plant species with which to build sustainable plantations should be based on knowledge of environmental factors in the urban areas of Sofia. The living conditions of the plants in the city differ from the conditions in their natural habitat in the wild. There are many factors that may be limiting or well tolerated development of plant communities.

Typical local species

Figure 32. Quercus frainetto, Sorbus torminalis, Acer campestre, Pyrus communis.

Figure 33. Quercus robur, Tilia tomentosa, Syringa vulgaris, Acer tataricum.

Figure 34. Fraxnius ornus, Fraxinus angustifolia, Cotinus coggygria, Quercus cerris.

Typical Bulgarian species

Figure 35. Pinus peuce, Carpinus betulus,Aesculus hippocastanum, Pinus mugo.

Figure 36. Laurocerasus officinalis, Corylus colurna, Prunus mahaleb, Platanus orientalis.

Figure 37. Tamarix tetrandra, Taxus baccata, Juniperus sabina, Pinus nigra, Acer pseudoplatanus.

Foreign for the Bulgarian flora species
(With proven high adaptability in urban conditions.)

Figure 38. Liquidambar styraciflua, Taxodium distichum, Gymnocladus dioicus, Ginkgo biloba, Parrotia pérsica.

Figure 39. Gleditsia triacanthos var. Inermis, Zelkowa carpinifolia, Maclura pomifera, Koelreuteria paniculata.

Irrigation

Along the route of the Healthy Corridor, as well as in the areas of intervention, there is no mechanical irrigation system. The vegetation relies on the natural humidity, climatic conditions and the qualities of the soil and the atmospheric air.

Weather conditions

The climate in the Nadezhda district is identical to the so-called "Sofia climate" and its characteristics are determined by the influence of three main factors: solar radiation, air circulation and physical geography.

The climate of Sofia is temperate-continental and its features include relatively cold winters, cool springs, warm summers and mild autumns.

Winters in the city are cold and snowy, and in recent years the city has less and less snow - and the snow cover lasts for increasingly shorter periods of time. Summers in Sofia are warm and sunny. In summer,

the capital remains slightly cooler than the other parts of the country due to its higher altitude. Spring and autumn in Sofia are relatively short with variable and dynamic weather.

The average annual rainfall is about 580 l / m2, reaching its maximum in late spring and early summer. In the spring, the city of Sofia is characterized by thunderstorms, and in late spring there is sometimes hail.

Ecological conditions of the site

One of the factors for the air pollution in the city of Sofia is the location of the city in the Sofia valley. The valley is surrounded by high mountains, which reduce the possibility of self-cleaning of the atmosphere.

Soil sealing is another serious problem. The permanent covering of the soil with impermeable pavements leads to a violation of its structure and qualities. Apart from the deterioration of the soil - and in fact its elimination from the urban environment, the sealing of the soil with pavements takes a large part of the rainwater directly into the sewer, which disrupts the natural water cycle.

There are no serious industrial air pollutants in the developed area of Nadezhda district. The air quality in the area is largely determined by the saturation of the existing transport network, the use of solid and liquid fuels for heating, unregulated landfills, construction, and some small manufacturing enterprises, as far as they exist.

Air pollution reduces the quantity and quality of sunlight. At the same time, the deposition of urban dust on the leaves of plants impairs their basic physiological functions - photosynthesis, transpiration and respiration.

Soil characteristics of the site

The predominant soil type on the territory of Nadezhda region is leached smolniks. They are formed on poorly drained areas, where due to the higher humidity meadow and meadow-swamp vegetation has developed, which is the reason for the formation of a thick humus horizon. Smolniks are characterized by good fertility, especially in years with spring-summer drought, due to their heavy sandy-clay composition, which explains their greater water holding capacity.

Despite their heavy mechanical composition, resins have a high natural soil fertility, which should be preserved by improving their physical properties, most often by organic fertilization. Practices such as composting naturally enrich the beneficial chemical composition of soils, and fertilization with combined mineral fertilizers increases the content of digestible nitrogen and phosphorus compounds in the soil.

Requirements for the irrigation systems needed for the implementation of the project along the Healthy Corridor

Automated underground irrigation system with mineral water for the greenhouse in the school yard

The irrigation system is to be supplied from the mineral water supply system after cooling the water by diluting it with water from the water of the water supply and sewerage system. The system will be divided into appropriate irrigation circuits (zones). The duration of work of one watering will be in accordance with the type of vegetation.

Irrigation system for the other proposals in the intervention zones

Drilling wells for irrigation purposes will be designed and built along the Healthy Corridor. Two sub-sites have been identified where drilling is required - at the “Green Amphitheatre” subzone and at the “Ecoparking” subzone.

Built structures, pavements and urban furniture

Green Assembly Zone

Here the corridor touches a spacious open green area with the character of a meadow - in its southern part the green area is open, while in the central and northern part there are two dense groups of low trees.

The two streets that run along the area are busy, and Republika Street can be described as very busy, especially during peak hours. In order to create some shielding of the area, the construction of green belts of trees with noise and dust-deterrent properties should be considered, which would reduce the negative effect of traffic.

Figure 40. Pictures of places for the green assembly zone.

Most of the footpaths in the area are naturally traced by the residents of the neighborhood, and most of the existing pavements are asphalt. The existing park furniture is scarce, characterized by handmade tables and benches by the residents, as well as gazebos, pergolas and benches placed by the Municipal administration around the entrances of the apartment blocks.

Aqua Vita Zone

Here the corridor passes through a spacious open area, most of which is occupied by grass meadows, crossed by asphalt alleys and playgrounds. The place is sunny and easily accessible, close to major streets without going directly to them. The area borders both the school yard and a playground built with the help of the local community. There are several groups of trees in the whole territory, but in general the wood vegetation in the area is insufficient and located mainly on the periphery, represented by the scarce species composition, typical for Nadezhda district.

Figure 41. Pictures of places for the aqua vita zone.

Health Energy Zone

Playground subzone:

The place designated for playgrounds is situated in the contour of an existing asphalt playground, located between apartment blocks and surrounded by mature trees planted in the adjacent green areas.

The existing playground is equipped with depreciated and damaged children's equipment, mounted on old asphalt and partly on damaged rubber flooring. This not only creates discomfort for visitors, but is also dangerous for children playing. The playground has old and dangerous facilities with outdated concept and aesthetics.

Figure 42. Pictures of place for the playground subzone.

Figure 43. Picture of place for the playground subzone.

Subzone for sports ground:

The sports playground is a reconstruction on the site of a preexisting sports field, which is in poor condition - a neglected asphalt playground, surrounded by a half-destroyed rusty metal fence.
The place is sheltered, located between low-rise apartment buildings and surrounded by green areas, lushly overgrown with mature trees, including the fence.

There are many trees in this part of the Green Corridor - both along the contour of the fence and in the adjacent green areas. Those on the fence have self-accommodated and, if they cannot be incorporated in the new guardrail, must be removed.

Figure 44. Pictures of places for the sports ground subzone.

Co-place Zone

Eco-parking subzone:

The green area designated for parking is small and open, with several self-contained low trees of fruit species, which during the implementation of the project do not need to be preserved at any cost, as they are located chaotically and do not have much decorative value.

The place has the character of a sunny meadow and is located at a crossroads between streets from the east and north, a block of flats from the west and a spacious sports field from the south.

Figure 45. Pictures of places for the eco-parking subzone.

Subzone for active recreation:

The area is located between apartment blocks and has an open character with a plant frame of mature trees, but is poor in terms of park furniture. The place offers good opportunities for meeting more people in a quiet park environment.

Both green areas in the active recreation area are compact, surrounded by asphalt pavement and located in a place of active pedestrian traffic.

In this subzone a large part of the area is used for parking of the residents in the neighboring blocks, which is unacceptable and for this reason the project envisages the construction of an eco-parking nearby.

Figure 46. Pictures of places for the active recreation subzone.

Passive recreation subzone

The area is located in a quiet and richly arborated inter-block space with existing asphalt alleys and sites in very good condition, but with scarce furniture. Adjacent to the North Park and yet - tucked away among the apartment blocks, the place offers excellent conditions for creating cozy corners with a peaceful forest park atmosphere.

Figure 47. Pictures of places for the passive recreation subzone.

2.3. People places (area by area)

The construction of the route of the Healthy Corridor, as well as of all sites in the intervention zones must be carried out with maximum protection of green areas and nature in general, with less intrusive technologies and minimal, renewable intervention in the natural terrain. The use of binders (cement, silicones, adhesives) should be minimal and only where there is no natural substitute. The use of construction chemicals in general (outside of unavoidable activities and technologies) should be avoided.

Healthy corridor of Sofia

The approximate length of the main route of the Healthy Corridor is 2640 m and has an approximate area of 7920 m2, the width is 3 m. The planned route (alley) passes through green areas, existing sidewalks and streets.

For the construction of the route, appropriate pavements and lighting, marking, as well as appropriate information elements (signs and other elements containing information about the project, the route, the directions of movement, ensuring safety, etc.) will be provided. The type of pavement shall be in accordance with the location of the alleys, and shall require minimal maintenance.

The project will take into account the existing natural footpaths, which have become established over time and have proven their functionality.

Models for the blind, Braille information boards and tactile maps, etc. will be provided, as well as access for disadvantaged people to as many areas as possible.

In order to ensure conflict-free and safe pedestrian traffic along the entire Corridor, a Traffic Organization Plan will be prepared, which will be agreed with the relevant institutions responsible for traffic safety in the city.

Figure 48. Example simulations for the healthy corridor paths.

Figure 49. Urban concept diagram.

Green Assembly Zone

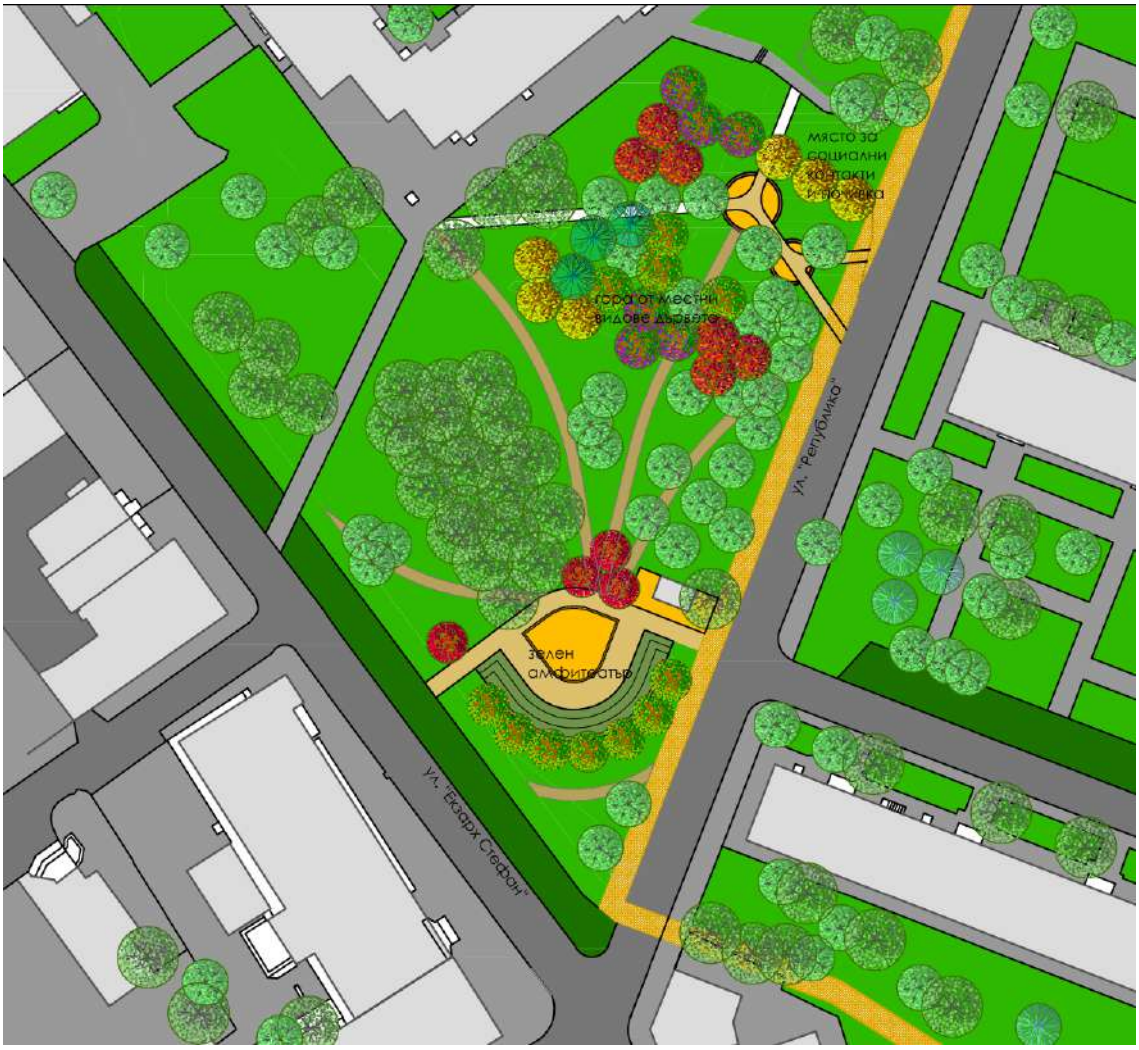


Figure 50. Plan for the green assembly zone.

Subzone Green amphitheatre and place for social contacts

Figure 51. Sections for the subzone of amphitheatre and place for social contacts.

Placing a green amphitheatre requires a wide and open space and therefore the facility is built in the open southern part of the area, being optimally away from the edge of the adjacent pavements, without entering the groups of trees.

Figure 52. Simulation of amphitheatre.

The green amphitheatre will be executed simply and minimalistically, with respect for nature, with suitable surrounding vegetation, by saving energy and minimal harmful emissions.

The amphitheatre is open and during its active use - morning or evening, the sun will give good natural light, providing strong but soft light. An additional shading structure is not recommended, which would complicate the design of the amphitheatre and turn it more into a building than a park element. However, trees can be planted on the periphery (especially on the streets).

Figure 53. Detail simulation of amphitheatre.

The place for social contacts is situated in the northern part of the zone and consists of two round platforms in which ecological seating places are built. The sites can be reached by four paths from the neighboring blocks and from the adjacent sidewalk. The paths are offered with an embankment of crushed stone, but they can also be paved paths on a grass joint.

The place for social contacts is based on the use of a minimum of means of expression and a minimum of input materials - only environmentally friendly - to achieve optimal results in creating a new urban park environment.

Figure 54. Simulation of place for social contacts.

The place for social contacts combines the possibilities of the small forest of local species and the freedom of the open green space. The multi-layered meaning of the term social contacts allows the natural resources to be used more fully with minimal intervention in the landscape through the implementation of environmentally friendly solutions.

Additional furniture with additional park furniture is allowed, without turning the place into a typical recreation area. Here we should look for originality in the design and a new approach to building materials - awareness of the power of stone and wood in the park furniture and extraction of optimal content from environmentally friendly materials.

Also, in order to enrich the furniture, the ideas of the people from the neighbourhood can be used, as the place is equipped entirely according to their concept.

The use of natural materials without construction chemicals limits not only the possibilities but also the durability of the built sites and seats. On the other hand, this may be a challenge for the residents of the neighbourhood to create - and maintain in good condition - a sustainable park environment of a new type, which will become something like a trademark of Nadezhda.

Figure 55. Materials for the place for social contacts.

Autochthonous urban forest

When creating the next park element - the forest of local species - the selection of trees and shrubs is consistent with soil and climatic conditions. The species used have high decorative qualities, creating color and mood in all seasons of the year. Although the vegetation used is undemanding to the growing conditions, it is necessary to apply fertilizer to the area provided for landscaping.

Plant species will be provided - trees, shrubs and perennial flowers with a decorative effect in all seasons and suitable for the region, while preserving the existing vegetation.

Having a dense group of existing trees can be useful in the first years of growing newly planted trees - but in the long run it will probably be necessary to thin the plums to make room for a sustainable and diverse plant community.

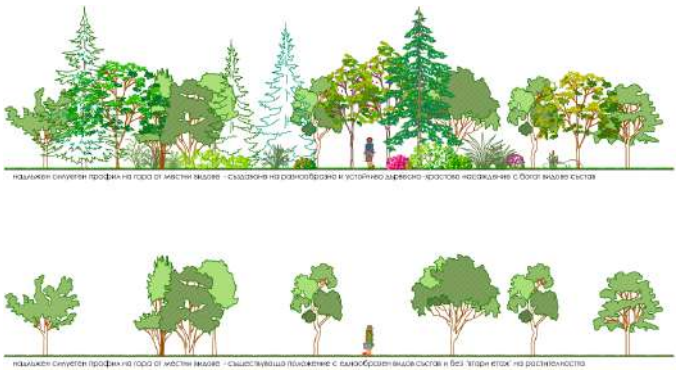


Figure 56. Sections of the Autochthonous urban forest.

The forest of native tree species will become denser and shady over time, but with sustainable maintenance it will retain its passable character without turning into a bush. At the same time (like a real forest) it will give coolness in the heat, a reprieve in the windy days and a small green oasis among the panel landscape all year round. This oasis in itself will create a favourable environment for further development of the ecosystem - through the natural attraction of new species of plants, small animals and birds. Last but not least, by using more farm (but not fruit) species such as walnut, hazelnut or even almond, the new plantation will add a new nuance to the locals' understanding of the concept of forest. Here, too, it is advisable to look for evergreen plants - which are missing not only in this area of the Green Corridor, but also in the neighbourhood as a whole.

Note: When selecting species, under no circumstances should invasive and weed tree and shrub species be used - white acacia, common aylant, mountain ash, amorphous, etc.

Figure 57. Picture of autochthonous urban forest.

Aqua Vita Zone

The zone has the highest concentration of activities along the Green Corridor. It will contain a square space, an outdoor fitness area, a place for entertainment games and a place for outdoor exhibitions, and in addition, the construction of a swimming pool in the future is planned. Placing so many different elements of the urban park environment next to each other will create a rich area for recreation, walks, entertainment and events.

Figure 58. Plan for the aqua vita zone.

A small pedestrian square is being built in the middle of the zone, in which the main directions of traffic intersect. A durable and flat pavement of environmentally friendly materials (preferably in different colors) is used, laid in strips so as to form a raster on a human scale. The square is furnished with wooden benches on the periphery, without interfering with the passage. Trees are planted around the square in order to create a greener urban environment, to provide natural shade and to enrich the species composition of the existing tree groups. Ornamental shrubs can be added sparingly and only from species that do not require intensive maintenance. All other elements of the area are grouped and located around the square. Due to the fact that the square is a kind of busy pedestrian crossroads, in and around it a system of park lighting or even video surveillance can be installed- powered by renewable sources.

Figure 59. Simulation of the interception design.

Figure 60. Simulation of the interception design.

According to the “Strategy for utilization of the potential of mineral waters and thermal energy on the territory of Sofia Municipality”, adopted by the General Development Plan of Sofia Municipality, the use of mineral water and thermal energy resources at Sofia-Nadezhda deposit for construction of mineral pool is envisaged next to the 15th School, as well as geothermal plant for heating public buildings in the area (38th Kindergartens, 115th Kindergarten).

Sofia-Nadezhda mineral water deposit belongs to the deposits of thermal mineral waters attached to the rock substrate of the Sofia valley. In the studied area the mineral water is established at a depth of about 515.0 - 520.0 m from the Earth's surface. The geological structure of the region includes rock formations with Upper Cretaceous (Senonian), Pliocene and Quaternary geological age.

The space provided for the construction of a swimming pool with mineral water will be used temporarily for an outdoor exhibition. It will hold events related to acquainting the local community

with the progress of the project for an innovative mineral pool, as well as to hold ongoing and final discussions of the conceptual designs resulting from the future student competition.

An information board will also be placed on the process of design and construction of the mineral water pool, as well as to acquaint the public with the qualities and possibilities for using mineral water.

This exhibition area is designed as a simple, flat and open space with a minimum of park architecture. An open space in which to hold cultural events, concerts and exhibitions.

It is built with a soft picturesque contour and is covered with an embankment of sand or fine crushed stone. In the northern part there are specific light constructions - boards on which can be placed paintings, posters, photographs, fabrics and other works of art, including at local events without claims to representation.

The southern part of the exhibition area is freer and here the only furniture is a few park benches, arranged on the periphery of the vast space. This allows the outdoor area to be used for a variety of events of all kinds, requiring more people to gather in one place. As along the entire Corridor, here too everything should be made of environmentally friendly natural materials: wood, stone, ropes. Steel, concrete or other non-environmentally friendly materials can only be added where it is unavoidable in terms of strength, safety and reliability. Continuing this attitude, the citizens of the neighbourhood should be encouraged to use the exhibition space to promote the problems related to nature conservation.

Figure 61. Simulation of the exhibition place.

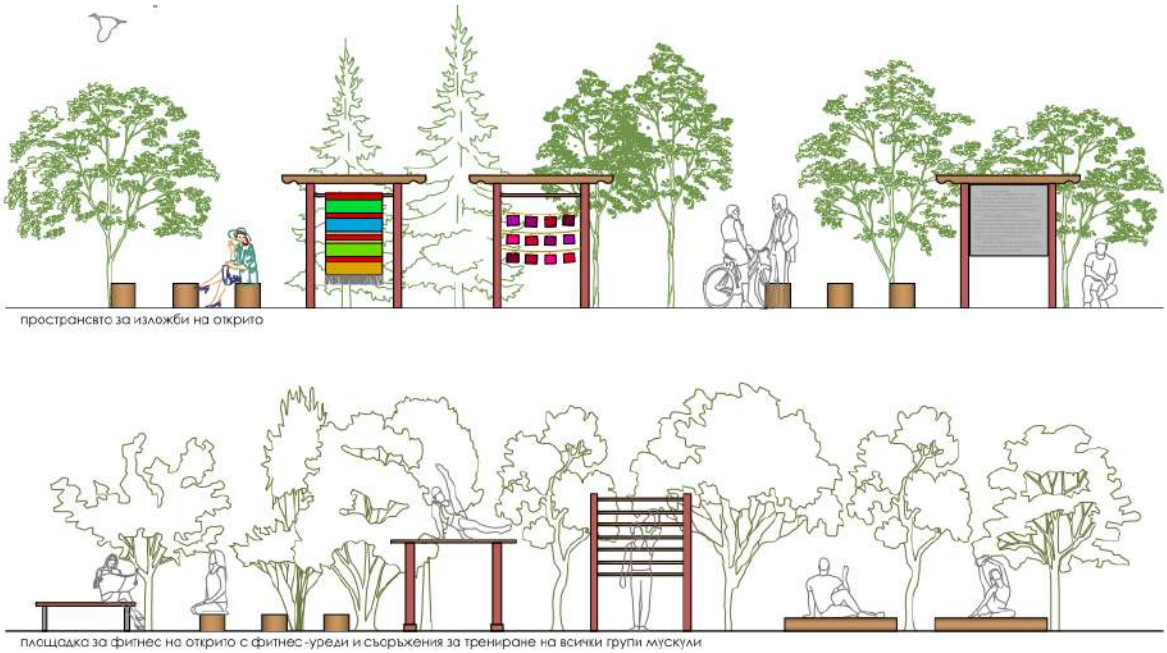


Figure 62. Section of the exhibition place.

In recent years, outdoor sports have become increasingly popular, including more and more people turning to daily outdoor fitness instead of a gym. For this reason, and in order to encourage the residents of the neighbourhood to spend more quality time outdoors, a new site for the so-called street fitness will be built in this area.

The outdoor fitness area is also subject to the concept of a clean and environmentally friendly park environment. By relying on non-traditional fitness equipment, the area can become a favourite place for athletes practicing more adventurous fitness.

The proposed set of equipment is made entirely of wood, offering a wide range of options for training all muscle groups. In addition, the devices challenge the imagination of athletes to invent their own exercises.


Figure 63. Simulation of exercise place.

The site is covered with sand, and the approaches to it - with loose crushed stone or felt. New trees are planted along the contour of the site for a fresher park environment. It is possible to plant useful edible plants to increase the culture of healthy eating not only among athletes but also among all residents of the neighbourhood.

Access to the site is free. In the mode of comfortable use, sports activities can be held by a maximum of 10 people. The site is designed for athletes of all ages. As part of the Green Corridor of Health, a sign can be placed in it not only with regard to the immediate exercises, but also with a broader topic aimed at a healthy lifestyle in general.

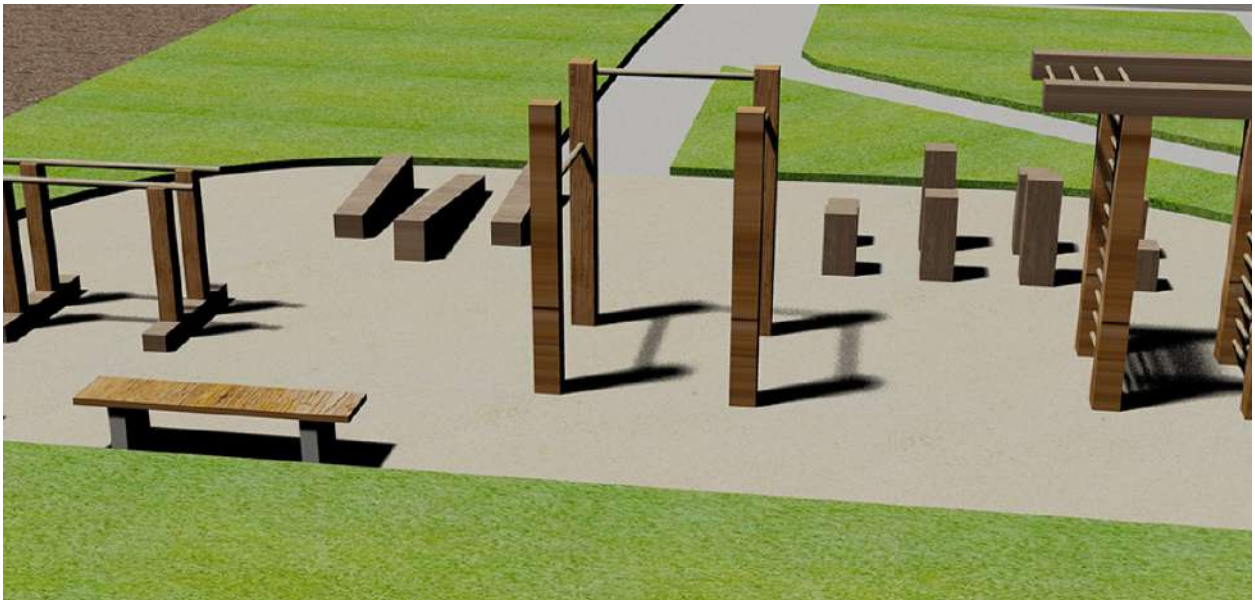


Figure 64. Simulation details of exercise place.

The construction of a place for entertainment games is also planned in the area, as there is no such place in the whole neighbourhood - even in the North Park. Although there are children's and sports grounds in the inter-block spaces, a separate place for outdoor games has not been built. Without using excessive park construction and furniture, here you can create a small meadow with rich opportunities for games in a park environment.

The place is shaped like a meadow with a soft outline, possibly covered with wood mulch or sand. The technical planning of this detail can provide for the deployment of basic equipment for popular outdoor outdoor sports: badminton, mini golf, bowling and more. The demarcation of the "playground" should be symbolic and rather through the way of maintaining the area to indicate which is a park lawn and which - a place for games. No special infrastructure or facilities are required.

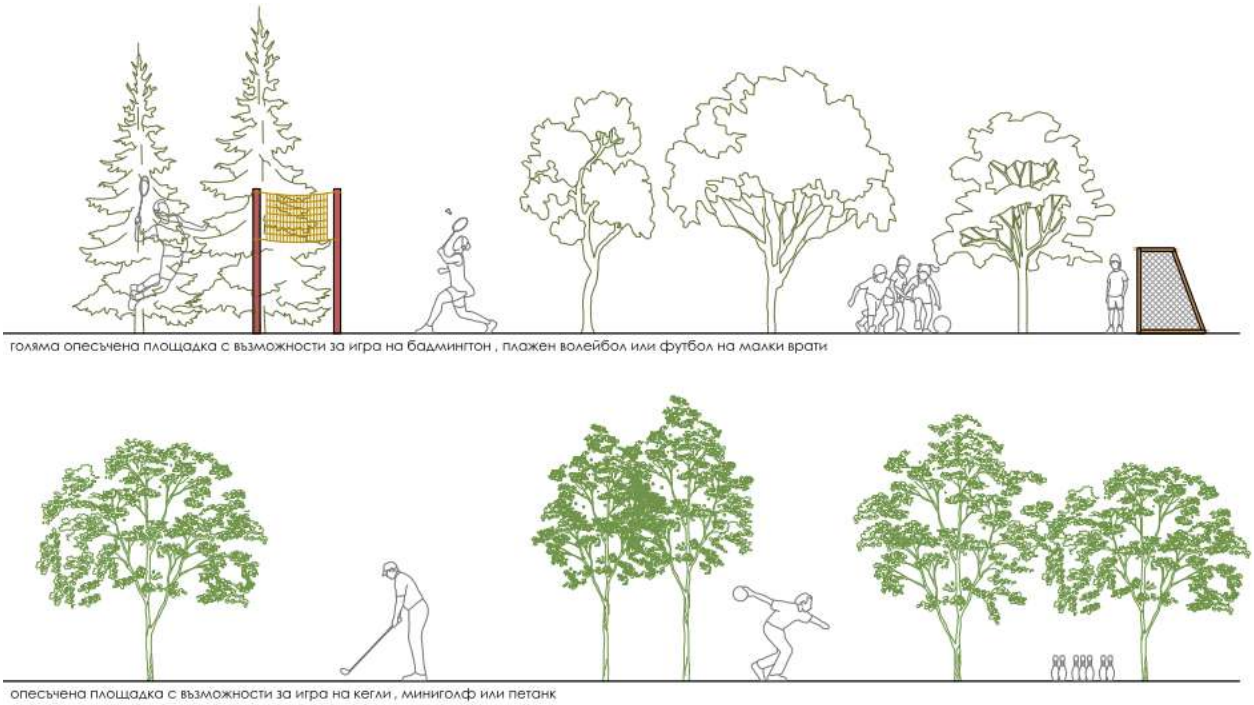


Figure 65. Section of games place.

A particularly enticing possibility would be to encourage the revival of traditional Bulgarian children's games from the past: Ashitsi, Guards and Apaches, Tsar-Portal, Oracle-Boracle, Happy Tsar etc. - anything that can take children out of the house and make them play outdoors in a healthy green environment. Here, too, local competitions in popular sports such as folk ball, drunken carrot, kite flying and others can be organized with great success.

In conclusion, it can be noted that the existing vegetation, although in adulthood, has a scarce presence in the area, which is not enough to give the space the character of a richly landscaped park. It is advisable to plant new trees of modern - and more exciting - park species and varieties. It is recommended to carry out sanitary pruning on the existing trees in order to remove all old and dry branches.

Greenhouse pavilion

The project for the greenhouse is under development by the Institute for Advanced Architecture of Catalonia (IAAC) - a partner in the project. It will be located in the yard of the adjacent 15th School and will serve multiple functions as a practical open-air classroom and outdoor reading and socialising space for students. The structure of the pavilion shall consist primarily of timber and will be constructed in accordance with all regulatory frameworks concerning the safety of educational facilities designed for use by children. The mineral water in the spring nearby will be used for heating and irrigation of the vegetation inside the pavilion.

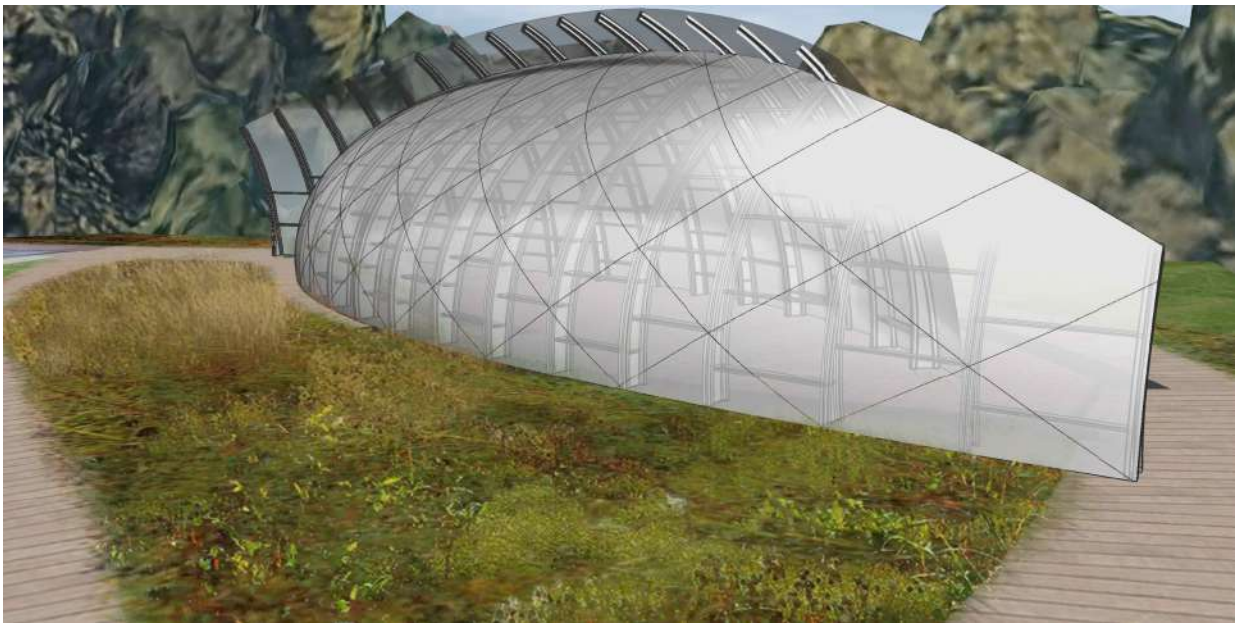


Figure 66. Greenhouse pavilion - plan and section - preliminary design.

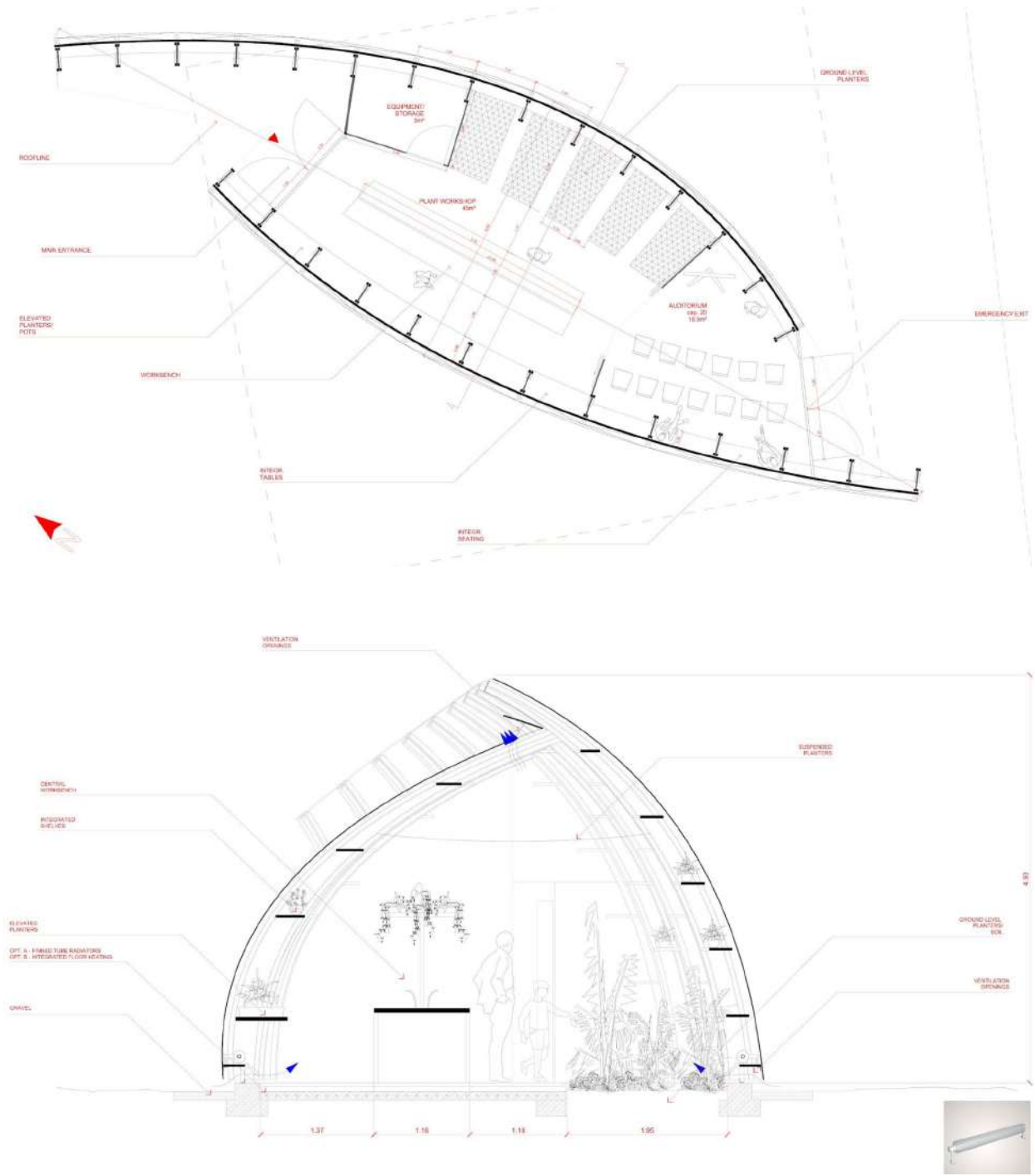


Figure 67. Greenhouse pavilion - plan and section - preliminary design.

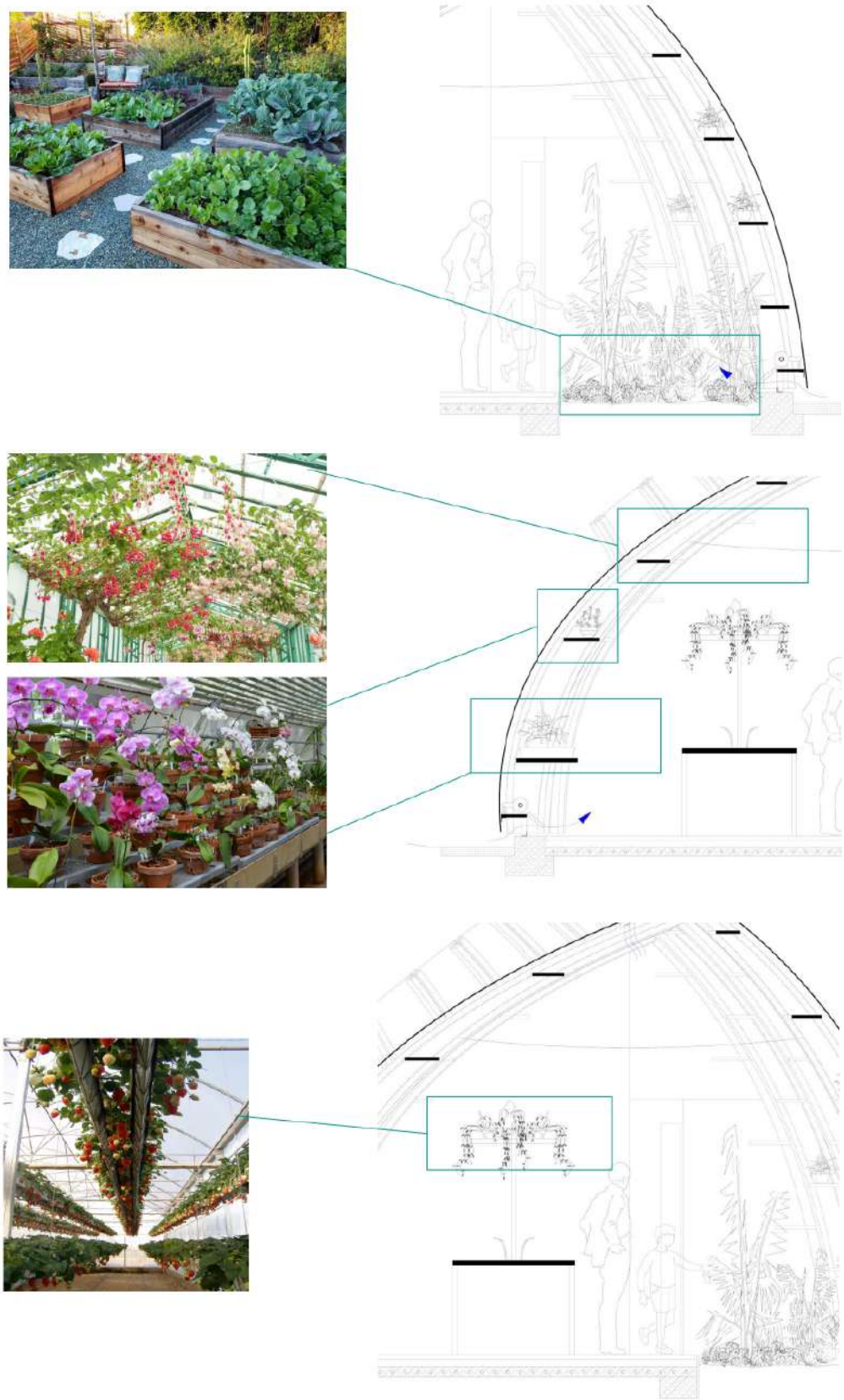


Figure 68. Greenhouse pavilion - plan and section - preliminary design.

Health Energy Zone

Playground subzone

Two new sites with a contemporary concept for play and zero carbon footprint will be built of environmentally friendly materials. The facilities in the playgrounds themselves should create preconditions for games that encourage young children to experiment with nature, get to know it and appreciate it from an early age.

One site has a narrow-elongated contour, and the other is more spacious and a small earthen hill will be built in it. The sites are designed with a geometric contour and an embankment of fine sand, and the elongated site can be filled with mulch of bark. The playgrounds have facilities for children of both age groups: children up to 3 years old and children aged 3 to 12 years. All equipment is made of natural materials - wood, iron, ropes - without added construction chemicals. In terms of materials, equipment cannot include moving, rotating and sliding parts. This limits the palette of possible games, but at the same time opens up opportunities for adventure and an innovative approach to the meaning of children's play in general.

Figure 69. Plan for the playground subzone.

Due to the presence of so many trees, the whole area is shady and, in some places, even too dark. There are bright and sunny places here only during the cold months of the year, when the trees are without leaves. So, in the hot months there is shade and vice versa - the rest of the time, when sunshine is desired, it is bright here.

Figure 70. Simulation of the playground subzone.

The lack of direct sunlight elsewhere in the Green Corridor can be seen as a disadvantage, but here it is an advantage. Playgrounds are used by young children and in the summer heat the coolness is a sought-after convenience. There are dry branches on the trees and for safety reasons sanitary pruning should be carried out on them.

Figure 71. Simulation of the playground subzone.

The existing asphalt pavement can be preserved and the entire site can be overhauled. The separation of the playgrounds can be done with curbs of wooden beams or beaten wooden washers. Of course, the laying of a row of rubber slabs with shock-absorbing function is also allowed, which will make the transition between the asphalt and the soft embankment on the sites.

Figure 72. Sections of the playground subzone.

The two playgrounds are designed so that 12 - 20 children can play in them comfortably. The use of environmentally friendly materials and a soft embankment of sand or mulch do not in themselves guarantee the safety of playing children. Playgrounds should only be used by children in the presence of parents or other adult companions.

Sports playground subzone

The area of the sports ground is a little over 2 decares, which allows the construction of two standard sports fields, equipped with the appropriate recreation areas and seats for spectators, athletes and coaches. The Healthy Corridor is included as an alley in the site and provides access to it from the north and south - and in addition there is an approach from the southwest. There are two playgrounds - for basketball and volleyball with standard sizes, equipped with basketball hoops and poles with a net.

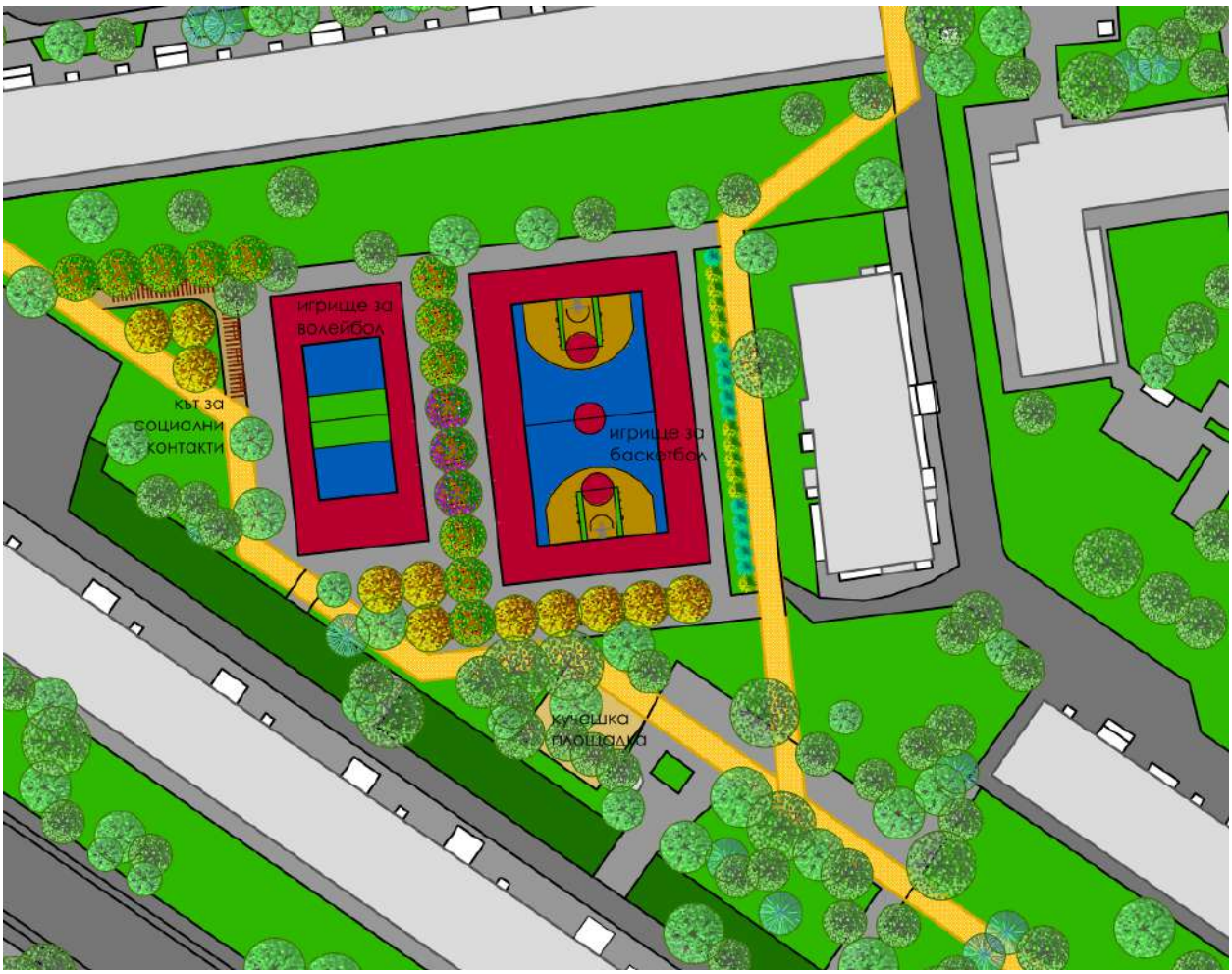


Figure 73. Plan for the sports playground subzone.

The fields and contours of the playgrounds are outlined with acrylic paint for sports purposes, laid on a solid foundation. The solid foundation can be built in two ways: a) by milling and re-asphalting only the top layer of the existing pavement or b) by removing the asphalt and casting a reinforced concrete platform. This should be decided after examining the condition of the pavement. Acrylic paint is applied on a smooth surface and creates some softening of the hard base - while increasing adhesion and reducing the reflection of both light and heat.

Figure 74. Simulation of the sports playground subzone.

The two playgrounds are located parallel to each other with an orientation along their long north-south axis. A strip with a width of 8.0 m is left between the courts. In this strip, as well as from the south of the courts (and from the west of the volleyball court) in the permanent pavement there are square green islands measuring 2.0 x 2.0 m where trees will be planted and the edges of the islands will serve as benches. Wooden pergolas are built over part of the seating areas to create shade.

Figure 75. Detailed simulation of sitting area of the sports playground subzone.

Subject to further deliberation, some of the pergolas can be replaced with canopies with thick roofs to serve not only for shade but also for shelter in the rain. In addition to trees, the green islands can be planted with shrubs and grasses.

Figure 76. Picture of the place for the sports playground subzone.

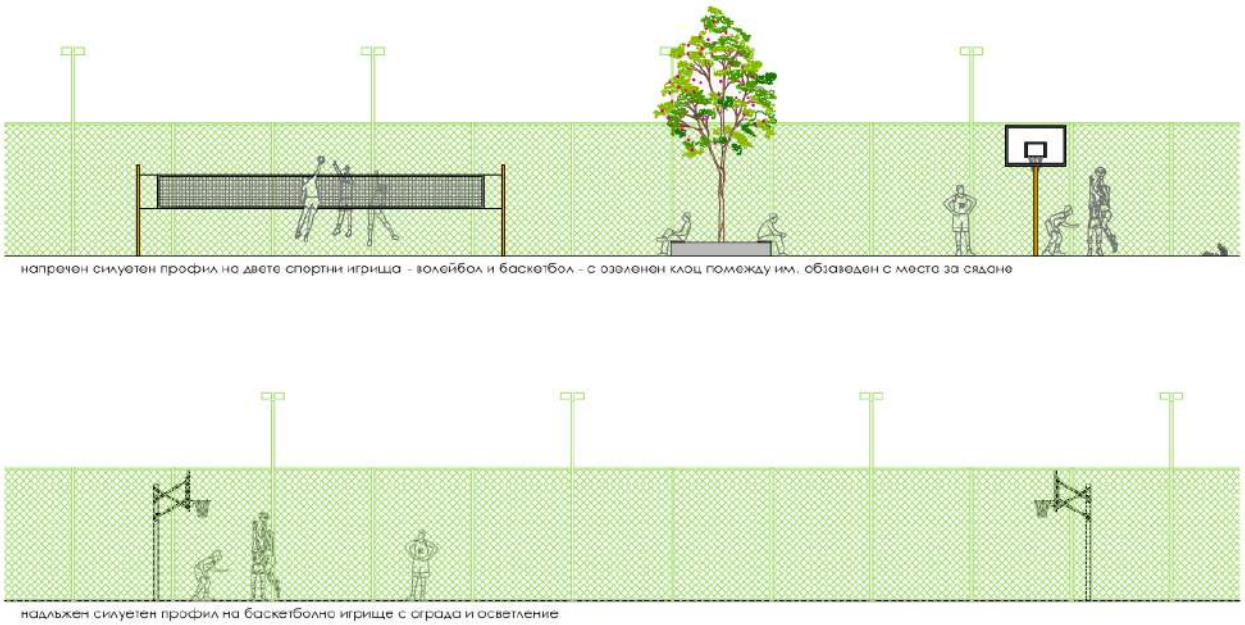


Figure 77. Sections of the sports playground subzone.

The sports ground is surrounded by a new safety fence with a height of 4.0 m, as both of the proposed sports do not involve firing higher balls. The fence is made of steel profiles: poles located in 3.0 m and horizontal beams for strength, mounted at a height of 0.2 and 4.0 m, respectively. stretches. The goal is to stop the ball in the net without bouncing back. All metal parts must have anti-rust coatings. Every third or fourth pillar is placed with a height between 7.0 and 9.0 m and lighting floodlights are mounted on these higher pillars.

The lighting must be planned in such a way as to allow sports competitions to be held during the dark part of the day. It is recommended to use LED lighting fixtures, as part of the required energy can be obtained from solar panels located on the roof of the aforementioned pergolas. The organisation of the space allows the simultaneous use of both courts - a total of four teams of competitors - and at the same time in the recreation areas a minimum of 60 spectators can attend.

Co-place Zone

Subzone "Eco-parking"

The new eco-parking alone cannot solve the problem of parking in the neighborhood, but suggests a modern and green urban environment solution implemented on a small intra-neighborhood scale. The use of green space for organizing parking is an unpopular solution and its construction presents a balanced concept for the implementation of two seemingly opposite elements of the urban environment - green space and parking. This implies the transformation of greenery into a leading component of eco-parking.

Figure 78. Plan of the "eco-parking" subzone.

The green area designated for parking is small and open, with several self-contained low trees of fruit species, which during the implementation of the project do not need to be preserved at any cost, as they are located chaotically and do not have much decorative value. The place has the character of a sunny meadow and is located at a crossroads between streets from the east and north, a block of flats from the west and a spacious sports field from the south. When turning the place into a parking lot, all requirements related to the construction and operation of such sites in the urban infrastructure and their inclusion in the traffic on the adjacent streets must be complied with.

It is planned to use parking elements made of recycled materials, resistant to load and weathering, mounted on a well-prepared base. An automated irrigation system for the whole area is also envisaged, as well as suitable park vegetation for the purpose of natural shading and aesthetic fencing and appropriate park lighting.

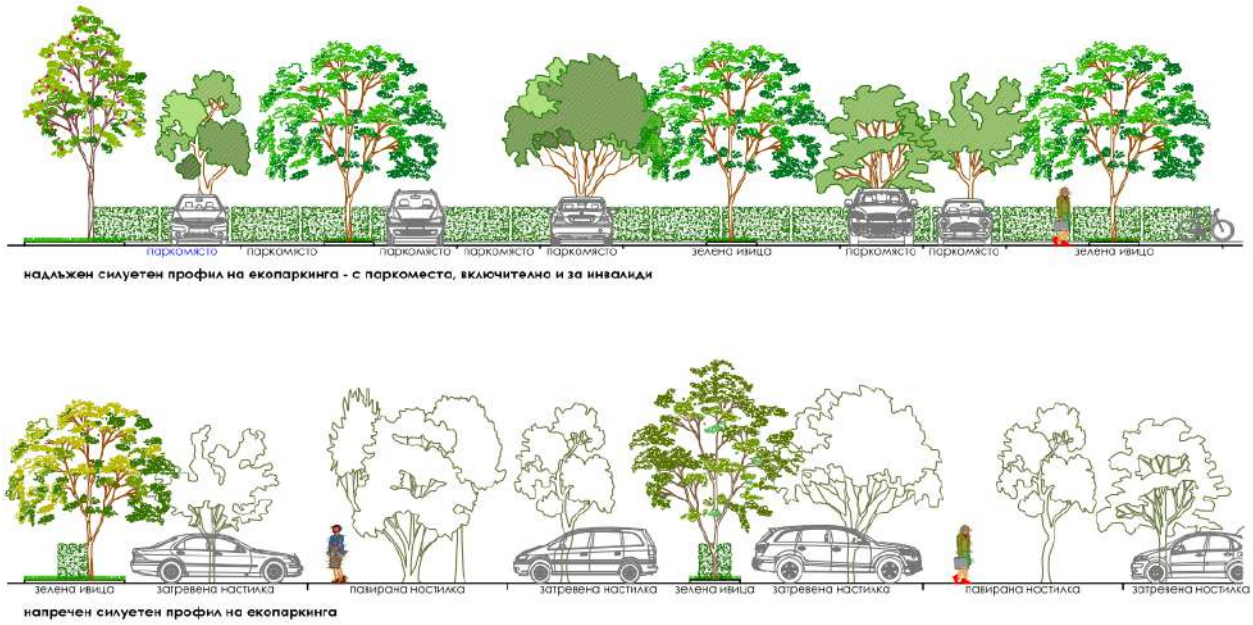


Figure 79. Sections of the "eco-parking" subzone.

Green areas are currently sparse of woody vegetation and parking can become a delicate plant accent. It is recommended that the trees be tall and slender, with highly shaped spreading crowns to provide enough shade without dominating the urban landscape and without interfering with the function of the eco-parking. In addition to cars, the parking lot is designed for parking on bicycles. For this purpose, classic lockable bicycle stands are used. Bicycle parking spaces are set aside in a compact area near the entrance to the car park. It is possible that this part has a small shed to protect the bicycles from rain and sun.

The eco-parking lighting system should include park lighting fixtures with a simple urban design that illuminate the area discreetly without turning it into a bright spot. The lighting should be sufficient to provide visibility, security and complement the calm character of the residential area.

Subzone for active recreation

The place offers good opportunities for meeting more people in a quiet park environment. The space is conditionally divided into two parts, respectively: part "do-it-yourself game" and part "family games", which are not mutually exclusive, but rather complementary.

Both green areas in the active recreation area offer enough space for light park furniture and conditional "playgrounds" with a sand embankment or crushed stone to focus weekly and annual entertainment events for the residents of the neighborhood.

Figure 80. Plan of the active recreation subzone.

The leading components in the area are the two "sites", covered with a mound of sand or crushed stone. One is furnished with park furniture, and the other is left free with the idea of each visitor to find their place in it - whether for sports, recreation, games or just meeting friends. Both places are connected by a green corridor with alleys, and both places are planted with new trees.

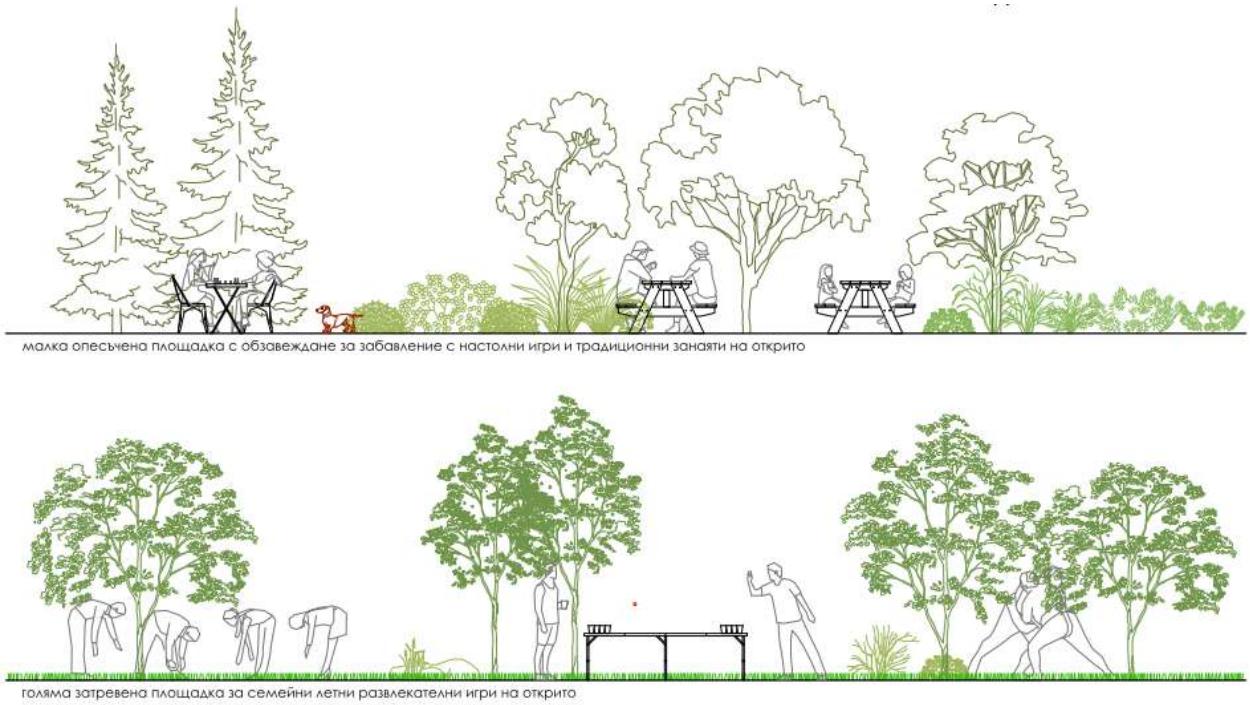


Figure 81. Sections of the active recreation subzone.

In the "do-it-yourself game" part there are sets of tables with several seats - made entirely of wood or stone. Here visitors can relax, play board games, discuss neighborhood issues or meet with neighbors. This is a cozy place to meet friends, cultural exchange and discussions in a casual green environment.

Figure 82. Detailed simulation of the active recreation sitting area.

The entertaining family games take place in the next "playground". Here the furniture is located only on the periphery, and much of the area is an open space, allowing outdoor entertainment, practicing a favorite sport or holding neighborhood competitions with a lot of laughter and joy.

Figure 83. Detailed simulation of the active area.

With proper organization, both green areas can be used by dozens of citizens at the same time, which allows this area to offer more opportunities for weekly recreation. Locals are encouraged to use their imagination freely to create new outdoor games - and have fun while playing them.

The use of park furniture for classic board games (chess, backgammon, checkers, etc.), which are available on the market, is allowed - but it is still preferable to leave it to the citizens to choose the games themselves. In this sense, it is possible here not only for playing games, but also for joint events with the participation of more residents of the neighborhood - a kind of incubator for ideas and a center of attraction for young people open to new and modern initiatives. The area can be used including sunbathing, yoga, meditation, outdoor lessons and training in oriental martial arts, seminars in a green park environment and last but not least - as the recently popular outdoor classrooms.

Figure 84. Detailed simulation of the tables and benches.

Subzone for passive recreation

While the green area designated for positioning the wood structure is compact, areas for recreation and picnics are involved in a long and narrow strip on the back of the residential block. This does not allow the construction of large sites, nor does it imply the placement of larger park furniture. The flower garden is a very small spot in the middle of the asphalt site and should be developed as a separate neat and cosy plant oasis.

Figure 85. Plan of the passive recreation subzone.

Figure 86. Sections of the passive recreation subzone.

The leading component in the area is the wooden structure with the function of a coffee workshop, which must be able to be used all year round. In addition, the structure has a simple architecture to attract retirees from the local club, and people of active age and young people. On the park side, the "walls" are open, while on the street side, the structure is more closed, albeit only with decoration.

An important point in the design of the structure are the two holes in its roof - one performs the function of skylight, and the other is left so that the stem of the existing park tree can pass through it. The inside of the building can be furnished with park furniture, which allows its use as a club. The architectural and constructive details are subject to refinement, as the general atmosphere of the building should be a cozy park pavilion for meeting friends, cultural exchange and discussions in a pleasant green environment.

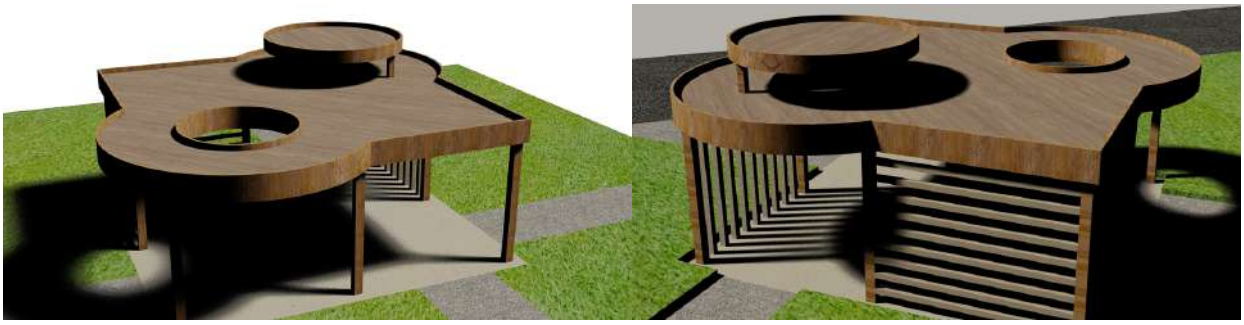


Figure 87. Simulation of the recreation wood structure.

Figure 88. Simulation of the recreation wood structure.

Figure 89. Simulation of the recreation wood structure.

The area designated for recreation and picnics is a long and narrow green strip. It can accommodate several small "pockets" arranged linearly with modular repeatability, in which to put benches made of natural materials. The width of the green strip limits the size of these unique booths and the nature of their park equipment. There are five playgrounds with sandy flooring and wooden furniture, which can seat no more than 6 people. The proximity of the strip to the adjacent residential block does not allow the creation of typical recreation areas with benches and tables to attract noisy companies.

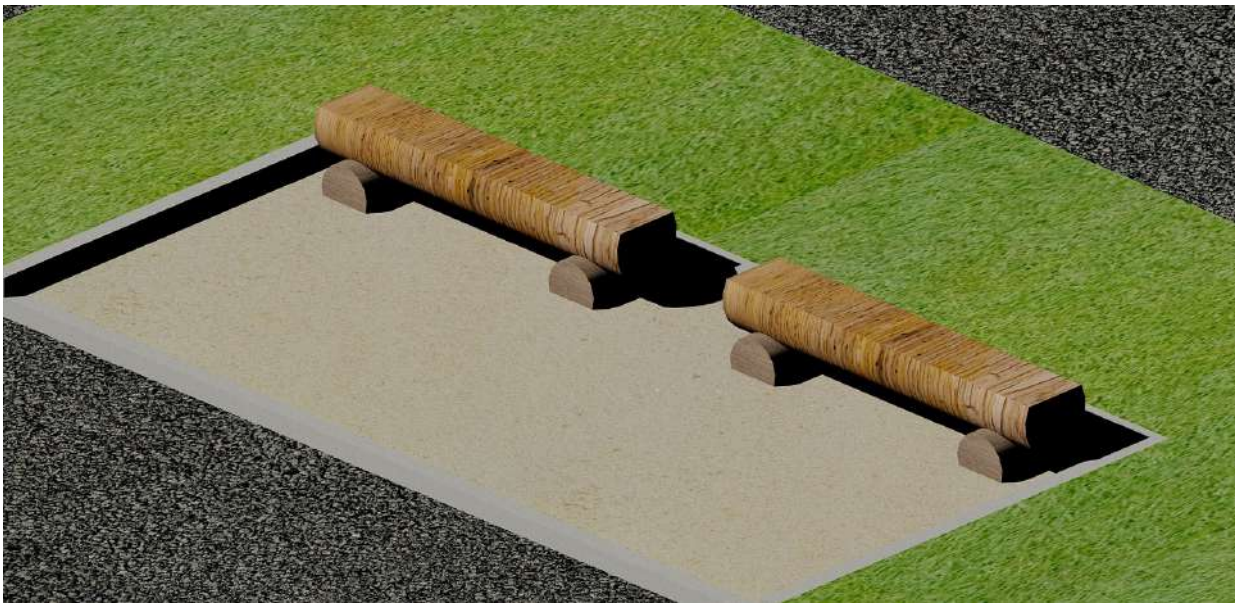


Figure 90. Simulation of the benches detail for the passive recreation subzone.

Of course, there is also a concept for the recreation areas to be in an environmentally friendly spirit directly on the grass meadows. Thus, the designation of specific places for recreation can be suggested only with discreet wooden decoration. This solution requires more intensive maintenance of green areas and especially the grass carpet, which will be subjected to a greater load. Recreation sites can be made in a forest park character with a looser shape and more forest furniture. It is preferable that the pavement is an embankment of sand or a fine fraction of crushed stone.

It is also planned to create a small garden in which flowers, herbs and spices can be grown. It is good for the garden to have both sunny and shady areas to allow different types of plants to find optimal conditions for development - which will rely on large tree vegetation in nearby green areas. The garden is built with a contour of concrete curbs in several layers, with which the area is shaped like a green block. Along the contour of the block wooden benches are installed for recreation of both the visitors and the citizens of the neighborhood working in the garden.

Figure 91. Detailed section of the flower garden.

The flower beds can have both a geometric shape and a free landscape contour - and can be arranged with large pieces of rock to resemble a rock garden or similar decorative park element.

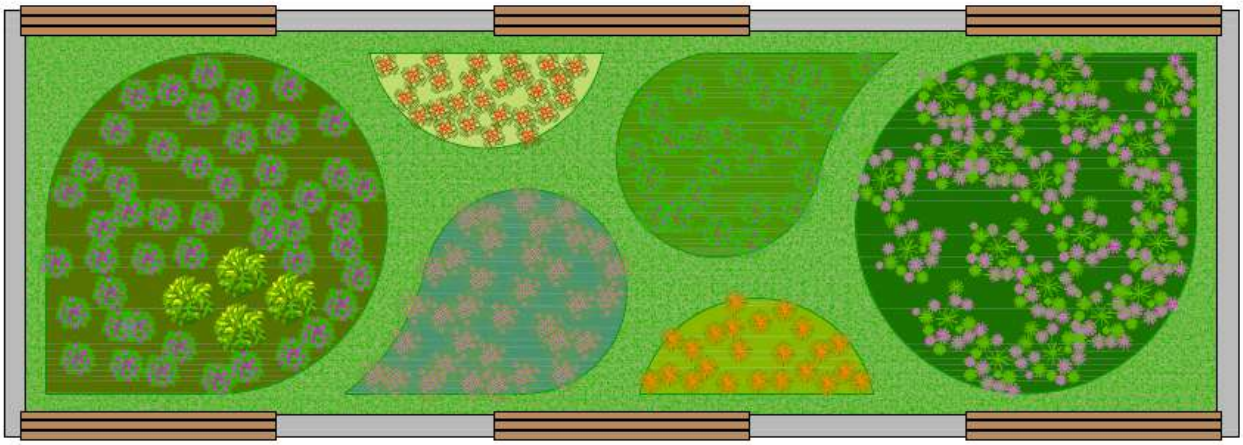


Figure 92. Detailed plan of the flower garden.

Figure 93. Detailed simulation of the flower garden.

2.4. Nature-based solutions

Thermal water Swimming pool

The idea is to provide an innovative project for a public mineral water swimming pool based on the desires of the citizens and with their active participation. Also, it aims to create a new functional and business model for cooperation between citizens, municipality and business. As an NBS, the project will create a social and technological innovation by using the qualities of the existing mineral water with emphasis on the physiological health of the children and pupils.

The pool project is expected to start with the preparation of an assignment for a **student competition for innovative ideas**. Based on the results of this competition, which will be evaluated by the residents, it is planned to compile a technical specification for conducting a public procurement for the preparation of an investment project in the "Detailed design" phase by applying innovative technologies meeting the requirements of the URBiNAT project. It is also planned that the design will be discussed with the civil society.

Nowadays part of the territory that will be occupied by the swimming pool is an empty and not well-maintained place. The project aims to make this an area for exhibitions related to the demonstration and information of the qualities and composition of the mineral water. Also, it could be used for demonstrating the swimming pool project progress and for organization of public discussions.

Positive aspects:

. Straighten the relationship and communication between different stakeholders concerning the urban environment and its use by opening a dialogue on the utilization of the thermal water as a public good;

. Contribution to the wellbeing of the citizens;

. Efficient and effective use of the existing mineral water resources;

. Access to a new public sport activity for the neighborhood.

Challenges:

. To create a working model of collaboration between different stakeholders;

. To attract investors for implementation of the project;

. To invent a proper business model for maintenance of the swimming pool.

Greenhouse and open classroom

Description

The school greenhouse and classroom pavilion will be located in the yard of 15th School and will serve an educational purpose. The space between the new structure and the school building will be designed as an area for recreation, conducting extracurricular activities and outdoor lessons.

The greenhouse and classroom pavilion will be used in the educational process of students between 1st and 12th grade (ages 7-19), in order to:

• enrich the educational process through practical activities;
• foster a sense of responsibility and care for the environment;
• raise awareness about nature-based solutions, etc.

The greenhouse will host harmless and safe species of herbaceous plants, small shrubs and small tree species.

The vegetation will be taken care of by the students from the gardening club at 15th School and the school staff during academic holidays.

Access to the greenhouse for educational purposes will be provided to the other schools in the district.

Functional requirements

Classes with up to 10 students and up to 2 teachers will be held in the greenhouse.
Classes with up to 15 students and up to 2 teachers will be held in the classroom.
The outdoor area for recreation and extracurricular activities will provide space for up to 60 students and up to 2 teachers.

1. Greenhouse - 50-60 sq.m:
• required depth of soil - 15 cm;
• required clear height - 3.00 m;
• required temperature – 25 degrees C;
• possibility to dedicate different parts of the greenhouse to different species;
• number of seats – 10;
• furniture - wooden benches, desk, teacher's chair, screen, multimedia and magnetic boards, lockable cabinets for equipment.
• equipment to be used during classes and stored in the greenhouse – ca. 30 pcs. microscopes, goggles, aprons and gloves, seed planting gloves.

2. Classroom - 30-40 sq.m:• seats for students - 15-20;
• furniture - a seat with a desk for students, a chair (desk and chair) for the teacher; from natural materials;
• equipment - screen, whiteboard, multimedia, laptop, blinds or other possibility for dimming, hangers for external clothing;
• installations - LED lighting, WiFi.

3. Storage space - 6-8 sq.m;

4. Technical room - 6-8 sq.m;

5. Library with a seating area - the classroom or the area for extracurricular activities outside the volume of the pavilion can be used.

6. The area for recreation and extracurricular activities (and outdoor lessons):
• seats for students - 60, if possible amphitheatrically located;
• equipment - board and screen for multimedia;
• installations - LED lighting, WiFi;
• possibility to cover the space (pergola, green canopy, etc.);
• possibility to enclose the space for extracurricular activities in order to restrict access and limit visibility from the area outside the school yard.

7. Installations:
• heating and ventilation - possibility for heating with geothermal energy from mineral water; cooling - natural and artificial ventilation;
• electrical installations - artificial lighting, wi-fi, multimedia, power supply - in the work areas for teachers and students, cctv video surveillance - incl. in the area for extracurricular activities;
• water supply and sewerage - sink for students, irrigation system using chilled mineral water leftover from heating the building, waste water drainage channel – to be linked into the system of the existing plumbing installation.

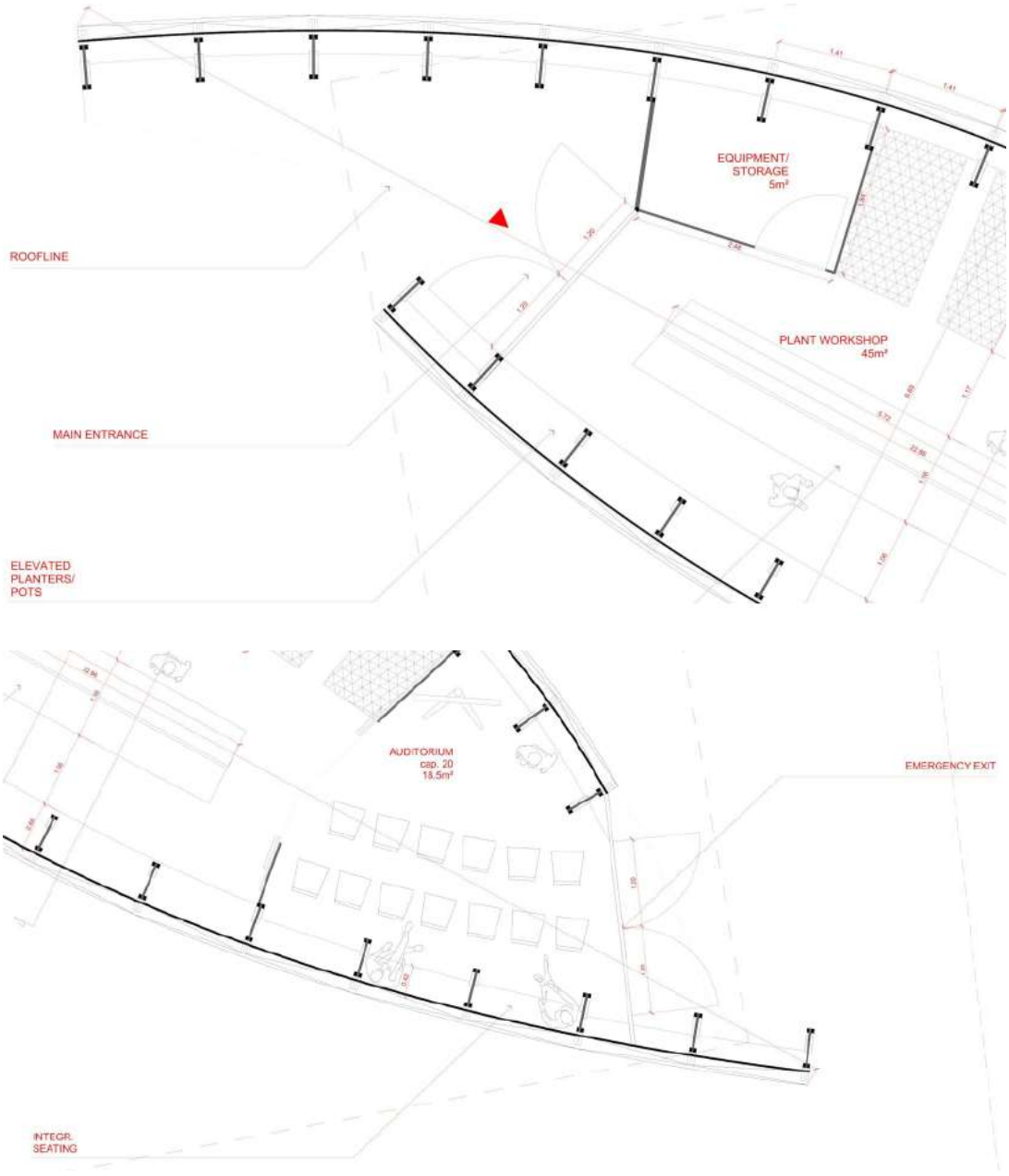


Figure 94. Greenhouse pavilion - plan, detail - preliminary design.

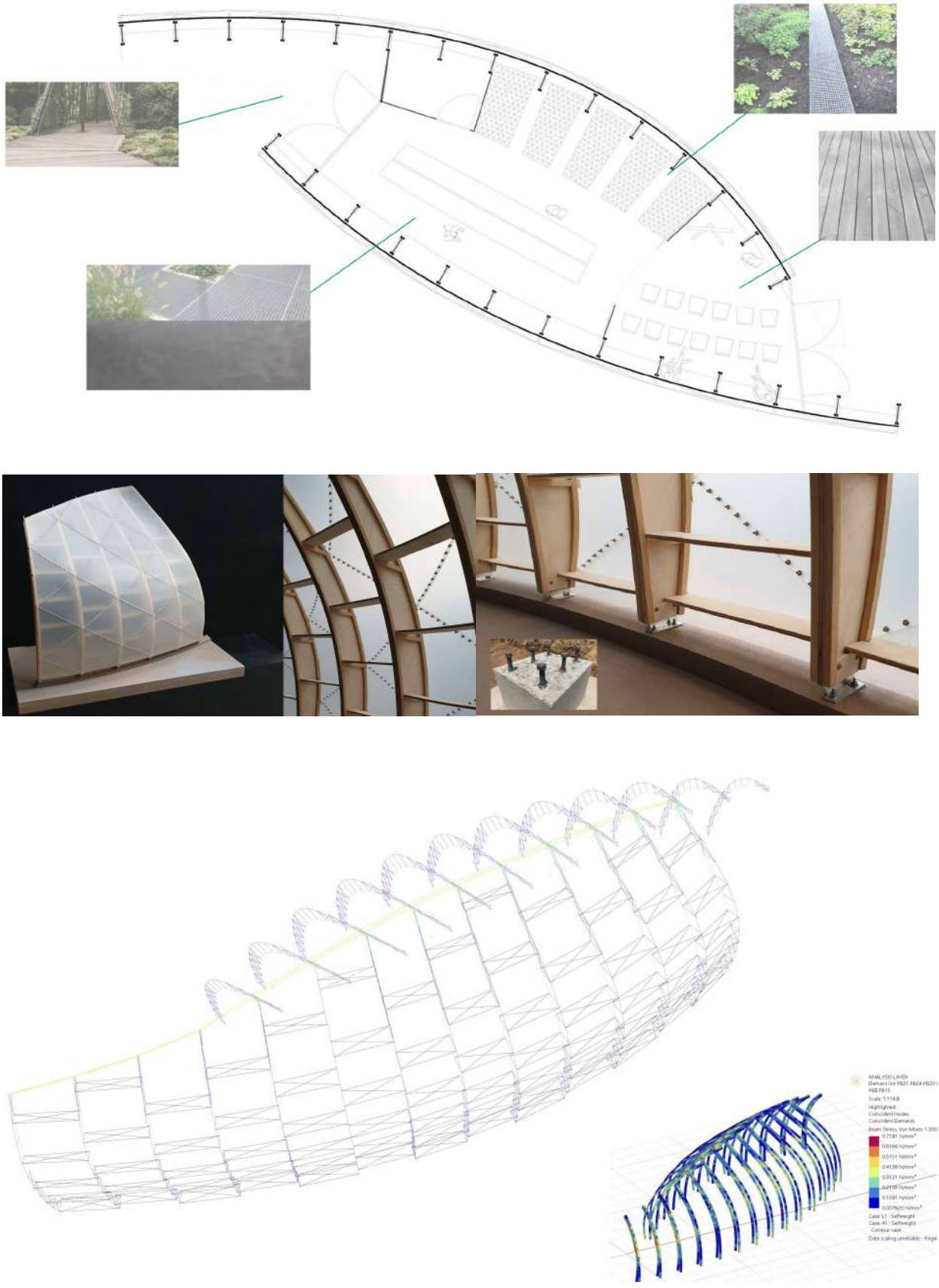


Figure 95. Greenhouse pavilion - materials - preliminary design.

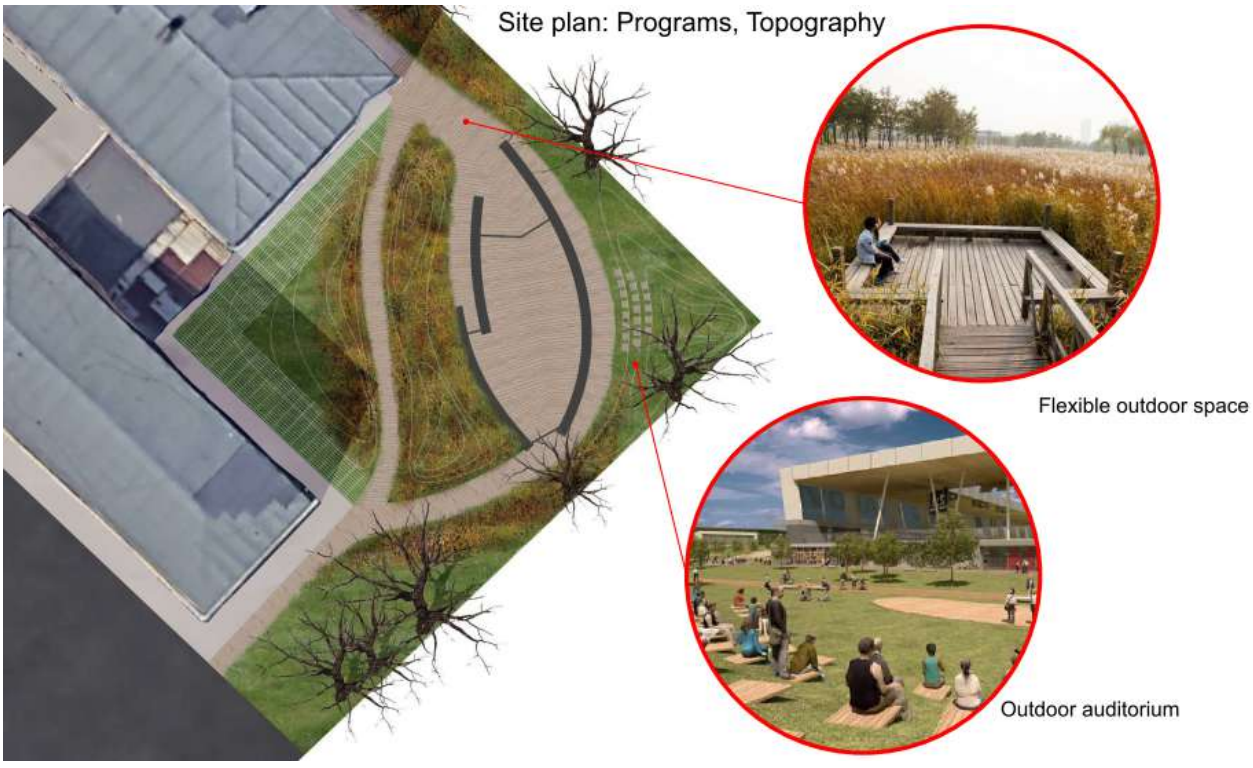


Figure 96. Greenhouse pavilion - site plan - preliminary design.

Green Amphitheatre

The amphitheatre should be a space designed and adapted both visually and acoustically to perform activities for public recreation. This space will be designed so that in normal use it does not require equipment or sound installations, but only lighting when needed. Portable sound equipment will be used during certain events.

The optimal amphitheater location of the seats depending on the possibility of visual perception - around the stage at 90^o, 135^o or 180^o will be studied.

One of the main objectives in the amphitheater is that every viewer does not interfere visually with other viewers positioned in front of him. For this reason, the realization of the green amphitheater will observe the following maximum distances of perception: for facial expressions - 20 m, for dances and concerts - 30 m.

On the stage of the preliminary project the amphitheater is designed with an arched shape and two approaches to it from the sidewalks of the adjacent streets. The "stage" is indicated only by a contour measuring 10.0 x 13.0 m, is filled with sand and has no additional lifting over the surrounding pavement, and the seats are located radially with an indentation of 120 cm in plan and 40 cm in height. Between the stage and the first row of stands is left a rainbow strip with a width of 3.5 m, which is covered with a mound of felt (rounded pebbles) in light color.

The contours of the "stage" and the sitting zone will be made of stone, and hewn stones should be used. The contours of the sitting zone are filled with humus soil and grass, and those on the "stage" - with a mound of sand or crushed stone of fine fraction. A high and narrow green wall of evergreen shrubs or trees can be built behind the "stage".

Eco-parking

The design and construction of the eco-parking will comply with the current regulations for planning and design of the communication and transport system of urban areas, as well as conditions for safe movement of people and vehicles such as:

. movement and direction of pedestrian flows by people who leave their cars in the parking lot;
. directions of movement of cars and people;
. proper marking of the individual parking spaces;
. need for pavements in a more intensive traffic flow of vehicles;
. sign and light signaling;
. directional signs; lighting;
. suitable pavements or special parking elements;
. slopes, according to the effective drainage to the nearest sewers;
. effective shading of open parking lots.

The concept of the new eco-parking includes the construction of rows of parking lots, interrupted by green strips in which trees and low hedges are planted. This results in some separation of groups of 3, 4 or 5 parking spaces, which creates a feeling of coziness and a more intimate park environment. There are two types of parking spaces: standard parking spaces with a size of 2.5 x 5.5 m and parking spaces for the disabled with a size of 3.6 x 5.5 m. Strips with a width of 6.0 m are left between the rows for maneuvering. The access to the parking lot is from the adjacent street - from the north.

The pavement of the parking lots themselves is grassed. Standard concrete modules with square holes or far more environmentally friendly honeycomb polyethylene gratings can be used. Strips of concrete slabs or pavers are laid along the contour of each parking space to mark the parking spaces. The parking lots for the disabled should be densely paved so that they can be used easily, conveniently and safely by people with mobility difficulties.

Maneuvering strips can be made of paving or compacted crushed stone of the finest fractions. It is possible that they will be realized with the same grassy pavement as the parking lots, but this will create difficulties in the pedestrian movement of the citizens.

The green stripes between the parking lots are made in natural terrain. Trees and low hedges are planted in them, and the vegetation-free areas are grassed with a multi-component grass mixture. To achieve a representative character of the subproject, it is necessary to rely on more exciting woody vegetation and greenery in general. The implementation of the new eco-parking is based on an abundance of new trees, which will create both shade and a modern green park environment.

The construction of the eco-parking must be carried out with maximum protection of green areas and nature in general, with gentle technologies and minimal and renewable interference in the natural terrain. The use of bonding materials (cement, silicones, adhesives) should be minimal and only where there is no substitute. The use of construction chemicals should be avoided altogether.

Figure 97. Picture for the eco-parking place.

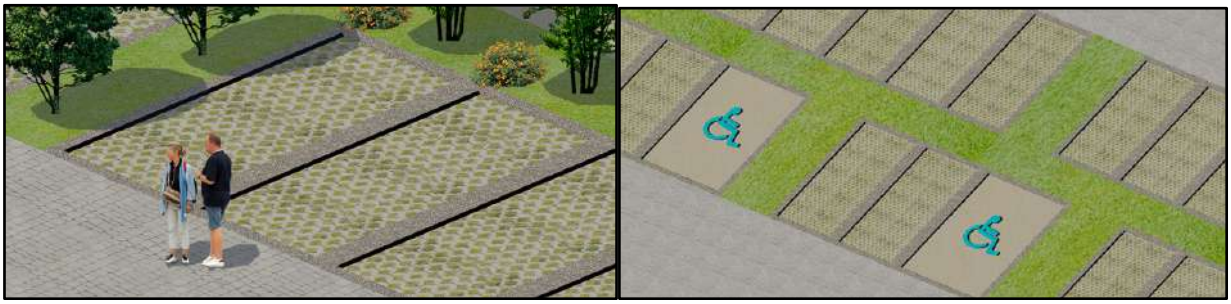


Figure 98. Detailed simulations of the eco-parking spaces.

Luminaires must be between 6 and 12 pcs., Located on the periphery of the parking lot outside the areas of maneuvering and parking.

In the future, the idea of installing "trees" with solar panels to serve as charging stations for electric cars may be included in the eco-parking lot. With a view to reducing conventional cars with internal combustion engines and their gradual obsolescence in the European Union, electric cars should find more comfort for use in an urban environment, including by setting up charging stations in the parking lot.

Figure 99. Detailed simulation of the solar panels' trees for eco-parking.

Autochthonous urban forest

The characteristics of the group of trees in the Northern part of the “Green Assembly” zone can be used by enriching its species composition with mainly local species, typical for the original local landscape of Sofia: Quercus frainetto, Quercus cerris, Quercus robur, Juglans regia, Acer campestre, Fraxinus ornus, Tilia tomentosa, Prunus mahaleb, Sorbus torminalis etc., described in detail in the section on Typical local tree species.

The location of new forest vegetation must comply with the following requirements:

. Adjustable shading of the place for social contacts and rest;
. Providing an appropriate background as far as possible;
. Visual isolation of the site from the neighboring territories;
. Possibility for formation of separate spaces and zones.

The location of new shrub vegetation must comply with the following requirements:

. Insulation, highlighting or shaping of architectural and engineering facilities;
. Form of vegetation in places unsuitable acquired form as a result of the passage of alley network - sharp corners, narrow sections, etc., in order to visually mitigation;
. Formation with bush vegetation in the places where tree vegetation cannot be used;
. Tying and shaping the groups of tree vegetation in a single composition.

The planting of coniferous and deciduous trees should be done in pre-dug holes that are 60/60/60 cm. Shrub vegetation should be planted in a checkerboard pattern, at a rate of 3, 4, 5 or 6 pcs. in sq.m. depending on the species. Planting will be done in holes measuring 30/30/30 cm. Shrubs in hedges should also be planted in a checkerboard pattern, in a pre-dug trench, at a rate of 6 pcs. in sq.m.

3. Conclusion

Main findings and results

Findings from the landscape analysis

During the inspection of the individual zones along the Healthy Corridor, additional adjacent territories were observed in order to build a more complete picture of the nature of the sunshine in the whole site. It can be concluded that the Healthy Corridor is designed to cover areas of diverse nature - and exciting alternation - of sunshine and shading. The passage of the corridor from end to end takes about 35 minutes and when the rounds are made at different times of the day in the spring and early summer, only a few (and short) sections are noticed, which can be marked as hot or wet. At the same time, the hotspots are mainly around the intersection of busy streets, and the hotspots are in the narrow inter-block spaces. The route passes neither through dense shady forests nor through vast open meadows. For the most part, the Healthy Corridor is a pleasant and cozy place for walking, recreation, games and sports with enough sunny and shady places to place the planned subprojects.

This greatly facilitates the selection of specific locations for the placement of the elements of the corridor so as to make optimal use of the positive sides of both direct sunlight and shade. The purpose of the sub-objects and their park content is so diverse that it allows one to fully master the features of the park environment.

In almost all areas of intervention (and along the entire corridor) it is necessary to carry out light sanitary and formative pruning of existing woody vegetation in adulthood. This will simultaneously increase its phytosanitary qualities, improve the aesthetic appearance of green areas and improve their light regime.

The import of new trees should be carefully and well measured - only where it is really necessary. The effect of mass afforestation should not be sought, but to supplement the scarce species composition of the available woody vegetation with typical native species that have disappeared from the neighbourhood in recent decades - or to introduce examples of modern and exotic species with exceptional decorative value.

The introduction of new plant species in order to create sustainable plant communities must take into account the following limiting factors:

- warm summer with prolonged heat and droughts;
- cold winter with sudden colds;
- deep soil horizon with rich nutrient composition;
- heavy and clayey soils prone to overwetting in spring and drying and cracking in summer;
- deteriorated air quality and dust;
- additional heat and reflected solar radiation from the urban environment;
- low level of maintenance of the green system of the city, expressed mainly in mowing the lawns and pruning the trees;

Consequently, species with resistance to environmental constraints should be given priority in the selection of species.

The proposed plant species have been selected in order to create sustainable plantations along the Healthy Corridor. Local, typical for the Bulgarian nature and parks trees and bushes are used, which show excellent growth in urban conditions. Some extremely specific Bulgarian plants with poorer performance in the city are also offered, as well as a limited set of trees atypical for the Bulgarian flora with a strong urban presence due to their high adaptability.

Citizen participation

Involving a variety of stakeholders throughout the entire lifecycle of the URBiNAT project remains a crucial aspect of the successful implementation of all envisioned proposals. Every intervention included in the Masterplan has been developed through rigorous discussions between the residents of Nadezhda district, as well as municipal technicians, political representatives and academic partners. A series of workshops in June 2021 enabled local citizens to get acquainted with the latest Healthy Corridor concept and reflect on their own visions for it by providing exceptionally valuable feedback to the Sofia Taskforce in charge of the project. Additionally, the creation of the Sofia Stakeholder Advisory Board laid the foundations for a structured and durable mechanism of interaction between all relevant interested parties. This will ensure the long-term success of the Corridor by engaging citizens in constructive dialogue with the governing bodies responsible for the district and the central municipal administration.

Institutional cooperation

Several important elements of the project are currently under development via collaborative effort on the local and international level. The most experimental of those is the new school greenhouse pavilion, to be designed and manufactured by the Institute for Advanced Architecture of Catalonia. Their proposal has been discussed every step of the way with the headmistress of the 15th School, where the structure will be located. The multipurpose pavilion will serve as an outdoor classroom for students and will encourage their interest in the preservation of the natural environment by educating them in more practical terms and empowering them to be responsible for the maintenance of the vegetation grown there. A separate subproject related to the creation of gardens with edible plants is also under development with the active involvement of local kindergartens and NGOs.

Conceptual framework

The concept for the Healthy Corridor manifests the desire of the local community for revitalisation of public spaces in Nadezhda through their incorporation into a single linear park. All separate elements form a continuous chain linking the southernmost and northernmost parts of the district, which host the major preexisting green recreation zones. The multitude of different proposals are complementary to each other and will encourage citizens to experience the areas along the route of the Corridor in a physically and mentally engaging manner, while knitting the local community together in an ever-closer relationship with the urban and natural environment.