URBAN INNOVATIVE ACTIONS

SPIRE Baia Mare

SUSTAINABLE USE OF LAND AND NATURE BASED SOLUTIONS

ADAPTIVE PHYTOREMEDIATION AND LANDSCAPING DESIGN PROJECTS FOR THE PILOT SITES

Deliverable O.6.1.1

EUROPEAN UNION

European Regional Development Fund

Author: Codruț PAPINA (URBASOFIA)

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01	15 01 2022	Codruț Papina	URBASOFIA	First Draft
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CONTENT

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EXECUTIVE SUMMARY

O.6.1.1 Adaptive phytoremediation and Landscaping Design projects for the Pilot Sites is the final result of the co-design process deployed within A.6.1 Participatory design of the Baia Mare renatured productive landscapes, and it represents the guiding document for pilot sites ecologic transformation. O6.1.1 encompasses synthetically all the co-design work performed in A6.1. Due to the pandemic specific restrictions, the co-design process deployed in a hybrid approach. Co-design process was completed in October 2021, having a total of 3 stages. First co-design stage had the main aim of introducing local communities in the SPIRE project and the specific co-design process. As a result, a public questionnaire was disseminated online and offline, followed by an initial workshop, discussing problems, necessities, and ideas for all pilot sites. Second co-design stage main aim was to co-elaborate the requirements and design ideas for the creation of technical designs (zoning plan and planting/vegetation plan). The second stage contained a more detailed public questionnaire, followed by a series of three co-design workshops (1 for site Craica, 1 for sites Urbis and Colonia Topitorilor, 1 for sites Romplumb and Ferneziu). Brainstorming and collaborative (creative) activities were organized for the purpose of co-elaboration the designs of the pilot sites. In order to have wide variety of participants, and ensuring creative and open ideas, students from local schools were involved as key actors, alongside residents. The community of Baia Mare was not excluded from the activity, the results of the workshops were communicated and disseminated. The final results of Co-creation Stage 2 were used for the elaboration of D.6.1.3 - Final technical designs for pilot sites. Co-design Stage 3 builds upon the results of the previous two stages and fills in the gaps in the co-creation process, that occurred due to pandemic conditions. More specifically, the main aim of the 3rd stage of workshops is to create a link (emotional, functional, environmental) between the pilot sites and the communities. The main objective was to continue the co-design activities with the collaborative development of solutions for micro-interventions and eventually co-implement them (involve the local communities in the building stage to take ownership of the interventions and value the pilot sites as a result of their endeavours).

O6.1.1 represents a co-design masterplan having embedded a set of actions plans for the management over-time of the 5 pilot sites. Besides the work conducted in A6.1, it also builds upon the work conducted in A6.5 (Plantathlons) and A7.1 Analysis and development of site management application.

The current document present additional measures and some minor modifications to the technical plans developed in D6.1.3. The site works and first stage of planting were completed before the final elaboration of this document. A critical analysis of the situation was conducted, with some modifications needed: additional plant quantities, and planting areas limits adjustments.

METHODOLOGY AND CONTEXT

O.6.1.1 builds upon the results of the co-design process and further details and enriches the technical plans elaborated in D6.1.3 - Final technical designs for pilot sites. Deliverable D6.1.3 was elaborated at a time when pilot site cleaning and preparation work were not fully complete. The vegetation quantities list elaborated for first stage of planting took into consideration the fact that pilot sites are brownfields, historically polluted, having different degree of degradation (debris, stones, unfertile soil). After cleaning, levelling the terrain and freeing the land from invasive vegetation, SPIRE team concluded that the technical plans (D.6.1.3) must be adjusted. Decisions were taken only after site visits for conducting comprehensive analysis of terrain conditions, cleaning works, mapping the existing plants that were kept, assessing the results of first stage of planting (Autumn 2021). O.6.1.1 provides additional areas to be planted and a new list of quantities to be added. Concerning other D.6.1.3 amendments, Colonia Topitorilor encountered some delays in planting the entire range of species, and as mitigation measures, the different plant species were places in Urbis site. The new plants are marked as vegetation samples, and were considered necessary in order to have proper monitoring of all studied species.

O.6.1.1 also contains designs and locations for the micro-interventions co-developed in the Co-design Stage 3. Solutions provided for micro-interventions are replicable, modular, and are using recycled materials. Micro-interventions are detailed in Annex 2 – Micro-interventions designs.

O.6.1.1 objective is to elaborate a final co-design master plan, encompassing valuable results from previous deliverables and activities within A.6.1 - Participatory design of the BM renatured productive landscapes. O.6.1.1 provides a general set of actions/provisions applicable to all sites' maintenance and sustainable transformation and a specific set of actions for each site (for the next 5 years).

Taken all into consideration (past deliverables, objective of the document), Output O.6.1.1 is structed as follows:

- Part I. General context of pilot sites: presenting sites' state, specific character, potential/specific value, target users, challenges encountered.
- Part II. Pilot sites Adaptive Phytoremediation and Landscaping Design projects (general actions / provisions and specific for each site): describing the interventions, zoning, landscaping/design, list of species, and specific set of actions / provisions.
- Annex 1: Technical Plans - Revisions
- Annex 2: Micro-interventions designs (co-design process is reported in D6.1.2)

PART I. GENERAL CONTEXT OF PILOT SITES

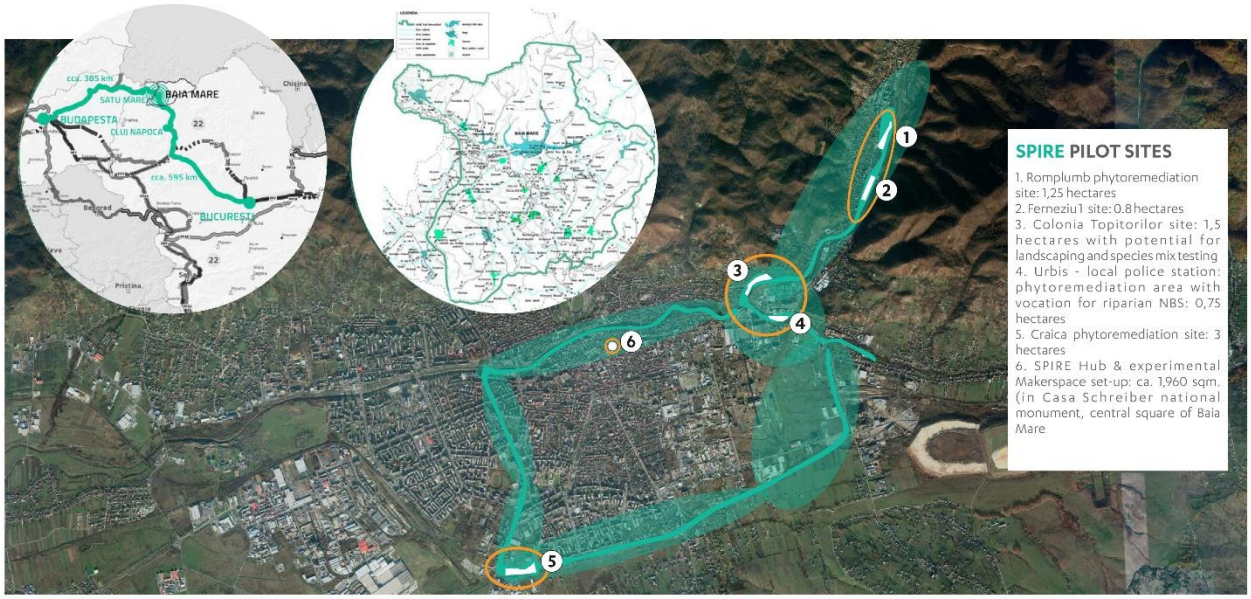

Figure 1 - Location of pilot sites

The pilot sites are located in the peripheral areas of the city, alongside Firiza-Săsar blue-green corridor. The pilot sites have been affected by industrial and mining activities, with concerning levels of contamination (for details check deliverables under A4.3 - Benchmarking).

Starting north to south, the pilot sites are: (1) Romplumb: 1.26 ha, (2) Ferneziu: 0.8 ha, (3) Colonia Topitorilor: 1,5 ha, (4) Urbis: 0.75 ha, (5) Craica: 3 ha (of which approximately 40% being occupied by illegal housing).

The green-blue axis represents an important element in the context of green infrastructure and the system of natural elements within the city. Pilot sites distribution within the city context follows a close relationship with these green-blue axis. Ferneziu site and Romplumb are in close relation with Firiza river, Colonia Topitorilor site is at the confluence of Firiza and Săsar rivers, Urbis site is on the right side of Săsar river, and Craica has a narrow pond that crosses the entire site. **The planting and landscaping work takes highly into consideration the river area, considering ecologic/environmental provisions and design principles. The pilot sites transformation provides suitable vegetation towards the river and a series of nature-observation areas and interaction spaces, that leverages on the natural ambiance of the sites.**

Considering local green infrastructure developments, the municipality has the initiative of planning and designing a set of interventions across Săsar River with the purpose of regenerating the public space

and the natural environment. SPIRE project takes into consideration this initiative, enhancing the green network with the 5 pilot sites to be renatured.

The five pilot sites have the main role of ecologic spaces, for phytoremediation experimentation and biomass production. The sites have the secondary role of ecologic community public spaces, that functions as specialized green facilities for the local neighbourhoods. The sites, due to the specific characteristics of the projects, will not be used as classic public spaces, but nevertheless they represent an important resource for the local communities, to be capitalized accordingly. The sites are made accessible, providing pedestrian paths, access points, minimal ecologic urban-furniture, and a series of interactions spaces.

Romplumb general description

In what concerns location and urban context, Romplumb site is in the northern part of the city, being the most peripheral site. The target groups located in this area are represented by few numbers of residents, from the local neighbourhood south of the site. Excepting cars, the area is being transited by people on bicycles with the destination of Accumulation Lake Firiza.

In what concerns planting and landscaping, the site presents difficult conditions in the north-eastern and eastern part, due to its steep slope. In the southern part, the site has a small hill, that acts as natural landmark, being densely planted with Acer platanoides. Existing valuable vegetation will be kept, especially in lower part of the site towards the river. Romplumb site cleaning works managed to clear the site from invasive vegetation. The soil is considered optimal for Salix and Robinia pseudoacacia (indigenous plants for the site).

Figure 2 - Romplumb site slope areas

Figure 3 – Romplumb site after cleaning works, in the progress of first stage of planting (Autumn 2021)

Ferneziu general description

In what concerns the urban context, Ferneziu site is located in the proximity of a low-density residential area, adjacent to local school: Nicolae Bălcescu. The residents expressed their need for local environmental and landscape improvement of the site. At the moment of the first site analyses, Ferneziu site was considered highly degraded, being completely covered in invasive vegetation, making the site unsafe. During the preparation works, the site was completely cleaned. Initially, SPIRE team did not consider possible (or feasible) to clean the entire site. The possibly of invasive vegetation (Reynoutria japonica) to resurface is high. The site needs constant maintenance in order to ensure proper planting and vegetation growth.

Ferneziu site physical limits represent a challenge, being delimitated by the river corridor on one side, and railway line and above-surface gas pipeline on the other side. For this reason, the site is mainly accessible from the northern part, near the school. The morphology of the terrain represents an advantage, the site being mostly flat.

Figure 4 - Ferneziu site after cleaning works

Figure 5 - Ferneziu site, Miscanthus plants after first stage of planting

Urbis general description

In what concerns the urban context, Urbis site is located adjected to blue-green corridor Săsar river, in the central area of the city. Site is located near important public functions – the Police Department in Baia Mare and Urbis Public Transportation Organization (being also a bus depot). The site can be accessed from the western side through a narrow path, and from central part, from within Urbis bus depot. The site is considered not very visible for people to access it. For this reason, Urbis site will be planted with Salix, having the important role of biomass production. In order to connect the community with the site, and have them use it occasionally, a series of educational and artistic activities are planned with the youth of Baia Mare (the morphology of the terrain and valuable existing vegetation gives the site an impressive natural ambiance, even if it is located in the middle of the city).

In what concerns planting and landscaping work, at the time of the first site analyses (before cleaning and site preparation work), the site was considered heavily degraded and with difficult conditions for planting. At the moment, site works performed better than expected, Urbis site being cleaned from debris and invasive vegetation. Careful maintenance of the site is still needed in order to make sure that invasive vegetation will not resurface.

Figure 6 - Urbis site after cleaning and preparation work

Figure 7 - Urbis site during first stage of planting (Autumn 2021)

Colonia Topitorilor general description

In what concerns urban context, Colonia Topitorilor site is relatively close to the city centre, located at the base of the northern hill of Baia Mare, where starting points for hiking tracks are located. The site is located within a well-developed residential area. The site has the most potential of being transformed into a community public space, due to its location, terrain morphology, and target users.

Similar to Urbis and Ferneziu site, Colonia Topitorilor also presented similar challenges for cleaning and preparation work, in what concerns the invasive vegetation. The site was partially cleaned (with some areas with debris to be removed), and partially planted with Salix. Proper public space ecologic infrastructure is planned for this site. Some of the planting works are on hold, in order to first built the pedestrian tracks, fence (toward the river, due to its steep slope) and lighting infrastructure.

Figure 8 - Colonia Topitorilor site, area planted with Salix viminalis

Figure 9 - Colonia Topitorilor, cleaning and preparation work in progress

Figure 10 - Colonia Topitorilor, steep slope area to be secured with fence

Craica general description

Craica site is also considered a peripheric site, being located in the southern part of the city. The site is delimited by heavily circulated roads, rail line and blue-green corridor. The site is accessible from the western part of the site, through an open field (of which municipal property represents only a narrow strip of land near the railway). Site will be properly signalized and secured, with the help of vegetation alignments. Cleaning and preparation work was difficult due to debris in various areas of the site. The terrain is considered to be degraded, having non-homogenous soil type throughout the site. Overall, the terrain has a slight incline from west to east, with one pit area which was partially levelled, but kept the distinctive morphology. The slope terrain is suitable for Salix, being the area where water is naturally collected.

In what concerns planting and landscaping, after cleaning works and first stage of planting, SPIRE team concluded that some areas could accommodate a higher density of Salix than initially planned in D.6.1.3. Existing valuable vegetation is kept, mostly Salix and Betula pendula. The site has a distinctive natural ambiance, due to river area, existing vegetation, orientation and site morphology. Visual relations of

the site with macro-landscape are important and taken into consideration for planting and location of interaction areas.

Figure 11 - Craica site, Betula pendula cluster. To observe: patches of grass - the terrain is now cleared from debris, but still considered degraded.

Figure 12 - Craica site, slope terrain, Salix planting in progress.

PART II. PILOT SITES ADAPTIVE PHYTOREMEDIATION AND LANDSCAPING DESIGN PROJECTS

SET OF ACTIONS / PROVISIONS (general level)

Phytoremediation and planting. Main objective for all pilot sites is to experiment with phytoremediation processes. As a result, the set of actions/provisions for sites related to planting are the following: (1) replace specimens that do not survive, (2) prioritize Salix for densifying planting areas, (3) make sure that invasive vegetation do not recover and affects valuable planting, (4) if terrain resources and site characteristics allow, try to contain invasive vegetation Reynoutria Japonica in strict limits (future research and potential uses of this plant represent an opportunity).

Stabilization via dynamic cropping. Dynamic cropping is necessary to ensure proper production of biomass. In what concerns the set of actions/provisions for sustainability of pilot sites, is important to adapt the harvesting periods to the plant evolution, assessing the health of vegetation and other external factors (terrain surface coverage level, weather, river-corridor situation). The balance between harvested material and vegetation kept for performing efficient phytoremediation, will be achieved with the help of the municipality trained team.

River corridor improvement. Heavy metal polluted soil has its impact also on water quality. All 5 pilot sites present a strong water component, being located along Săsar river, Firiza river, Craica creek. There is the necessity to have dense plantation towards the river. Salix is considered to be the optimal plant, being a species that thrives in soil that is rich in water. At the same time plantation of river corridors improve the stability of slope terrain. Concerning actions and provisions for sustainability over time of, is important that river corridors are densely planted, and, according to their health and growth, to be harvest not so often as the other areas of the sites.

Habitat and service provision. Besides what is already researched (soil remediation) renaturing the pilot sites will impact the local neighbourhoods in environment in other various ways: air quality, soil stability, biodiversity, local landscape. The set of actions/provisions for site sustainability overtime are: (1) ensure the proper growth of "green curtains", (2) avoid pervious surfaces, (3) keep valuable existing vegetation and maintain it.

Landscape and design. After phytoremediation and biomass production, the secondary role of the pilot site is to be open to the local residents for occasional use. Due to specific requirements and conditions, the pilot sites cannot have the same role and function as a formal public space. Landscaping design and criteria have been elaborated together with the local community. Future user are invited to take part in the co-implementation process. In the end the sites will be used occasionally by local residents for: nature observation, education activities, explorations.

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Romplumb adaptive phytoremediation and landscaping design project (specific set of actions / provisions)

Romplumb proposed vegetation:

Plants	Initial planting plan (D6.1.3)	Revisions (Option 1 minimal aditions)	Revisions (Option 2 comprehensive planting)[1]	Total Option 1	Total Option 2
Acer platanoides	80	0	0	80	80
Robinia pseudoacacia	150	0	0	150	150
Salix alba	100	+180	+900	280	1000
Salix viminalis	100	+500	+1900	600	2000
		Salix 3m planting distance	Salix 1m planting distance		

Romplumb set of actions:

Typology of provisions	Specific set of actions / provisions
Phytoremediation and planting	Entire flat area of the site will be planted and maintained accordingly (Robinia pseudoacacia + Salix alba / Salix viminalis). Out of all 5 sites, Ferneziu site has the highest percentage of Robinia pseudoacacia (proposed for planting). The tree is considered native to the site and relatively resilient to specific soil conditions, which is why phytoremediation capacities will be thoroughly tested.
	Slope ground of the site will be planted with Salix, as much as the terrain and existing valuable vegetation allow.
	Revisions from D6.1.3: New areas with Salix viminalis are proposed, and densification of Salix viminalis and densification of Salix alba
Stabilization via dynamic cropping	Harvesting Robinia pseudoacacia will be possible after the trees develop enough biomass (constant monitoring is being conducted) - harvesting will not be done as often as Salix.
	Ferneziu site is maintaining considerable amounts of the existing vegetation (also due to difficult terrain) which will be harvested periodically for biomass upcycling.
River corridor improvement	Existing valuable vegetation will be kept and protected. In this case, the river is not accessible due to difficult terrain.
Habitat and service provision	none

[1] Plan for Planting in Autumn season 2022 – The exact quantities of planted salix will be updated. Given the degraded state of the terrain, precise estimations cannot be made in advance.

Landscaping and design	Alignment vegetation of Acer platanoides has the purpose of separating the site from the road and providing protection from the highspeed traffic. At the same time the local landscape is improved.
	Micro-interventions are planned to be minimal, using ecologic materials, in several strategic areas of the site. Micro-interventions do not interfere with the natural settings.

Ferneziu adaptive phytoremediation and landscaping design project (specific set of actions / provisions)

Ferneziu proposed vegetation:

Plants	Initial planting plan (D6.1.3)	Revisions (Option 1 minimal aditions)	Revisions (Option 2 comprehensive planting)[2]	Total Option 1	Total Option 2
Betula pendula	30	0	0	30	30
Salix viminalis	250	+750	+4000	1000	5000
Parthenocissus	360	0	0	360	360
Miscanthus	350	0	0	450	450
		Salix 3m planting distance	Salix 1m planting distance		

Ferneziu set of actions:

Typology of provisions	Specific set of actions / provisions
Phytoremediation and planting	Ferneziu site is considered to be one of the most fertile sites for Salix - considering the results after the first stage of planting (summer and autumn 2021). Salix will be planted where possible at a 1-meter distance.
Stabilization via dynamic cropping	Miscanthus growth on contaminated land will be assessed If the plants do not achieve maturity as normal, the site can be completed with new plants, in order to ensure optimal biomass quantity.
River corridor improvement	Valuable vegetation towards the Firiza river will be kept and maintained.
Habitat and service provision	Before site works, the Firiza site was completely covered with invasive and ad-hoc vegetation (mainly Reynoutria japonica, locally known as Urișcă). Site maintenance will ensure that invasive vegetation will not relapse.

[2] Plan for Planting in Autumn season 2022 – The exact quantities of planted salix will be updated. Given the degraded state of the terrain, precise estimations cannot be made in advance.

Landscaping and design	The site is accessible to residents, and the local landscape is improved with the help of vegetation alignment (Betula pendula). Site maintenance will ensure that the meeting/interaction areas are accessible, and vegetation alignment is maintained - seasonal cuttings must not harvest all vegetation, keeping the role of vegetation alignment.

Urbis adaptive phytoremediation and landscaping design project (specific set of actions / provisions)

Urbis proposed vegetation:

Plants	Initial planting plan (D6.1.3)	Revisions (Option 1 minimal aditions)	Revisions (Option 2 comprehensive planting)[3]	Total Option 1	Total Option 2
Salix alba	100	+180	+ 1300	280	1400
Salix viminalis	100	+500	+ 3900	600	4000
Veg.sample - Catalpa	0	4	0	4	4
Veg.sample – Sorbus acuparia	0	4	0	4	4
Veg.sample - Thuja	0	9	0	9	9
Veg.sample – Juniperus horizontalis	0	9	0	9	9
Veg.sample – Prunus laurocerasus	0	9	0	9	9
Veg.sample – Berberis thunbergia	0	9	0	9	9
Veg.sample – Hibiscus	0	25	0	25	25
Veg.sample – Lavanda	0	25	0	25	25
Veg.sample - Iris	0	25	0	25	25
Experimental plots of Salix	0	362	0	362	362
		Salix 3m planting distance	Salix 1m planting distance		

Urbis set of actions:

Typology of actions / provisions	Specific set of actions / provisions
Phytoremediation and planting	Site works managed to clean the majority of the site from invasive vegetation. Urbis contains a series of vegetation samples: Catalpa,

[3] Plan for Planting in Autumn season 2022 – The exact quantities of planted salix will be updated. Given the degraded state of the terrain, precise estimations cannot be made in advance.

	Sorbus acuparia, Thuja sp, Juniperus horizontalis, Prunus laurocerasus, Berberis thunbergi, Hibiscus, Lavanda, Iris, which was planted in the first stage of planting in order to monitor the phytoremediation process. The vegetation samples will not be harvested and will only be monitored in order to assess the plants' capacities. The main added value of the plant selections is that they can be widely used for landscaping works throughout the city.
Stabilization via dynamic cropping	Salix alba and Salix viminalis cover 85% of the site. The Urbis site has the potential of generating important quantities of biomass.
River corridor improvement	Valuable vegetation is be kept, especially in the areas towards the river.
Habitat and service provision	Due to its location and urban context, the Urbis site will not present major artificial interventions, keeping the natural ambience and landscape.
Landscaping and design	Landscaping works in the case of the Urbis site consists of green and unpaved pedestrian paths, with one intervention: meeting place and nature observation area. Due to delays in Colonia Topitorilor planting process, vegetation samples with a wider selection of plants has been arranged on Urbis. The vegetation samples were planted in order to ensure proper monitoring, avoiding further delays. On Urbis site is planned to have experimental Salix Plots (of 365 species), planted at different distance, to assess what method is best for this type of polluted land (process is planned for the second planting stage)

Colonia Topitorilor adaptive phytoremediation and landscaping design project (specific set of actions / provisions)

Colonia Topitorilor proposed vegetation:

Plants	Initial planting plan (D6.1.3)	Revisions (Option 1 minimal aditions)	Revisions (Option 2 comprehensive planting)[4]	Total Option 1	Total Option 2
Salix babilonica	60	0	0	60	60
Frasinus Excelsior	80	0	0	80	80
Catalpa	120	0	0	120	120
Sorbus acuparia	50	0	0	50	50
Pinus nigra	40	0	0	40	40
Thuja sp	40	0	0	40	40
Juniperus	30	0	0	30	30
Salix viminalis	400	+760	+5600	1160	6000
Prunus laurocerasus	40	0	0	40	40

[4] Plan for Planting in Autumn season 2022 – The exact quantities of planted salix will be updated. Given the degraded state of the terrain, precise estimations cannot be made in advance.

Berberis thunbergi	40	0	0	40	40
Hibiscus	40	0	0	40	40
Lavandula	100	0	0	100	100
Iris	50	0	0	50	50
		Salix 3m planting distance	Salix1m planting distance		

Colonia Topitorilor set of actions:

Typology of actions / provisions	Specific set of actions / provisions
Phytoremediation and planting	Colonia Topitorilor site will be planted with the widest range of plant species. In order to have a coherent phytoremediation process, the vegetation will be planted in specific species clusters. Depending on the site conditions, each plant species will be planted to an equal distance from another (see Annex plans for details).
Stabilization via dynamic cropping	The south and the southwest parts of the site are reserved only for Salix viminalis and Salix babilonica, for biomass production. The location is advantageous due to site morphology, the terrain having an increasing slope towards the river.
River corridor improvement	Existing valuable vegetation towards the river will be kept, being important for land stabilization.
Habitat and service provision	Prior to the transformation initiatives triggered by SPIRE, Colonia Topitorilor was considered degraded terrain with invasive vegetation. The transformation process is reintroducing native vegetation, which is performing phytoremediation processes and biomass production.
Landscaping and design	Colonia Topitorilor site will be transformed and given back to the residents, with the main use as ecologic community public space. The interventions planned for site transformation are minimal, with all pervious surfaces and ecologic materials. In contrast to other sites, the landscaping for Colonia Topitorilor will have public lighting infrastructure and systematized pedestrian alleys. The south part of the site, towards the river, will be landscaped with a fence for user protection, given the steep slope.

Craica adaptive phytoremediation and landscaping design project (specific set of actions / provisions)

Craica proposed vegetation:

Plants	Initial planting plan (D6.1.3)	Revisions (Option 1 minimal aditions)	Revisions (Option 2	Total Option 1	Total Option 2

			comprehensive planting)[5]		
Betula pendula	150	0		150	150
Salix alba	150	+350	+1850	500	1600
Salix viminalis	300	+500	+3700	800	4000
Miscanthus	100	0		400	400
		Salix 3m planting distance	Salix 1m planting distance		

Craica set of actions:

Typology of actions / provisions	Specific set of actions / provisions
Phytoremediation and planting	Craica site is considered a terrain with various degrees of degradation (areas with stone, areas with debris illegally deposited). Some areas of the sites are considered areas with good soil for planting. Salix is planted where terrain permitted. Supplementation of Salix will be done as much as the terrain permit, but respecting the 1m minimum distance between plants.
Stabilization via dynamic cropping	Craica terrain present a series of slopes, towards the river and within the terrain (in the middle of the site). The slopes are to be stabilized with Salix (especially near the river).
River corridor improvement	River corridor is improved with an alignment of Salix and Betula pendula. Depending on the evolution of the plants, additional Salix may be needed (respecting minimum distance of 1m).
Habitat and service provision	Site is heavily affected from historic pollution and debris. Local residents deposited illegally debris and other waste on the site. The situation is considered to be under control at the moment – security measures being implemented (constant surveys of local police). In contrast to the other sites, Craica was not affected by invasive vegetation (only locally, towards the river).
Landscaping and design	Natural ambiance of the site (despite of debris and illegal waste disposal), is considered valuable and intended to be kept. As a result, the site will not have arranged pedestrian alleys or major man-made interventions. With constant maintenance the site is easily accessible.

[5] Plan for Planting in Autumn season 2022 – The exact quantities of planted salix will be updated. Given the degraded state of the terrain, precise estimations cannot be made in advance.

CONCLUSIONS

O6.1.1 Adaptive phytoremediation and Landscaping Design projects, represents the main output of Activity 6.1 Participatory design of the Baia Mare renatured productive landscape. It encompasses all progress of co-creation work and research analyses conducted in WP4 and WP6, representing the main document that ensures the sustainability and proper management of pilot sites, during and after SPIRE project implementation.

From the point of view of utility of the document, O6.1.1 is considered to be hybrid, providing set of actions and provisions for pilot sites, and encompassing the final designs (and potential locations) for micro-interventions.

During SPIRE implementation process, O6.1.1 is:

- Guiding the following stages of planting, and community work to be performed within Plantathlons events.
- Ensuring the proper transformation of pilot sites in relation to phytoremediation principles, feasible biomass production, river corridor requirements, ecologic function, requirements provided by local residents involved in the co-creation process.
- Providing set of options for micro-interventions, in the form of small-scale ecologic urban furniture (to be realized with the help of local actors).

After SPIRE implementation process is complete, the project will continue, managed by the local urban authority and local residents. Within project framework, capacity building and transfer on instruments is being complete. O6.1.1 will help with sustainability over time by:

- Providing set of actions and provisions for phytoremediation and vegetation management.
- Providing set of principles for blue-green corridor improvement.
- Providing set of guidelines/recommendations for proper establishment of habitat services.
- Providing options for ecologic public space transformation.

O6.1.1 - Adaptive Phytoremediation and Landscaping Design projects for the Pilot Sites marks the finalization of co-design work performed in SPIRE project. It is an integral part of the project results, both an operational document for site management and important research output, that encompasses synthetically the results of work performed with local citizens –the design outputs being in the form of Technical Plans (see Annex 1 - revised from the elaborated D6.1.3) and Micro-interventions Designs (see Annex 2 – representing the outcomes of last set of co-design workshop).

Another important purpose of the current document is its exploitation of set of actions and provisions, for other contaminated sites around Baia Mare, within the metropolitan area. The elaboration of the metropolitan strategy () will follow after the deployment of this document. The interested municipalities that want to replicate SPIRE experimentation will use this document of establishing their own guidelines for site provision, under overarching guidelines for phytoremediation that will come SPIRE experts.

O6.1.1 – ANNEX 1

TECHNICAL PLANS – REVISIONS

1 Romplumb Pilot Site – Technical Plans (planting) Revision

2 Ferneziu Pilot Site – Revision – Technical Plans (planting) Revision

3 Colonia Topitorilor Pilot site – Technical Plans (planting) Revision

4 Urbis Pilot Site – Technical Plans (planting) Revision

SPIRE BAIA MARE – TECHNICAL PLAN – PILOT SITE ROMPLUMB

ZONING AND PLANTING PLAN – AS A RESULT OF CO-CREATION PROCESS

DATE

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REVISIONS
Salix viminalis (ocasional nests)
"nests" complete the existing valuable vegetation where possible
min 25 pc

REVISIONS
Salix viminalis (approx 180m2)
cluster - approx. dist. 3m/1m
+25 pc

REVISIONS
Salix viminalis (approx 440m2)
cluster - approx. dist. 3m/1m
+50 pc

REVISIONS
Salix viminalis (approx 160m2)
"nests" complete the existing valuable vegetation where possible
min 25 pc

25 pc
25 pc
100 pc
50 pc
25 pc
50 pc
40 pc
150 pc
30 pc
15 pc
20 pc
20 pc
40 pc
50 pc

56
13
36.5
11
6
35
16
31
12
60.5
3.5
85
2
120
8.5
27
5
14
40.5
22.5
43
11

mountain bike track
Safe area
Nature observation area (approx 30m2)
Entrance (for mountain bikes)
Entrance (pedestrian)
Pedestrian green path
Relaxation/socializing and picnic table area (approx 90m2)
Mountain bike track
Entrance (pedestrian)
Entrance (for mountain bikes)

Salix alba (aprox 840m2)
cluster - approx. dist. 3m/1m

Salix alba (approx 280m2)
cluster - approx. dist. 3m/1m

Acere platanoides (approx 40 pc)
veg. alignment - approx. dist. 5m

Robidia pseudoacacia (approx 900m2)
cluster - approx. dist. 3m

Salix viminalis (approx 460m2)
veg. alignment - approx. dist. 3m/1m

Salix viminalis (approx 300m2)
veg. alignment - approx. dist. 3m/1m

Salix alba (approx 150m2)
cluster - approx. dist. 3m/1m

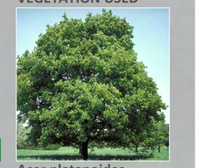
REVISIONS
Salix viminalis
"nests" complete the existing valuable vegetation where possible
min 25 pc

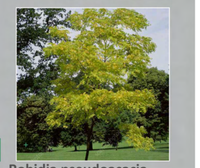
REVISIONS
Acere platanoides (ocasional nests)
"nests" complete the existing valuable vegetation
min 40 pc

Salix viminalis (approx 160m2)
cluster - approx. dist. 3m/1m

REVISIONS
Salix viminalis (approx 500m2)
cluster - approx. dist. 3m/1m
+50 pc

VEGETATION USED


Acer platanoides


Robidia pseudoacacia


Salix alba

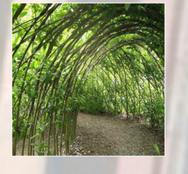
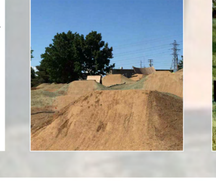

Salix viminalis

rev. +200 PC

INFORMATION ABOUT PILOT SITE

Romplumb site has the advantage of having an important share of land flat terrain. The other part of the site has a steep slope towards the river, hard to access but having some important tall vegetation to be kept. Planting in the slope areas is to be done where is possible, inserting small clusters/nests of salix. The southern part of the site has a 3-4 meters hill, with tall vegetation, having the potential as a local landmark, due to its composition and landscape, and also has the potential of becoming a local landmark for mountain bikers (many cross this route on the way to the dam and the lake in the northern part of Baia Mare). The potential activities for this site, according to the community could be a picnic table/relaxing area for the bikers on their road to the lake, a small area for nature observations, a bike and pedestrian path. The vegetation must offer protection from the cars on the road (especially when this side of the road has no sidewalk).

AMBIANCE - RESULTS OF COMMUNITY WORKSHOPS


QUANTITIES - LIST

	INITIAL PLANTING PLAN	REVISION (OCT 2021) ADDITIONS Option 1 - Salix aprox 3m distance	REVISION (OCT 2021) ADDITIONS Option 2 - Salix aprox 1m distance	Total Option 1	Total Option 2	STATUS (OCT 2021)
Acer platanoides	80 pc	0 pc	0 pc	80 pc	80 pc	4 out of 80
Robidia pseudoacacia	150 pc	0 pc	0 pc	150 pc	150 pc	4 out of 150
Salix alba	100 pc	+40 pc	+180 pc	140 pc	280 pc	0 out of 140/280
Salix viminalis	100 pc	+200 pc	+500 pc	300 pc	600 pc	0 out of 300/600

format 594x841mm
scale 1 500

SPIRE BAIA MARE – TECHNICAL PLAN – PILOT SITE FERNEZIU

ZONING AND PLANTING PLAN – AS A RESULT OF CO-CREATION PROCESS

DATE

EUROPEAN UNION
European Regional Development Fund

UIA URBAN INNOVATIVE ACTIONS

INFORMATION ABOUT PILOT SITE

Fernezíu site is located near Nicolae Bălcescu school, in an area of low-density individual housing. The sense of community is very strong, the area having a rural ambiance. The specific landscape is dominated by the hill on the east side.
The Fernezíu site represented a degraded terrain, with spontaneous vegetation, impossible to access, creating a limit between the houses, and the river.
The local landscape can be improved, the alignment of vegetation proposed having the role of a green screen, and the new nests of salix planted, creating a unitary landscape.
The activities for this site are related to the nearby school, and the local community, creating an area where students can meet and have educational and nature observation activities.

AMBIANCE - RESULTS OF COMMUNITY WORKSHOPS

QUANTITIES - LIST

	INITIAL PLANTING PLAN	REVISION (OCT 2021) ADDITIONS Option 1 - Salix 3m distance	REVISION (OCT 2021) ADDITIONS Option 2 - Salix 1m distance	Total Option 1	Total Option 2	STATUS (OCT 2021) ADDITIONS
Betula pendula	30 pc	0 pc	0 pc	30 pc	30 pc	15 out of 30
Salix viminalis	250 pc	+270 pc	+750	520 pc	1000 pc	250 out of 520/1000
Parthnocissus	360 pc	0 pc	0 pc	100 pc	100 pc	complete
Miscanthus	350 pc	+100 pc	0 pc	450 pc	450 pc	100 out of 450

SET OF ACTIONS

format 594x841mm
scale 1 500

SPIRE BAIA MARE - TECHNICAL PLAN - PILOT SITE COLONIA TOPITORILOR

ZONING AND PLANTING PLAN - AS A RESULT OF CO-CREATION PROCESS

DATE

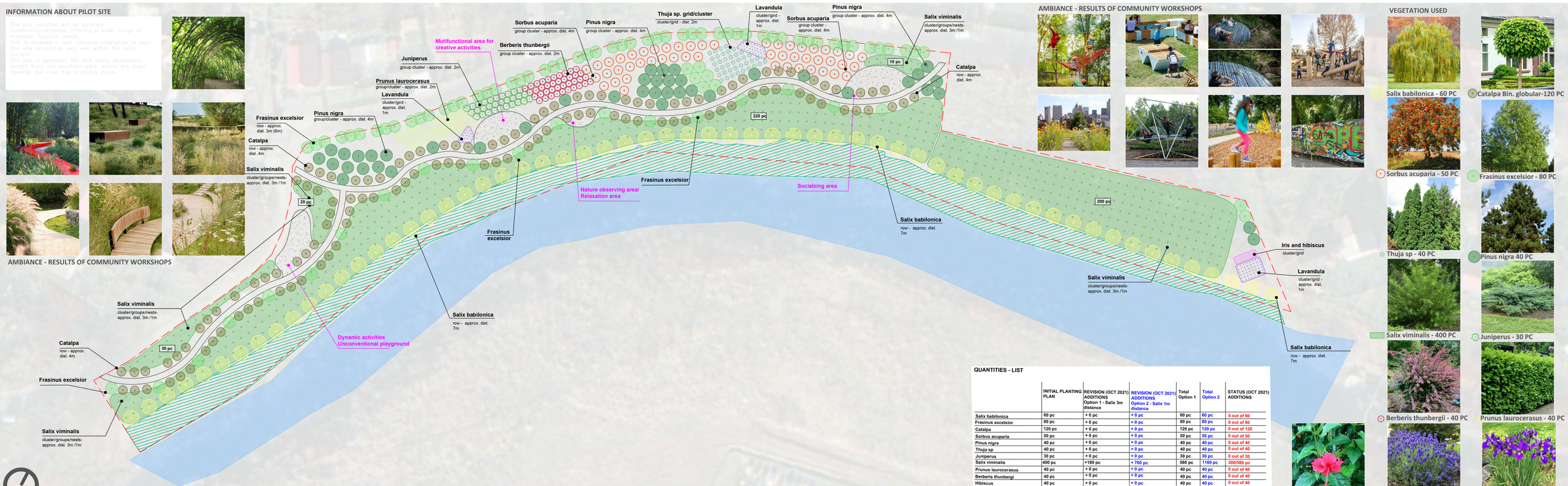
EUROPEAN UNION
European Regional Development Fund

UIA URBAN INNOVATIVE ACTIONS

INFORMATION ABOUT PILOT SITE

The site vocation will be strongly community-oriented, offering a wider range of thematic function areas.
Site is cleared - just valuable vegetation is kept.
The site integrates very well within the local context.
The site is generally flat and easily accessible, except from the southern part, where the slope towards the river has a strong slope.

AMBIANCE - RESULTS OF COMMUNITY WORKSHOPS



VEGETATION USED

Salix babilonica - 60 PC

Catalpa Bin. globular-120 PC

Sorbus acuparia - 50 PC

Frasinus excelsior - 80 PC

Thuja sp - 40 PC

Pinus nigra 40 PC

Salix viminalis - 400 PC

Juniperus - 30 PC

Berberis thunbergii - 40 PC

Prunus laurocerasus - 40 PC

Hibiscus - 40 PC

Lavandula - 100 PC

Iris - 50 PC

QUANTITIES - LIST

	INITIAL PLANTING PLAN	REVISION (OCT 2021) ADDITIONS Option 1 - Salix 3m distance	REVISION (OCT 2021) ADDITIONS Option 2 - Salix 1m distance	Total Option 1	Total Option 2	STATUS (OCT 2021) ADDITIONS
Salix babilonica	60 pc	+ 0 pc	+ 0 pc	60 pc	60 pc	0 out of 60
Frasinus excelsior	80 pc	+ 0 pc	+ 0 pc	80 pc	80 pc	0 out of 80
Catalpa	120 pc	+ 0 pc	+ 0 pc	120 pc	120 pc	0 out of 120
Sorbus acuparia	50 pc	+ 0 pc	+ 0 pc	50 pc	50 pc	0 out of 50
Pinus nigra	40 pc	+ 0 pc	+ 0 pc	40 pc	40 pc	0 out of 40
Thuja sp	40 pc	+ 0 pc	+ 0 pc	40 pc	40 pc	0 out of 40
Juniperus	30 pc	+ 0 pc	+ 0 pc	30 pc	30 pc	0 out of 30
Salix viminalis	400 pc	+180 pc	+ 760 pc	580 pc	1160 pc	200/580 pc
Prunus laurocerasus	40 pc	+ 0 pc	+ 0 pc	40 pc	40 pc	0 out of 40
Berberis thunbergi	40 pc	+ 0 pc	+ 0 pc	40 pc	40 pc	0 out of 40
Hibiscus	40 pc	+ 0 pc	+ 0 pc	40 pc	40 pc	0 out of 40
Lavandula	100 pc	+ 0 pc	+ 0 pc	100 pc	100 pc	0 out of 100
Iris	50 pc	+ 0 pc	+ 0 pc	50 pc	50 pc	0 out of 50

format 420x1094mm
scale 1 500

SPIRE BAIA MARE – TECHNICAL PLAN – PILOT SITE URBIS

ZONING AND PLANTING PLAN – AS A RESULT OF CO-CREATION PROCESS

DATE

EUROPEAN UNION
European Regional Development Fund

UIA URBAN INNOVATIVE ACTIONS

N

VEGETATION USED

Salix alba

Salix viminalis

VEGETATION SAMPLES - FOR PHYTOREMEDIATION MONITORING

Catalpa (4PC) · Sorbus acuparia (4PC) · Thuja (9PC) · Juniperus horizontalis (9PC) · Prunus laurocerasus (9PC) · Berberis thunbergi (9PC) · Hibiscus (25PC) · Lavanda (25PC) · Iris (25PC)

REVISIONS
Salix viminalis (approx 1400m2)
cluster - approx. dist. 3m/1m
165 pc

REVISIONS
Salix viminalis (approx 200m2)
cluster - approx. dist. 3m/1m
25 pc

25 pc

Salix viminalis (approx 1100m2)
cluster - approx. dist. 3m/1m

Nature observation area

Secondary pedestrian green path

Main pedestrian green path

Entrance (pedestrian)

1 Entrance (pedestrian) · 2 Main pedestrian green path · 3 Secondary pedestrian green path · 4 Nature observation area

165 pc · 25 pc · 100 pc · 400 pc · 170 pc · 98 pc · 66 pc · 28 pc

EXPERIMENTAL PLOT Salix - planted 50 cm distance

EXPERIMENTAL PLOT Salix - planted 75 cm distance

EXPERIMENTAL PLOT Salix - planted 100 cm distance

EXPERIMENTAL PLOT Salix - planted 150 cm distance

REVISIONS
Salix viminalis (approx 2700m2)
cluster - approx. dist. 3m/1m
+400 pc

INFORMATION ABOUT PILOT SITE

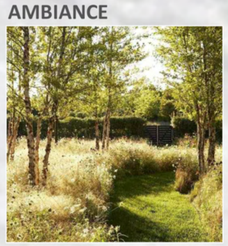
Urbis site is one of the most difficult sites to open to the public, due to location, proximities, and difficult terrain.

Nevertheless, activities such as nature observations, educational small-scale events, birdwatching, are possible - the site has a powerful natural ambiance, due to tall pines and the fast-running river.

The entry is made from the Urbis SA site. The flat area and mild slope of the site are planted with Salix alba and Salix viminalis.

The main function of the site, besides phytoremediation, is biomass production.

AMBIANCE



QUANTITIES - LIST

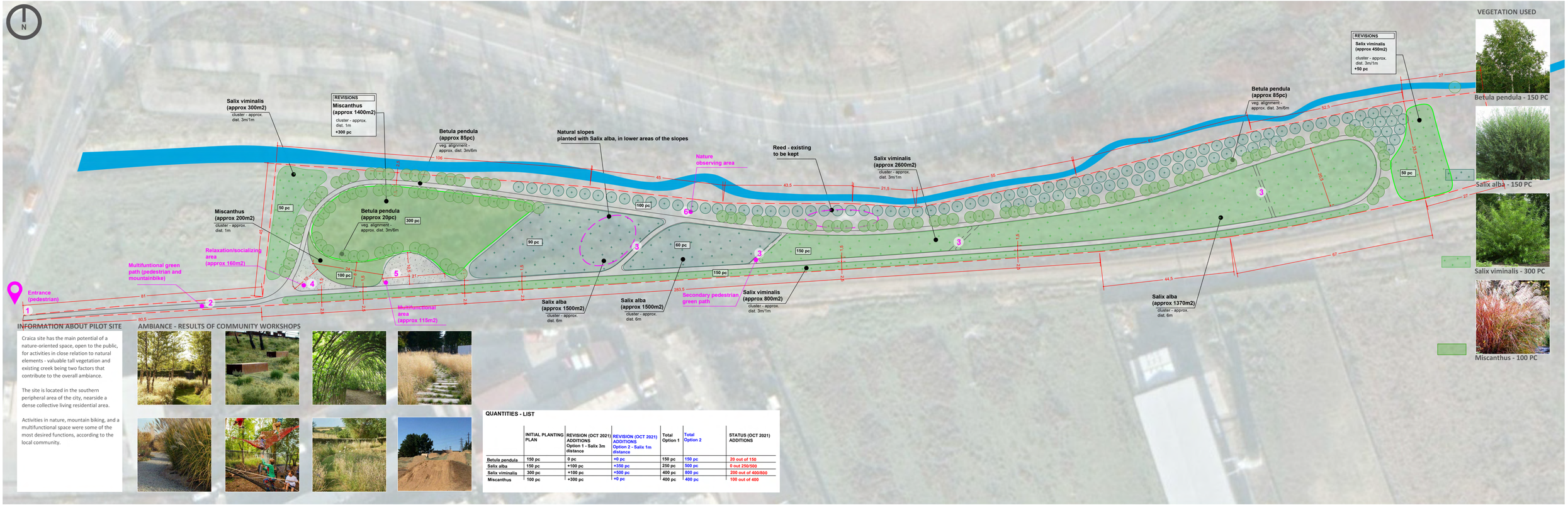
	INITIAL PLANTING PLAN	REVISION (OCT 2021) ADDITIONS Option 1 - Salix 3m distance	REVISION (OCT 2021) ADDITIONS Option 2 - Salix 1m distance	Total Option 1	Total Option 2	STATUS (OCT 2021) ADDITIONS
Salix alba	50 pc	+115 pc	+ 280 pc	165 pc	330 pc	0 out of 165/330
Salix viminalis	100 pc	+425 pc	+ 950 pc	525 pc	1050 pc	0 out of 525/1050
Salix viminalis (experimental plots)	0 pc	+ 362 pc	+ 950 pc + 362 pc		362 pc	

format 420x594mm
scale 1 500

SPIRE BAIA MARE – TECHNICAL PLAN – PILOT SITE CRAICA

ZONING AND PLANTING PLAN – AS A RESULT OF CO-CREATION PROCESS

DATE



VEGETATION USED

Betula pendula - 150 PC

Salix alba - 150 PC

Salix viminalis - 300 PC

Miscanthus - 100 PC

INFORMATION ABOUT PILOT SITE

Craica site has the main potential of a nature-oriented space, open to the public, for activities in close relation to natural elements - valuable tall vegetation and existing creek being two factors that contribute to the overall ambiance.

The site is located in the southern peripheral area of the city, nearside a dense collective living residential area.

Activities in nature, mountain biking, and a multifunctional space were some of the most desired functions, according to the local community.

AMBIANCE - RESULTS OF COMMUNITY WORKSHOPS

QUANTITIES - LIST

	INITIAL PLANTING PLAN	REVISION (OCT 2021) ADDITIONS Option 1 - Salix 3m distance	REVISION (OCT 2021) ADDITIONS Option 2 - Salix 1m distance	Total Option 1	Total Option 2	STATUS (OCT 2021) ADDITIONS
Betula pendula	150 pc	0 pc	+0 pc	150 pc	150 pc	20 out of 150
Salix alba	150 pc	+100 pc	+350 pc	250 pc	500 pc	0 out 250/500
Salix viminalis	300 pc	+100 pc	+500 pc	400 pc	800 pc	200 out of 400/800
Miscanthus	100 pc	+300 pc	+0 pc	400 pc	400 pc	100 out of 400

format 420x1094mm
scale 1 500

O6.1.1 - ANNEX 2

MICRO-INTERVENTIONS DESIGN

1 SPIRE Totem – Micro-intervention design

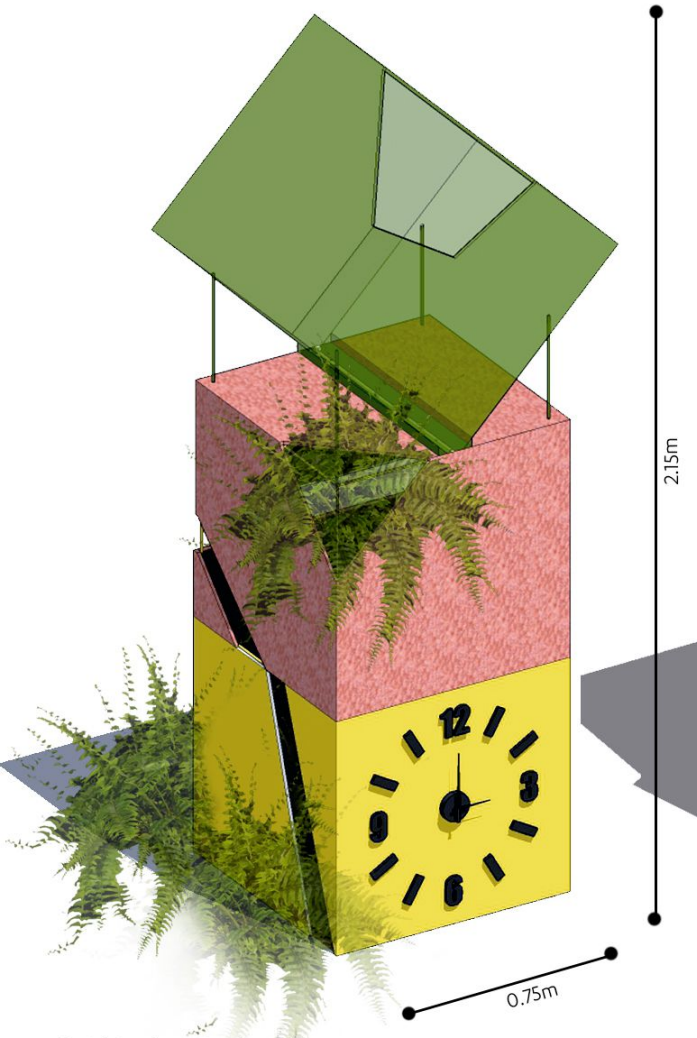
2 Modular Bench Social Interaction Space

3 Sitting Area Made of Recycled Biomass

4 Recycled Materials Micro-interventions

MICRO-INTERVENTIONS DESIGN 1

SPIRE TOTEM OPTION 1



SPIRE TOTEM OPTION 2

DESCRIPTION OF THE DESIGN

SPIRE TOTEM 1

Attendees to the 3rd co-design workshop created a deconstructed symbol, with the function of a clock. The message the attendees tried to convey is that the the passage of time is inevitable, and our mistakes, of the society we form, cannot be reversed. Alternative remedies must be found.

The totem is composed of three sectioned cubes, which represent a pervious and translucid structure, allowing vegetation to grow within it. The middle cube is intended to be canvas for artwork.

SPIRE Totem represents a specific landmark encompassing the project essence, having the function to mark key areas of the site.

SPIRE TOTEM 2

Attendees to the 3rd co-design workshop created a symbol of Baia Mare past industrial activities and SPIRE journey. The SPIRE totem contains three distinct stages, representing the context of Baia Mare history and identity: (1) the base is a black cube, made of steel, representing past mining and metallurgic industry; (2) the middle module is the community of Baia Mare, youth, elders, families, workers. They stand in the middle of all; (3) the third module on top (made of wood) represent the new green identity and the more ecologic future of Baia Mare.

LIST OF MATERIALS / DESCRIPTION OF INTERVENTION

SPIRE totems are 0.75 m wide and 2.15 m high, made of a wooden frame. Depending on the design chosen, the faces of the cube will be plated with steel (corten), or translucid materials.

SPIRE TOTEM 1

Wood frame = 30m (40x40mm profile)
Steel sheets = 2,5 sqm (1750x1750mm for 1 sheet)
Timber = 2,5 sqm
Foundation = concrete bricks (400 x 200 x 195 mm)
Paint = 12 spraycans
Other materials: nails, screws, angles

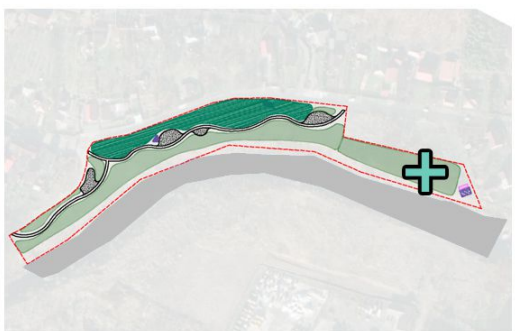
SPIRE TOTEM 1

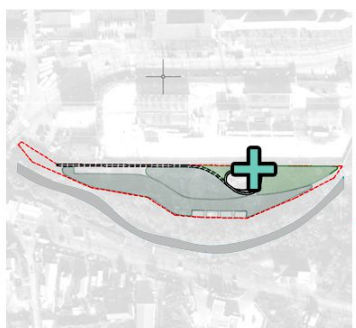
Wood frame = 30m (40x40mm profile)
Steel sheets = 5sqm (1750x1750mm for 1 sheet)
Timber = 2,5 sqm
Foundation = concrete bricks (400 x 200 x 195 mm)
Paint = 12 spraycans
Other materials: nails, screws, angles

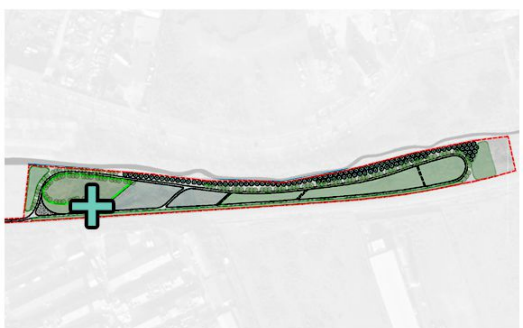
POTENTIAL LOCATIONS


ROMPLUMB


FERNEZIU

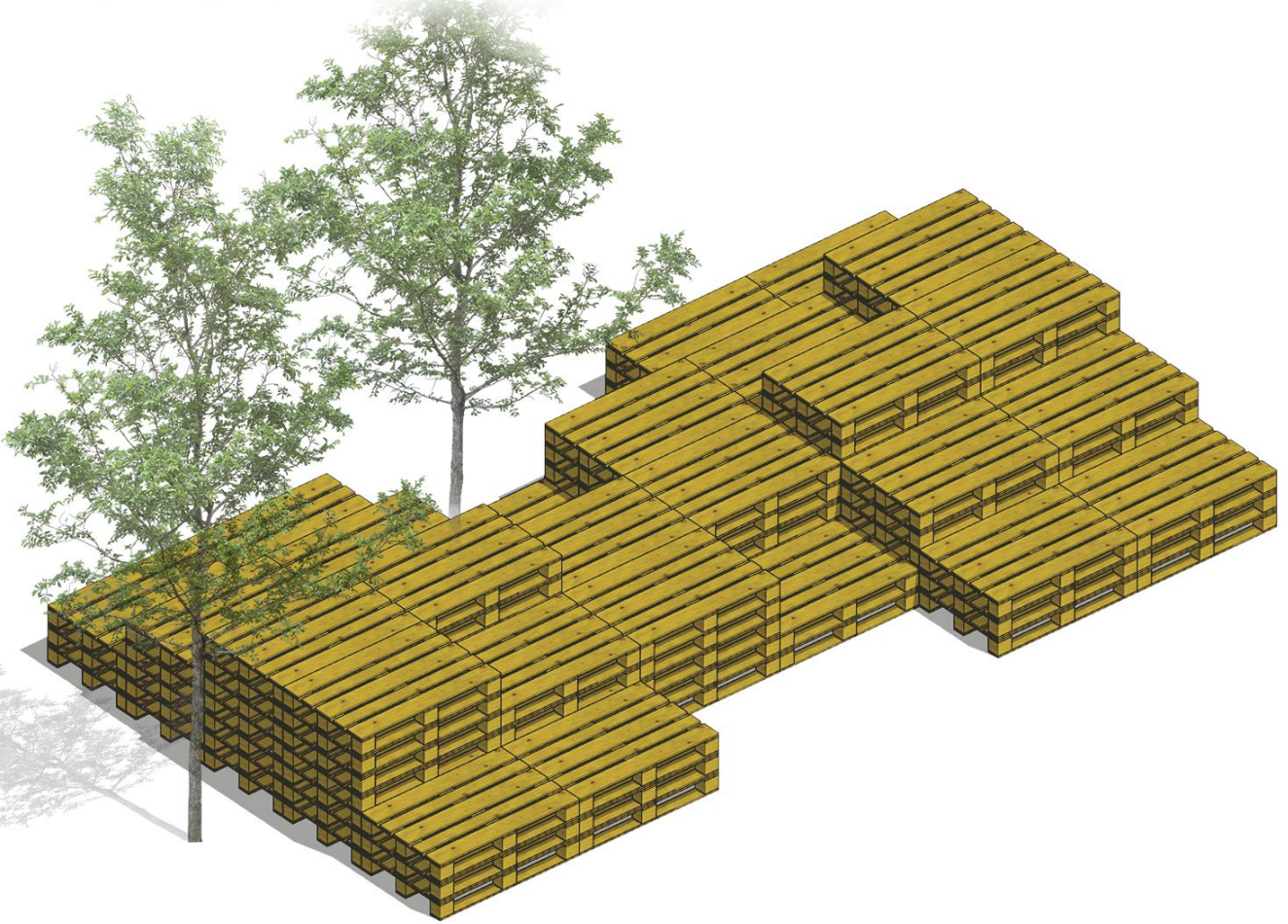

COLONIA TOPITORILOR


URBIS


CRAICA

MICRO-INTERVENTIONS DESIGN 2

MODULAR BENCH - SOCIAL INTERACTION SPACE



DESCRIPTION OF THE DESIGN

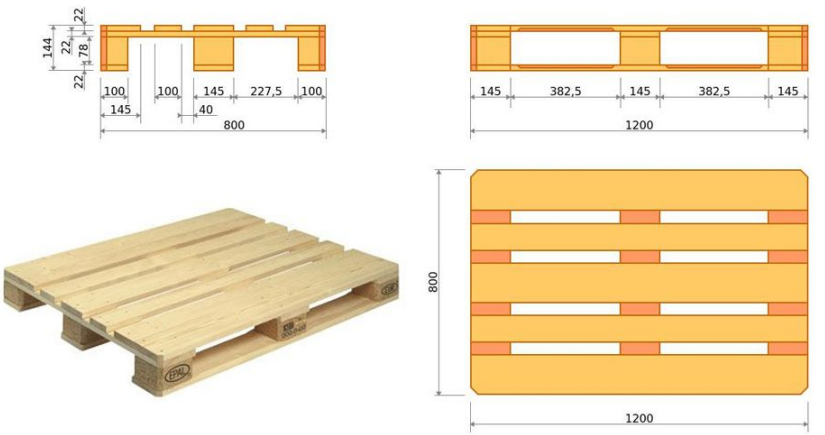
Attendees to the 3rd co-design workshop, designed a modular bench, made of recycled urban pallets. The design provides different options for resting, relaxation and social interaction. The sitting areas are on two different levels. The possibly of combining plants in the design is an option. The bench can provide openings through which the vegetation can grow.
This bench concept allows for multiple designs and spaces combinations. The scale can be reduced or increased depending on the necessities and the site requirements.

LIST OF MATERIALS / DESCRIPTION OF INTERVENTION

Option 1 - large scale design = total of 115 pallets
Option 2 - medium scale design = total of 80 pallets
Option 3 - small scale design = total of 40 pallets

Pallet standard dimension = 1200 x 800 x 145 mm

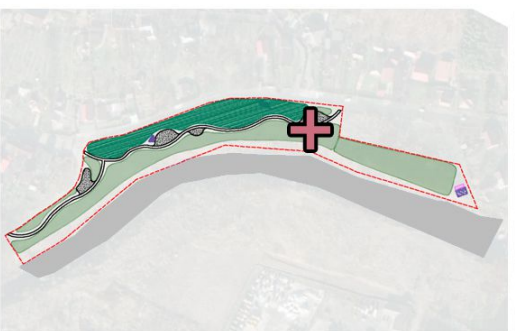
Other materials = nails, screws, angle fittings, varnish paint, sandpaper



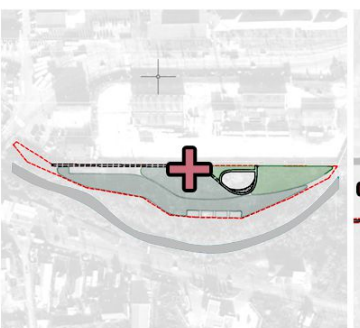
POTENTIAL LOCATIONS

ROMPLUMB

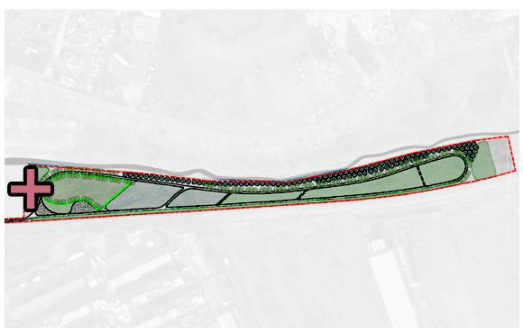
FERNEZIU



COLONIA TOPITORILOR



URBIS



CRAICA

MICRO-INTERVENTIONS DESIGN 3

SITTING AREA MADE OF RECYCLED BIOMASS

DESCRIPTION OF THE DESIGN

Attendees to the 3rd co-design workshop provided a series of micro-interventions options built recycled biomass and/or hay (or similar subtitute). The solution represents a easy sollution of upscalling harvested biomass directly on site.

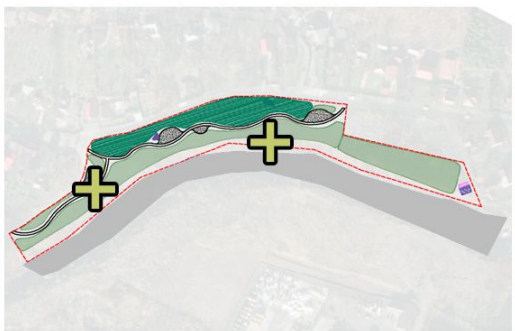
LIST OF MATERIALS / DESCRIPTION OF INTERVENTION

Wooden pallet table = total of 8 palets
Pallet standard dimension = 1200 x 800 x 145 mm
Other materials = string, textile

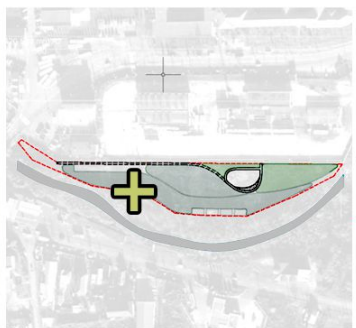
POTENTIAL LOCATIONS

ROMPLUMB

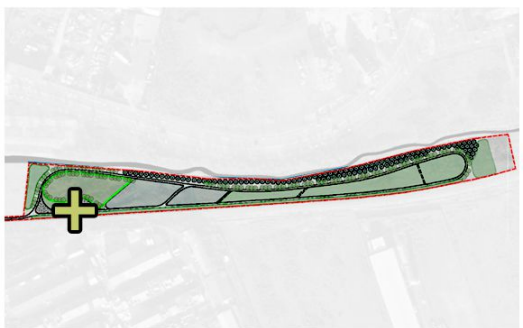
FERNEZIU



COLONIA TOPITORILOR



URBIS



CRAICA

MICRO-INTERVENTIONS DESIGN 4

RECYCLED MATERIALS MICRO-INTERVENTIONS

DESCRIPTION OF THE DESIGN

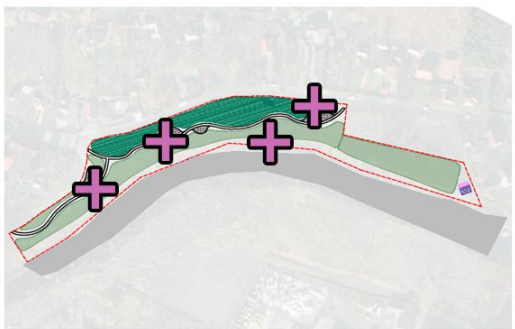
Part of the attendees to the 3rd co-design workshop did not focus on one detailed object, but instead they provided a series of sketches for a wide variety of potential interventions, that can be replicated in different contexts. The options are: (1) table made from wood barrel; (2) wooden table integrated around a tree; (3) recycled tires as benches or unconventional playgrounds; (4) sitting area from hay or recycled biomass; (5) hammocks placed among the trees.

These micro-interventions designs can change and adapt according to the available recycled resources. The final product will be subject to co-implementaion the interventions with future users of the pilot sites.

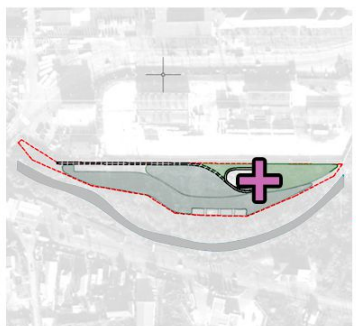
POTENTIAL LOCATIONS

ROMPLUMB

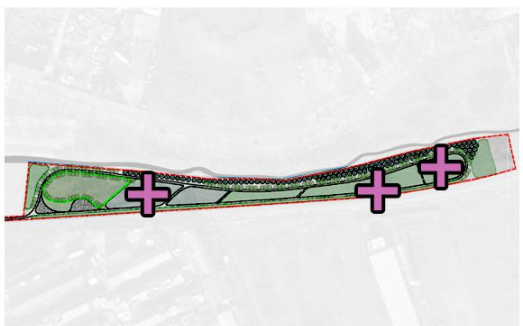
FERNEZIU



COLONIA TOPITORILOR



URBIS



CRAICA