D 5.1.

5 Co-designed infrastructural demonstration plans

28th February 2023 (M18)

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Responsible partner: **Queen's University Belfast (QUB)**

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 101003818.

DOCUMENT DETAILS

Title:	5 Co-designed infrastructural demonstration plans
Annexes:	Annexure D5.1 Design Plans contains the design plans for the five NBS demonstration cities (Budapest, Breda, Maribor, Katowice and Belfast). Included are: the final designs of the demonstration sites in Maribor and Belfast; the conceptual designs for the five NBS sites in Katowice; the final design for the Breda demonstration site, along with the design guide; and the final designs for the three main demonstration sites and design guide for raingardens in Budapest (BP18).

Deliverable No.:	D 5.1.
Work Package:	5
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RE	Restricted to a group specified by the consortium (including Commission Services)	
CO	Confidential, only for members of the consortium (including Commission Services)	

DOCUMENT HISTORY

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1.	25/05/2022	QUB	Jennifer McKinley, Emma Campbell, Bakul Budhiraja	First draft report was sent to demonstration (demo) cities for review

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2.	6/12/2022	QUB	Jennifer McKinley, Emma Campbell, Bakul Budhiraja	Updated report in discussion with demo cities and LEITAT
3.	9/01/2023	QUB	Jennifer McKinley, Emma Campbell, Bakul Budhiraja	Final report sent to demo cities for review
4.	28/02/2023	QUB, Belfast council, BP18, BREDA, RRA-PODRAVJE, Katowice City	Jennifer McKinley, Emma Campbell, Bakul Budhiraja	Review responses incorporated into the deliverable
5.	31/03/2023	QUB	Jennifer McKinley, Emma Campbell, Bakul Budhiraja	Updated report followed by responses from Cities
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9.	26/09/2023	QUB	Cite as McKinley, J.M, Campbell, E., Budhiraja, B., Cullen, S., Cox, S. Ogle, N., Newell, J., Doherty, R., Keeffe, G.	Final revised report

ACRONYMS AND ABBREVIATIONS TABLE

Acronym / Abbreviation	Meaning
E-Institute	E-ZAVOD, ZAVOD ZA PROJEKTNO SVETOVANJE, RAZISKOVANJE IN RAZVOJ CELOVITIH RESITEV
UNIPASSAU	UNIVERSITAT PASSAU
ICS	INSTITUTE OF COMMUNICATION STUDIESSKOPJE
LEITAT	ACONDICIONAMIENTO TARRASENSE ASSOCIACION
GCE	UNIVERSITEIT ANTWERPEN
PATRAS	DIMOS PATREON
POR	POR CONSULT DOO ZA POSLOVNO SAVJETOVANJE
PRATO	COMUNE DI PRATO
AITIIP	FUNDACION AITIIP
OC	OPENCONTENT SOCIETA COOPERATIVA

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Belfast Council	Belfast City Council
BURST	BURST NONPROFIT KFT
ICLEI	ICLEI EUROPASEKRETARIAT GMBH
RRA-PODRAVJE	REGIONALNA RAZVOJNA AGENCIJA ZA PODRAVJE – MARIBOR
BOKU	UNIVERSITAET FUER BODENKULTUR WIEN
BP18	BUDAPEST FOVAROS XVIII. KERULET PESTSZENTLORINC-PESTSZENTIMRE ONKORMANYZATA
BREDA	GEMEENTE BREDA
BeeoDiv	BEEODIVERSITY
QUB	THE QUEEN'S UNIVERSITY OF BELFAST
33OPERATE	FONDAZIONE OPERATE
UniLeeds	UNIVERSITY OF LEEDS
IETU	INSTYTUT EKOLOGII TERENOW UPRZEMYSLOWIONYCH
Katowice City	KATOWICE - MIASTO NA PRAWACH POWIATU

EC	European Commission
GA	Grant Agreement
M no.	Month e.g., 1 of project implementation
NBS	Nature Based Solutions
EU	European Union
KPI	Key performance indicator

1 Executive Summary of Deliverable

1.1 Purpose and Scope

Presentation of the deliverable purpose and conjunction with the UPSURGE objectives (see GA, Annex I Part B, page 8) and WP objectives (see GA, Annex I, Part A, before each WP).

The main objective of Work Package 5 (WP5) is to demonstrate, simulate and verify different fit-for-problem NBS and their effects in different urban environments through five infrastructural Nature Based Solutions (NBS) demonstrations. WP5 is led by Queen's University Belfast (QUB) in collaboration with project partner LEITAT and the five demonstration cities, Budapest, Hungary, Breda, Netherlands (NL), Belfast, United Kingdom UK), Maribor, Slovenia and Katowice, Poland with support from city partners, E-Institute, UniLeeds, Burst and IETU.

The demonstration cities differ in climate types (e.g., Katowice with temperate humid continental climate vs. Belfast with oceanic climate), population sizes (e.g., Maribor with 100.000 vs. Budapest with 1.73 million inhabitants), density (e.g., Maribor with 794 inhabitants/km^2 vs. Belfast with 2.961 inhabitants/km^2) and development rate. The demonstrations are designed in parallel, meaning that one UPSURGE demo city is adjusting and implementing in UPSURGE an NBS type that has previously been implemented in another UPSURGE partner's city, providing results for comparative analysis of the NBS interventions and (dis)proving their

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replication dimension and appropriateness for wider upscaling. Reflecting on the wide range of contexts, the city will implement different NBS interventions within the wider contexts of cities' regenerative policies. This approach is necessary to verify the transferability, suitability, upscaling, trade-off potential, acceptance, and effects of different NBS implemented in different environments.

Deliverable 5.1 presents five co-designed infrastructural demonstration plans, an output of Task 5.1 'Co-creation, Preparation and Final Design for Infrastructural Demos'. Led by QUB, with support from cities and E-Institute, UniLeeds, Burst and IETU, these demonstration plans provide a summary of the NBS demonstration concept and detailed designs in each city, reflecting on how they were co-designed with a quintuple helix of stakeholders. Task 5.1's description of work is as follows:

"All 5 infrastructural demonstrations have already been co-designed pre-UPSURGE in intensive participatory processes including citizens and other relevant stakeholders. Each city will organize at least 1 public consultation before finalizing the design plans to potentially update and modify the demo design to correspond to the current needs of citizens. The consultation will be organized with the help of the local UPSURGE ambassador outreaching out to the citizens. Special attention will be given to including the elderly, children, and youngsters in the design finalization process. The final co-created design plans will be checked to ensure their smooth implementation from legal, spatial, and environmental standpoints."

This deliverable feeds into UPSURGE's main objective, 'to build the EU Regenerative Urban Lighthouse as a reference framework offered guided support on how tested and verified NBS can be strategically implemented to significantly improve the multiple problems faced by cities. This is a 'practice-based deliverable created on real-life tested NBS practices implemented by different innovative EU cities, research institutions and companies. As such, outputs from this deliverable may be used to reflect on how to navigate the challenges faced by cities to collaboratively implement real NBS on urban sites, considering issues such as limited budgets, a lack of education on NBS, contested space and opinions, short-term thinking, measuring impact, and agreeing governance and ownership approaches.

The overall objective of this deliverable is that it can be used as a guide of practical examples and reflections by the future UPSURGE Lighthouse to 'assess and assist cities in their transition into a regenerative future'.

1.2 Intended Readership/Users

This deliverable is a valuable resource to a range of audiences:

- EU Regenerative Urban Lighthouse: One of the key outputs of the UPSURGE project, this deliverable functions as a resource for experts within the Lighthouse to understand the complex climate and social challenges faced by cities and to provide advice reflecting on how the different demo cities in this document approached co-design and design development of different NBS.
- Community Groups: This report provides interesting examples of how stakeholders from the quintuple helix may be involved in the design process of bringing NBS into urban environments. Community groups may want to replicate or build on these approaches to build capacity for change in their local neighbourhoods.
- Environment Groups: Equally, environment groups may use the examples in this report as a precedent to activate change in their local city. These groups might be particularly interested in certain aspects of the report such as co-design processes, or specific NBS types like community gardens or green transport infrastructure.
- Urban Designers, Architects and Landscape Architects: Built environment designs will find the detailed description of innovative engagement strategies useful. They might also be inspired by some of the specific spatial design approaches used in these case studies.

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- Cities/Municipalities: UPSURGE partner cities will be able to refer to this document as they reflect on current engagement processes. They will also benefit in referring to the learnings gleaned to adapt the design processes used in the application of NBS in the future.
- Researchers: This deliverable is a practical case study to consider the types of NBS that might be installed as well as interrogate how NBS might be implemented in different cities and the challenges and opportunities arising in this process.
- Policymakers: Policymakers at the city or national level may use this report to build strategies for embedding effective engagement in the design of future NBS projects.

1.3 Contribution to Other WPs and Deliverables

Task 5.1 – Co-creation, Preparation and Final Design for Infrastructural Demos

- **Deliverable 5.2 - 5 Investment Specifications (due M18, LEITAT):**
  It's worth noting that this report was developed at the same time as deliverable 5.2, 'Five Investment Specifications', led by LEITAT. This is described further in Task 5.1:

  'Each city will prepare its investment specification, which will present in detail the technical, technological, and infrastructural aspects of each demo defining the location, scope, planting, geospatial properties, intervention in possible utility infrastructure, road infrastructure, etc. This documentation will serve to carry out a qualitative and transparent preparation process of expert documents for administrative procedures for obtaining permits (environmental, spatial permit, construction permit) and consents (nature-protection, water-protection, infrastructural consents). Moreover, technical documents will also be inherent for preparing designated public procurement documents to carry out construction and infrastructure works'.

  Where D5.1 outlines each city's context, NBS demonstrations, co-design activities, design development and final design, D5.2 pertains to the delivery of NBS on sites and logs the preparation process to implement demonstrations such as the required permits, timelines, and technical details.

Task 5.2 – Infrastructural Demonstrations

- **Task 5.2.1 – Construction of Demonstration Sites (M18-M28, QUB)**
  This task corresponds to the construction and implementation of NBS on demo sites.

- **Task 5.2.2 – Deployment of Demonstrations Sites (M24-M48, QUB)**
  This task corresponds to the deployment of NBS demos to stakeholders.

- **Deliverable 5.3 - 5 Implementation Reports (Due M36, QUB)**
  This will report on the construction and implementation of NBS on demo sites and the work done to deploy these sites to stakeholders.

- **Deliverable 5.4 - 5 Deployment Reports (Due M40, QUB)**
  This will report on the continued deployment of demo sites to stakeholders.

Task 5.3 - Comparative Assessment and Simulative Demonstrations

- **Task 5.3.1 – Comparative Assessment of Infrastructural NBS (M38-48, QUB)**
  This task requires a comparative assessment of NBS previously implemented in partner cities looking at effects and results with UPSURGE demo results.

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- **Task 5.3.2 – Simulative NBS Demonstrations (M38-48, QUB)**
  Reflecting on the five demo cities, compared with the matchmaking matrix in Task 2.3, simulations of all 13 UPSURGE cities will be elaborated. This will consider the assessment data from Tasks 6.1, 6.2 and 6.3 as well as evaluate socio-cultural circumstances for implementation.

- **Deliverable 5.5 – Comprehensive Simulation of NBS Scenarios (Due M48, QUB)**
  This will report on the findings from Task 5.3.2

- **Deliverable 5.6 – Comprehensive Assessment of NBS implementation Reports (Due M48, QUB)**
  This will report on the findings of Task 5.3.1

WP2

Plant selections to enhance NBS performance, Task 2.4, inform the detailed design of demo cities and will be implemented and monitored on these sites. Specific details on plant selection on demo sites are found in Deliverable 5.2. Results from the construction, implementation, and deployment of NBS on the demo sites will be compared against the results from the Matchmaking for Tailored NBS in Task 2.3.

WP3

Demo cities have had to work closely with WP3 to correctly source sensors to meet the required specifications for both the UPSURGE project and local guidelines. D5.1 and 5.2 are concerned with ensuring sensors are considered in the detailed design, and considerations are made for how they are procured, installed, and managed, seeking the necessary permits and consents, aligning with Task 3.1 and 3.2. WP5 will continue to work closely with WP3 to align the deployment of sensors with the construction, implementation, and deployment of the demo sites (Task 3.3).

WP4

The digital ecosystem proposed in UPSURGE aims to visualize, mainstream and connect with other open-access relevant environmental data the data measured in Task 3.3. Demo cities have had to work closely with WP4 to create the framework for the Participatory Co-Design of UPSURGE Digital Services (Task 4.1). WP5 will continue to work closely with WP4 to contribute their vision to the platform, services and tools development and will support cities in the development of digital services in order to voice different potential-users' views (Task 4.3).

WP6

Environmental impacts directly related to NBS implemented in the 5 demo cities (Task 5.2) will be evaluated by WP6 in Task 6.1 based on the data provided from all the elements in the sensing system established in Task 3.3. WP5 provides support to Demo cities to comprehensively assess the regenerative potential of implemented NBS measures in demonstration cities (Tasks 6.1, 6.2 and 6.3). WP5 will also support the assessment of ecosystem services and provide information, knowledge and feedback for solutions developed in Task 6.4, 6.5 and 6.6.

WP7

Learnings on the processes to collaboratively develop designs for the NBS demonstrations will inform the development of the EU Regenerative Urban Lighthouse, led by WP7. WP5 will support cities to serve as a fail-safe in the creation of the Clearinghouse and lighthouse in Tasks 7.2 and 7.3, presenting a feedback-loop inside the project as representative final users of the Lighthouse service.

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WP8

D5.1 generates learnings on how each city collaboratively prepared designs for construction and implementation. These can be used to inform better ways to engage with stakeholders involved in urban NBS projects. While WP5 is place-centred, WP8 follows a people-centred approach. While WP5 (D5.1, D5.2.1 and D5.2.2) aims to get NBS demo sites designed, constructed and implemented; WP8 aims to build social capacity for those sites, spanning beyond the site scale to the neighbourhood and city. Though the timescale of focus for WP5 and WP8 is during the project period, WP8 is also concerned with securing the future expansion of NBS projects in cities.

During the timespan of this deliverable, cities have worked closely with WP8 to better understand the social context (T8.1.1) around demonstration sites. WP8 supported cities to carry out quintuple helix stakeholder mapping (T8.1.2) to identify the right mix of people for consultations, a stakeholder management plan (T8.1.3) and a plan to adapt to change, monitoring and assessment (T8.1.4). These activities inform the development of Competency Groups and Place Labs, place-centric Living Labs, as the demonstration sites are constructed and implemented, see **Fig 1.1**.

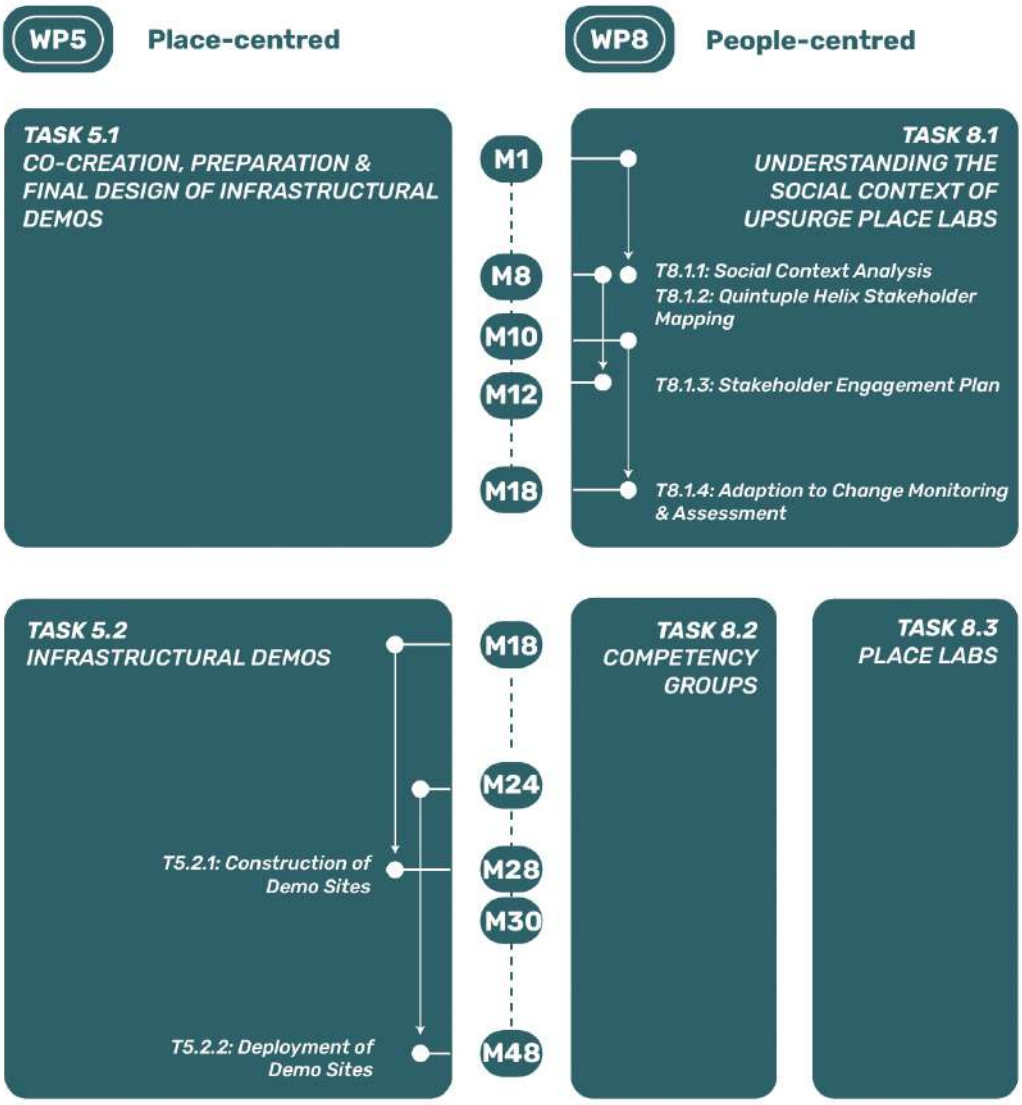

Figure 1.1: Comparison of WP5 and WP8 Tasks in line with the overall UPSURGE timeline of activities

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Learnings from this deliverable have fed practical insights into Task 8.3.1, Place Labs Methodology Development (E-Institute).

WP5 will continue to work closely with WP8 while supporting cities to establish and run Place Labs and Competency Groups (Task 8.2.1, 8.2.2, 8.3, 8.3.2, 8.3.3). More generally, WP5 and Deliverable 5.1 have linked with Task 8.4, Communication about consultation activities within cities and in QUB connected to the project. As the project develops, WP5 will be more active in supporting Task 8.5, Dissemination, in the project.

1.4 Summary of Key Findings and Recommendations

The most significant findings for D5.1 followed by key recommendations are provided below:

Key findings

- There are three key aspects for co-designing NBS: 1) the importance of building consensus for on-the-ground action; 2) the importance of enabling shifting of hierarchies as required; and 3) raising and managing expectations.
- Each city took different approaches to involve people in the demonstration sites. Some projects were initiated by citizens while others invited citizens to co-design. Both are valuable approaches. The former requires consistent ongoing communication and feedback to ensure the vision is met. The latter requires cities to consistently engage with a wide mix of stakeholders to build capacity and interest. The cities of Breda, Belfast and Budapest were underpinned by climate resilience strategies which highlighted key challenges. These cities were able to integrate the key recommendations from their city climate resilience strategies and focus on the highlighted challenges into the NBS design. This is useful to enable and encourage local authority engagement for NBS projects at the decision-making level.

Recommendations

- Advice for the co-design of NBS must be tailored to fit within existing structures and processes in local authorities to make decision-making more transparent and inclusive.
- Approaches need to be reflective of individual city cultures to maximise engagement.
- Cities need to tailor approaches to co-designing NBS considering different climates resilience strategies and social challenges.
- Co-design processes work better with the same team across a whole project, particularly in terms of providing good communication between municipalities and other stakeholders.
- Involving designers in the pre-design stages helps to embed co-design processes in the early decision-making processes.

Further detail and reflections on the key findings and recommendations are provided in Sections 8.4 and 8.5.

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DELIVERABLE OVERVIEW

The main objective of Work Package 5 (WP5) is to demonstrate, simulate and verify different fit-for-problem NBS and their effects in different urban environments through five infrastructural NBS demonstrations. WP5 is led by Queen's University Belfast (QUB) in collaboration with project partner LEITAT and the five demonstration cities, Budapest, Hungary (HU), Breda, Netherlands (NL), Belfast, United Kingdom (UK), Maribor, Slovenia (SI) and Katowice, Poland (PL) with support from city partners, E-Institute, UniLeeds, Burst and IETU.

There are six phases in the UPSURGE project's overall methodology: (1) Analysing (2) Preparation (3) Demonstration (4) Digitalisation (5) Validation (6) Exploitation. The main objective of Work Package 5 (WP5) is to demonstrate, simulate and verify different fit-for-problem nature-based solutions (NBS) and their effects in different urban environments.

Task 5.1 sits within the preparation phase, requiring the preparation of five real-life demonstrations of NBS for a smooth and timely implementation (Fig 1.2). Deliverable D5.1 aims to produce 5 Co-designed infrastructural demonstration plans by month 18 (M18) of the project. The lead partner on Deliverable 5.1 'Co-designed infrastructural demonstration plans' is Queen's University Belfast (QUB) in collaboration with city partners and assisted by project partner LEITAT. The UPSURGE project has five demonstration cities namely Budapest, Hungary (HU), Breda, Netherlands (NL), Belfast, United Kingdom (UK), Maribor, Slovenia (SI) and Katowice, Poland (PL).

According to the description of Task 5.1 in the UPSURGE project document,

"All 5 infrastructural demonstrations have already been co-designed pre-UPSURGE in intensive participatory processes including citizens and other relevant stakeholders. Each city will organize at least 1 public consultation before finalizing the design plans to potentially update and modify the demo design to correspond to the current needs of citizens. The consultation will be organized with the help of the local UPSURGE ambassador outreaching out to the citizens. Special attention will be given to including the elderly, children, and youngsters in the design finalization process. The final co-created design plans will be checked to ensure their smooth implementation from legal, spatial, and environmental standpoints."

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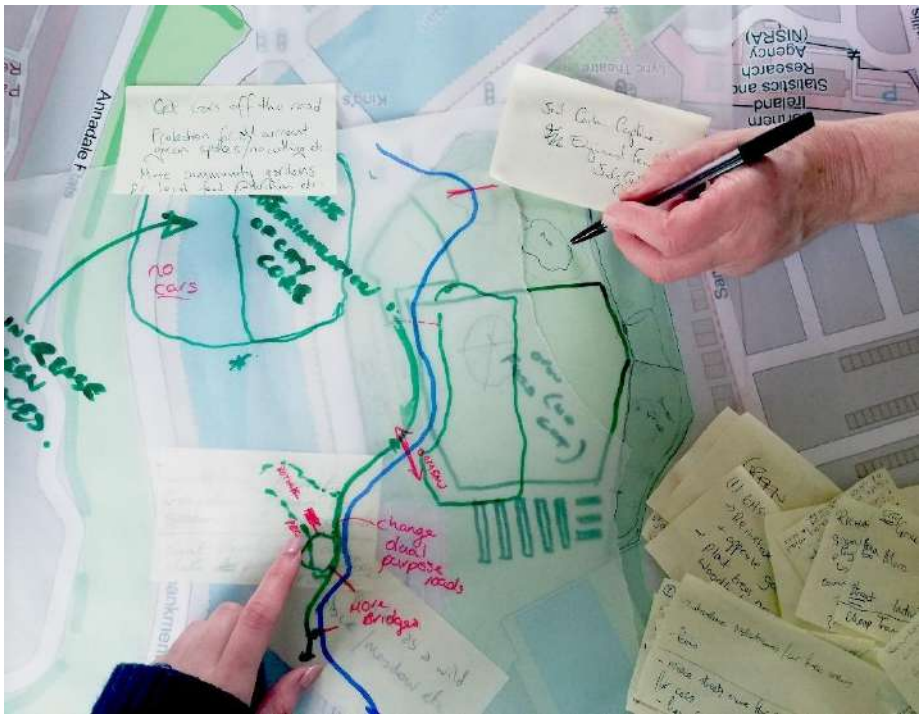

Figure 1.2: Co-designing demonstration sites for NBS

2 METHODOLOGICAL APPROACH

Deliverable 5.1 in the UPSURGE methodology

There are six phases in the UPSURGE project's overall methodology: (1) Analysing (2) Preparation (3) Demonstration (4) Digitalisation (5) Validation (6) Exploitation. Task 5.1, including D5.1 and D5.2, sits within the preparation phase, requiring the preparation of five real-life demonstrations of NBS for a smooth and timely implementation (Fig. 2.1).

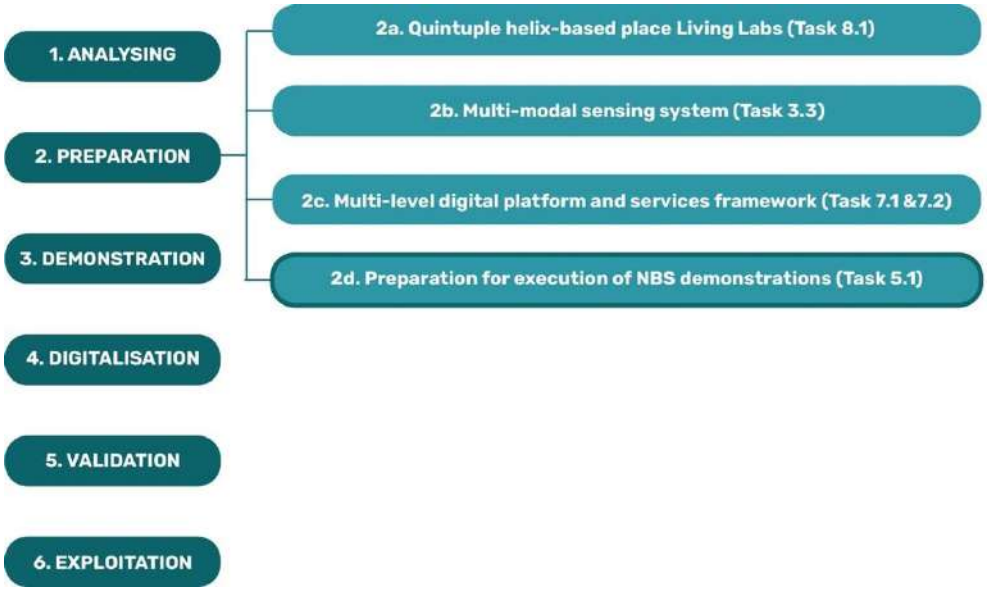

Fig 2.1: Identifying Task 5.1 within the overall research methodology used in the UPSURGE project

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Challenges

This task is concerned with recording how cities prepare designs, as well as supporting processes, to construct and implement NBS in urban sites. Cities are well-versed in preparing designs to construct on urban sites, but doing this from the perspective of constructing, implementing, and monitoring NBS rather than for example, a building is less common. Even less well understood, are effective ways to involve a mix of stakeholders in this process, from the preparation of the brief to the design, construction, and governance of a site, while also consistently considering the needs of 'nature' in this dynamic.

There are clear tensions in meaningfully collaborating with citizens, particularly in the design process, a focus of the deliverable report. While it is easier to equally collaborate on the development of design briefs and concepts, design professionals are still required to translate requirements and ideas into detailed designs suitable for building contractors to develop in real life. These detailed designs must be developed in a complex landscape, considering issues of ownership, access, and use, meeting local building regulations to gain the required permits, and navigating existing and future infrastructures, while also meeting the needs of an NBS-led project. Reflecting on this, this report highlights co-design processes used by each city in consultations both before and during the UPSURGE project to date. The insights from Task 5.1, particularly D5.1, help to build the groundwork to understand how different cities, in different contexts, address different climatic and social challenges and go about this process of preparing for the construction and implementation of NBS. Though different methodologies were used to involve stakeholders in each city, general reflections on ways to involve and collaborate are observed.

Comparing the WP5 tasks with a generic 'Plan of Work'

Plan of Work is a common tool used in the architectural profession to define the different, chronological stages in an architectural design project. Generally, there are five moments across an architectural design project: 1. Pre-Design, 2. Design, 3. Construction, 4. Handover and 5. In-Use. Within this, there are sub-categories or stages. As indicated in **Fig 2.2**, stages tend to differ in different Plan of Work models.

Mapping a more generic set of stages against WP5's task descriptions highlight how the UPSURGE Tasks compare with the Plan of Work model **(Fig 2.3)**. Stages 0 and 1, were developed before the UPSURGE project began through intensive participatory processes including citizens and other relevant stakeholders. Stages 2,3, and 4 fall within the remit of Task 5.1. In building projects, these stages typically regularly require client engagement, with less frequent consultations with wider audiences across the stages.

Future task, 5.2.1, Construction, maps exactly to stage 5, while Task 5.2.2, Implementation, covers stages 6 and 7, also considered aspects of governance. **Fig 2.3** also highlights that Breda Maribor moved into concept design development including consultations before the beginning of the UPSURGE project, in contrast to Katowice, Belfast and Budapest who started UPSURGE with the development of the concept design.

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	Pre-Design		Design				Construction	Handover	In Use	End of Life
RIBA (UK)	0	1	2		3	4	5	6	7	
	Strategic Definition	Preparation and Brief	Concept Design	NOT USED	Developed Design	Technical Design	Construction	Handover & Close Out	In Use	NOT USED
ACE (Europe)	0	1	2.1	2.2	2.3	2.4	3		4	5
	Initiative	Initiation	Concept Design	Preliminary Design	Developed Design	Detailed Design	Construction	NOT USED	Building Use	End of Life

Figure 2.2: RIBA Plan of Work: A Table comparing UK and Europe Plans of Work[1]

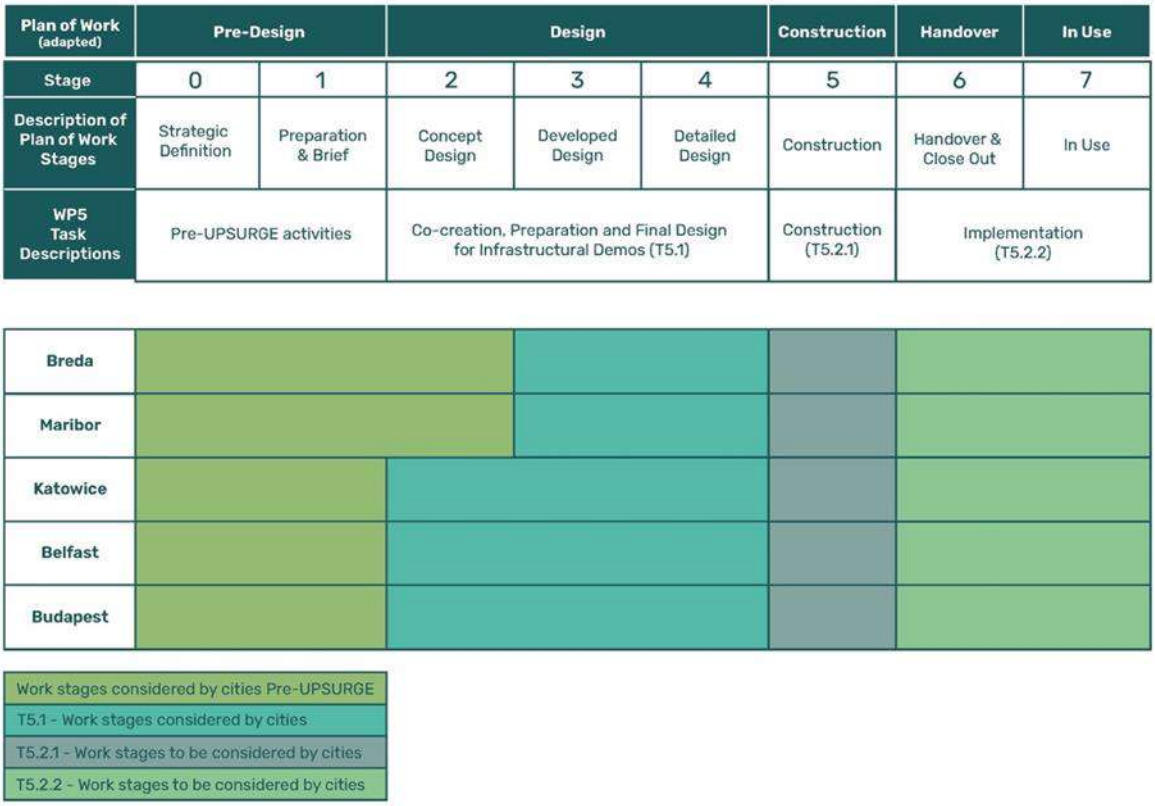

Figure 2.3: Comparing WP5 tasks with a generic Plan of Work to identify deviations between work stages in each city at the beginning of the UPSURGE project

Co-creation and co-design

The term 'Co-creation' emerged in the business and management sector and can be defined as the active involvement of stakeholders across the entire design and production process (see further details on co-creation in D8.3.1). Co-creation may be divided into two categories based on the typical chronological steps to realise a

[1] *RIBA Plan of Work* (2020) *RIBA*. Available at: https://www.architecture.com/knowledge-and-resources/resources-landing-page/riba-plan-of-work (Accessed: 24 August 2023).

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product or service (Fig. 2.4). The first category is co-design, which encompasses the process of identifying, analysing and defining a brief to design a solution. The second category, co-production, is focused on realising the idea and evaluating its 'success'. This deliverable is concerned with the first category 'co-design' since it focuses on ways to involve actors in the design of real-life NBS demonstrations across five cities.

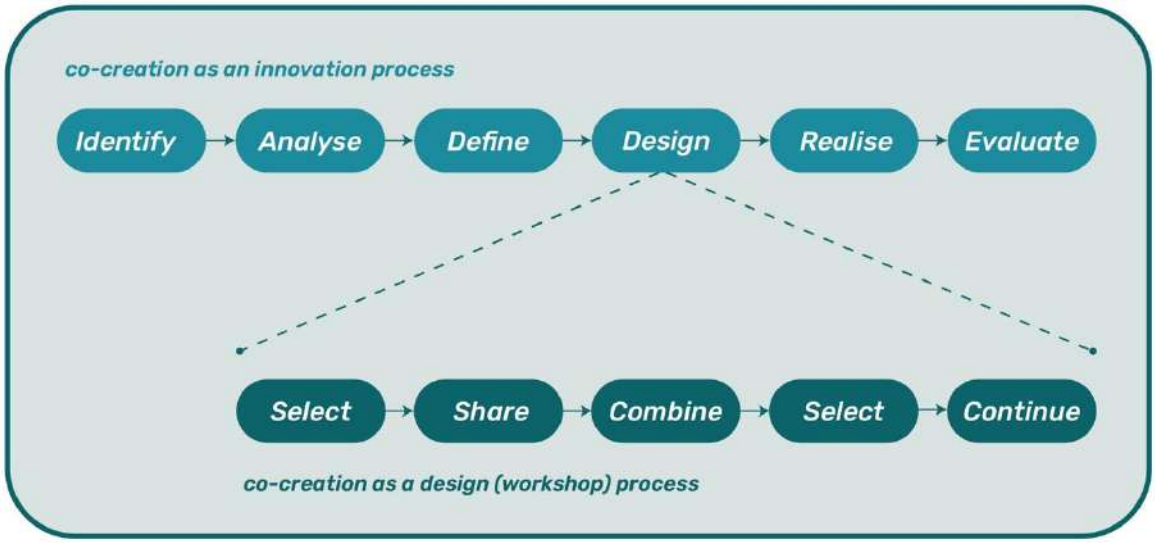

Figure 2.4: Expanding the role of design, and design workshops, within a co-creation process[2]

Co-design sits within the wider umbrella of co-creation[3]. Where co-design focuses on product development, co-creation is more concerned with consumption and use[4]. It relates to active collaboration between stakeholders in designing solutions to address a challenge.

Co-design is well understood in the design of a product or service but is a much newer concept in the design of urban spaces. Though architectural and urban design projects are already a collaboration between a mix of actors, including architects, clients, developers and local authorities, co-design processes seek to initiate continued and meaningful involvement of people from outside these domains [5]. Co-design involves this wider mix of people across the whole span of a design process to better understand user needs.

The design of NBS in urban spaces requires technical expertise, and therefore, the input of design professionals. Co-creation approaches normally enable stakeholders to function as creators, however, this isn't feasible in the case of an architectural project[6]. This is why, in this deliverable, co-design processes are more appropriate. In co-design, stakeholders take the role of information providers, creative thinkers, and evaluators of new ideas. Design professionals support these stakeholders by acting as facilitators and mediators, assimilating a wide range

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[2] *This diagram is adapted from Koning, Crul and Wever's paper 'Models of Co-creation'. It acknowledges that while various field use co-creation, no consensus exists. This meta-model includes both the design method and innovation approach view. https://www.researchgate.net/publication/303541138_Models_of_Co-creation*

[3] https://www.archdaily.com/992363/what-is-co-creation-in-the-context-of-architecture-and-urban-planning#:~:text=The%20term%20is%20used%20to,administration%2C%20to%20name%20a%20few.

[4] 10.21315/aamj2019.24.1.3
https://www.researchgate.net/publication/334082605_User_Engagement_Mechanisms_of_Online_Co-Design_Service_Does_User_Innovativeness_Matter

[5] https://www.phrp.com.au/issues/june-2022-volume-32-issue-2/co-creation-co-design-co-production-for-public-health-a-perspective-on-definition-and-distinctions/

[6] https://www.researchgate.net/publication/338656268_Co-creation_and_co-design_in_technology-_enhanced_learning_Innovating_science_learning_outside_the_classroom

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of ideas into a cohesive design proposal that can be built on time and within budget, following local building regulations as necessary. Co-design sees the stakeholders as expert citizens of their environment, providing vital knowledge, ideas and concepts however the designer still retains responsibility for the design and should function as a moderator in the collaboration process[7&8].

3 SUPPORTING CITIES: DEMONSTRATION ASSESSMENT COMMITTEE

WP5 is tasked to assist in the smooth implementation of NBS demonstrations in the 5 partner cities. To support this, WP5 leads a Demonstration Assessment Committee (DAC), led by a Demonstration Assessment Manager (DAM), nominated by the WP5 leader. The DAC is comprised of one member from each demonstration city and 5 technical experts. The Committee will manage and ensure the quality of the demonstrations and feed into NBS verification from multidisciplinary fields. They keep track of life cycle innovation from both a technical and commercial point of view to integrate the different technical aspects developed in the project and bring them to the market. It is also responsible for quality assurance in cross-cutting issues relating to the Quintuple Helix Place Labs and Competency Groups.

To assist in the implementation of demonstrations in the 5 partner cities, a Demonstration Assessment Manager (DAM), Dr Emma Campbell, was appointed by the WP5 Leader to closely cooperate with the Demonstration Assessment Committee (DAC). Dr Bakul Budhiraja was appointed as the DAC Co-ordinator, to assist the DAM in the organisation of the Demonstration Assessment Committees. The Demonstration Assessment Committee (DAC) met at the beginning of the project (September 2021) to ensure a proper start-up of the work at demonstration sites and pave the way for the exploitation of the results. The DAC has met quarterly to assist in the implementation of demonstrations in the 5 partner cities. Details of the DAC and PGM meetings are provided in Table 3.1, and meetings with other WPs are provided in Table 3.2.

Table 3.1: DAC and PGM meetings (Note online meetings Sept 2021-June 2022 due to COVID restrictions)

Number	Date(s)	Attendees Project group meeting (PGM)	Comments
1.	September 2021	PGM - All project partners	Project launch Hybrid meetings
2.	December 2021	DAC members	Introduction to Cities Online
3.	January 2022	DAC members	DAC Meeting Online
4.	March 2022	DAC and PGM – All project partners	DAC Meeting Online
5.	June 2022	DAC members	DAC Meeting Online
6.	June to August 2022	DAC members	WP5 and WP8 visited all 5 demo cities to see their site(s) and support the co-creation process
7.	October 2022	DAC and PGM All project partners	DAC Meeting Prato, Italy

[7] https://www.archdaily.com/983107/the-expert-citizen-a-change-of-perspectives-in-participatory-design
[8] https://www.archdaily.com/992363/what-is-co-creation-in-the-context-of-architecture-and-urban-planning#:~:text=The%20term%20is%20used%20to,administration%2C%20to%20name%20a%20few.

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8.	December 2022	DAC members	DAC Meeting,Online
9.	March 2023	DAC and PGM All project partners	DAC Meeting, Maribor, Slovenia
10.	June 2023	PGM all project partners	UPSURGE Review Meeting
11.	July 2023	DAC members	DAC Meeting, Online
12.	August 2023	DAC members	One to One online meeting with all 5 cities to collate information based on EU Reviewer comments
13.	November 2022 - ongoing	PGM all project partners	UPSURGE monthly meetings
14.	October 2021 - ongoing	BCC and QUB partners	QUB/BCC Monthly regular meetings

Table 3.2: Meetings with other WPs

Number	Date(s)	Attendees	Comments
1.	February 2022	Reprentatives from all partners	Communication Plan Meeting
2.	April 2022	Ezavod, QUB and LEITAT	Discussion on template for Task 5.1
3.	May 2022	Representatives of all WPs and Demo Cities	WP4 – Pilot Data Visulisation
4.	June 2022	Representatives of all WPs and Demo Cities	WP4 Technical Meeting for Final selection of KPIs
5.	June 2022	QUB and LEITAT	Progress of Task 5.1
6.	November 2022	QUB and LEITAT	Discussion on progress of D5.1 and D5.2
7.	January 2023	Members from WP5 (QUB) and WP8 (IETU)	Demo City Inforgraphics development
8.	February 2023	DAC members	Discussion on Sensors with WP5, WP3 and city partners
9.	February 2023	WP3, Demo cities, and WP5	Support WP3 one to one meeting with Cities for devloping sensor plan
10.	August 2023	Reprentatives from WP5, WP1 and WP8	Discussion based on EU review comments for the Co-creation approach of the entire project
11.	August 2023	Represntatives from WP5, WP1, WP3, WP2, WP8	Discusion on D2.3

Beyond the formal mechanism of the DAC, WP5 supports cities and other UPSURGE partners through more regular, less formal meetings.

From June to September 2022, the WP5 team, with co-design expertise, and the WP8 team, with engagement and communications expertise, also visited each demo site in each of the cities to understand existing collaborative engagement approaches and to support the demonstration cities to embed inclusive co-design processes in demo site consultation activities.

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As WP5 is based in Belfast (QUB) and Belfast City Council (BCC) functions as a city partner, visits to the other cities helped to share progress in Belfast, extrapolating ways to apply learnings and advice, informally beginning the process of the Lighthouse service in the project.

4 STRUCTURE OF THE REPORT

The Deliverable D5.1 report is structured as follows:

- Overview for each of the demonstration city case studies. The overview comprises the context of the city and the demonstration site, the historical and present use of the demonstration site, including the contextual neighbourhood of the site, the key challenges and a description of the proposed NBS implementation plans.
- Mitigations to address risks to the proposed NBS implementation plans for each Demonstration city, including tabular representation of the proposed NBS implementation plans as detailed in the UPSURGE project document and amendments made by each city.
- Public Consultation and Design Plans including an overview of the overall design methodology and Process diagrams for each city depicting internal activities and external consultations to co-design the NBS demonstration sites
- Co-design element of the infrastructural demonstration plans through participatory processes including citizens and relevant stakeholders. This comprises details about the pre and post-public consultation including the aim of the consultation, diversity of stakeholders, workshop outputs, key feedback on the design plans, and future consultations.
- Conceptual design and changes in the design during the process of consultation. It also provides the description of design, justification for the selection of NBS and implementation, usage of space, key users and legacy of space
- Drawings of the proposed final design in connection to the scale of the site itself are attached. As the cities are finalising the designs, further drawings of site design highlighting NBS and relevant infrastructural/architectural details will be available at a later reporting period.
- Summary of challenges faced by demonstration cities and reflections from the co-creation process.

5 OVERVIEW OF DEMONSTRATION CITY CASE STUDIES

The UPSURGE project aims to co-create, construct and implement Nature-Based Solutions (NBS) on demonstration sites. Five demonstrator cities are involved in the project– Budapest, Hungary, Breda, Netherlands (NL), Belfast, United Kingdom UK), Maribor, Slovenia and Katowice, Poland (Fig 5.1).

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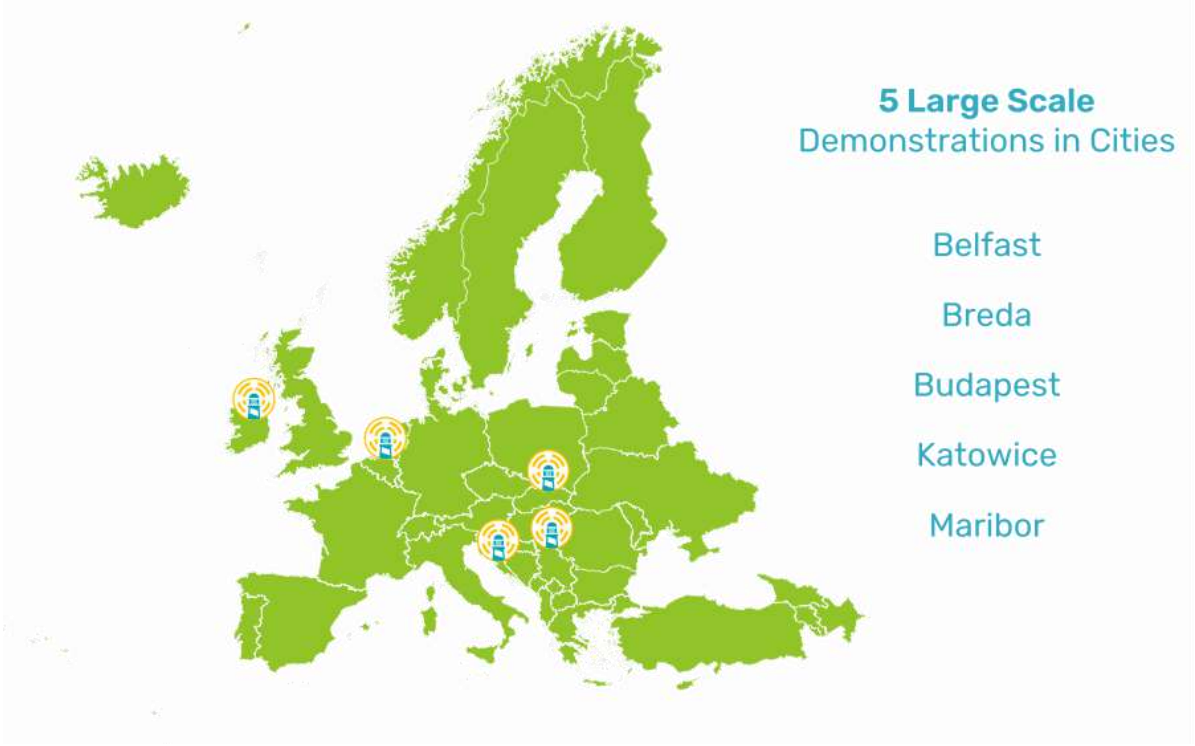

Figure 5.1: Location of Five Demonstration cities (https://www.upsurge-project.eu/)

The main characteristics of the demonstration cities are described in Table 5.1.

Table 5.1: Characteristics of Demonstration Cities

	Budapest (BP18)	Breda	Maribor	Katowice	Belfast
Location	Hungary 47.4979°N, 19.0402° E	Netherlands 51.5719°N, 4.7683° E	Slovenia 46.5547°N, 15.6459° E	Poland 50.2649°N, 19.0238° E	Northern Ireland, UK 54.5973°N, 5.9301° W
Köppen Climate Classification (Beck et al., 2018)	Dfb Warm summer Continental climate	Cfb Moderate sea climate	Dfb/ Cfb Humid Continental bordering oceanatic climate	Dfb/Cfb Temperate, ocean - moderated humid continental climate	Cfb Marine West Coast climate
No: of Sites	55	1	1	5	1
Proposed NBS	Tree-lined Bioswales, Gravel lawn parking lot, Raingarden, Living walls,	Plant areas, Trees, Green facades, Sunken areas, Infiltration areas	Green corridor	Greening of bus stops and city centre	Ecological garden, recarbonisation of soil
Proposed Sensor methodology	Fixed – 2 AQ and 3 MET Mobile - 3 Wearable - 50	Fixed – 3 AQ and 3 MET Mobile – 3 Wearable - 50	Fixed – 1 reference station Mobile – 2 Wearable - 50	Fixed –3 AQ and 3 MET Mobile – 3 Wearable - 50	Fixed – 2 AQ and 2 MET Mobile – 6 Wearable - 50

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AQ – Air Quality and MET – Meteorological Station

More information about sensors, NBS and interventions can be found in D5.2 'Investment specifications'.

6 DEMONSTRATION CITY AND SITE(S) CONTEXT

6.1 BUDAPEST BP18, HUNGARY

6.1.1 CITY CONTEXT

Budapest, the capital city of Hungary, consists of 23 districts. Budapest's 18th District (BP18) Pestszentlőrinc – Pestszentimre is located on the outskirts of Budapest, in the south-east of the city centre. BP18 is the fourth largest district in Budapest.

Temperature and precipitation conditions are typical of the continental version of the temperate zone. The annual temperature is around 11 °C and the annual precipitation varies between 400-600 mm. In contrast to the north-west wind direction that prevails in the country, the microclimate of the district is characterized by the more frequent east-southeast wind direction.

Today, nearly 100,000 people live in the district, in 23 self-described residential neighbourhoods. Urban density is 25.9 citizens per ha, which is less than Budapest's average of 32.5. The breakdown of the population by age shows that the majority of the district's permanent population is made up of working-age people, 18-59-year-olds, followed by over 65s and then 0-14-year-olds. In terms of the gender composition of the population, the proportion of women exceeds that of men, similar to the national ratio. It can also be noted that in the 18-59 age group, there is an excess of women, whereas the proportion of men is higher for the age group younger than 18 (Per Comm with BP18).

The BP18 District has a mainly residential, garden suburban character, with some housing estates. Of the 1800 hectares (ha) of green spaces, 23.84 ha are public, and 1,776 ha are private. The public areas are used as recreation areas with benches, fireplaces and playgrounds, several sports fields, and spaces for public events. Some of the public areas are small parks and forests. There are also 11,510 m^2 of water surface.

BP18 is considered a commuter town as there are limited employment opportunities, and more people work outside the district than within it. The employment rate in the district is 47.28%. Some institutions of national importance operate within the district, including the Marczell György Main Observatory of the Hungarian Meteorological Service and the country´s largest international airport, which is named after Franz Liszt.

6.1.2 KEY CITY CHALLENGES

Despite the extent of green space already present, significant air pollution can be detected along the three main roads linking the district with other parts of the city, due to increased traffic load coming from the commuting residents and the transit traffic from Liszt Ferenc International Airport.

An increasing number of heavy rainfall events and lack of a drainage system are increasingly leading to problems with water drainage and thus to flooded streets in residential parts of BP18 (Fig. 6.1.1). Moreover, the geology of the area includes an impermeable Pannonian clay, sometimes with considerable thickness, that hinders infiltration into the soil. Urban flash floods stemming from soil sealing and climate change are more and more affecting the BP18 District. There has also been a rise in severe submergence cases in recent years. The drainage system in many parts of the district and the soil structure of the area are incapable of absorbing or leading off run-off water properly. Currently, private house owners are allowing excess rainwater from their property to drain away onto the streets, which is also overwhelming

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the gutter system. In addition, private homeowners are covering areas in front of their properties with asphalt creating parking lots, which is hindering rainwater infiltration.

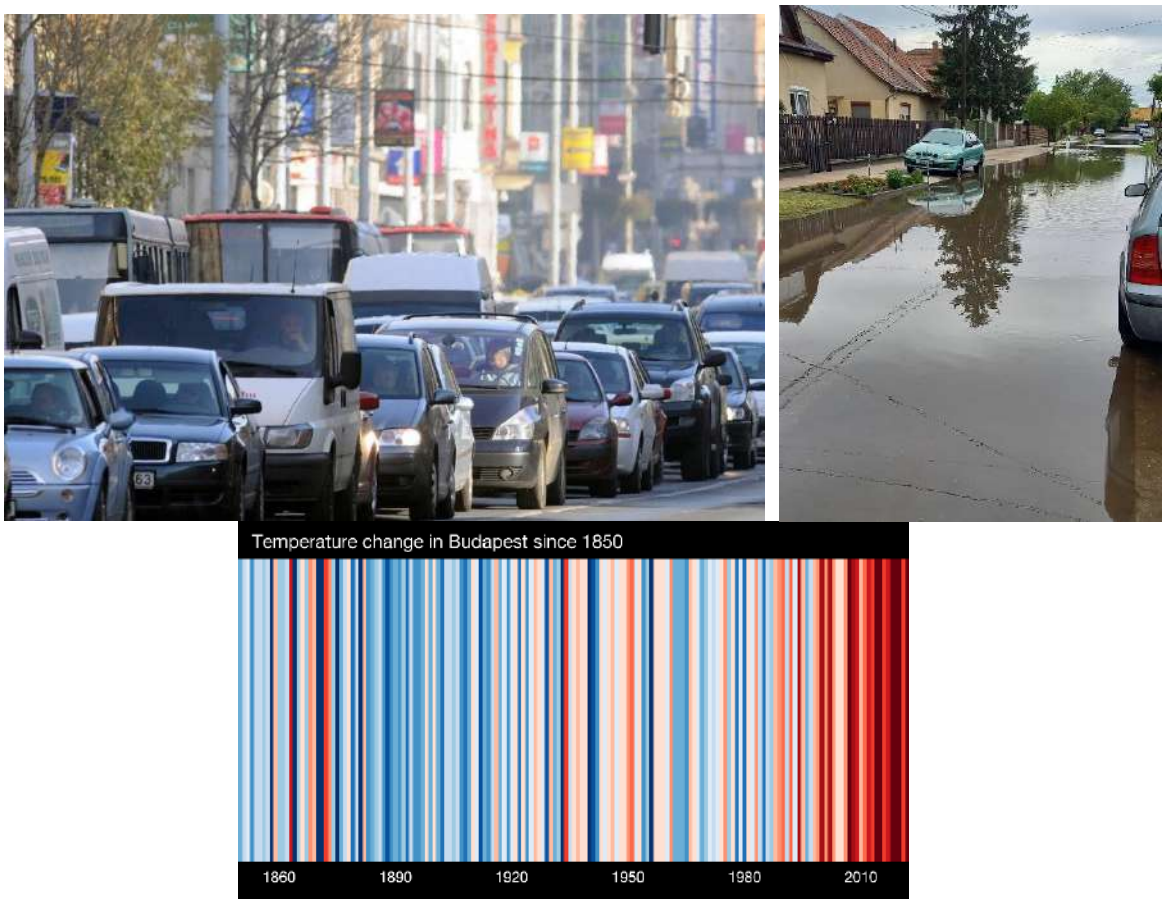

Figure 6.1.1 a) Traffic Jam on Üllői street and the street after heavy rainfall showing the impact of flooding b) Temperature Change in Budapest since 1850 (Source -Ed Hawkins, University of Reading)

6.1.3 DEMONSTRATION SITE CONTEXT

The Budapest District 18 (BP18) is relatively homogeneous, and overall garden-like, with a mosaic and scattered network of institutions (Fig, 6.1.2). This is because individual neighbourhoods have built up gradually since the end of the 19th century (Fig. 6.1.3). These neighbourhoods lived a relatively independent life. Several of them have their church, school, and kindergarten. Thus, the institutional centre of the BP18 has gradually emerged as a single district that is still evolving.

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Figure 6.1.2: Location of Budapest District 18 demonstration site (BP18) within the city context

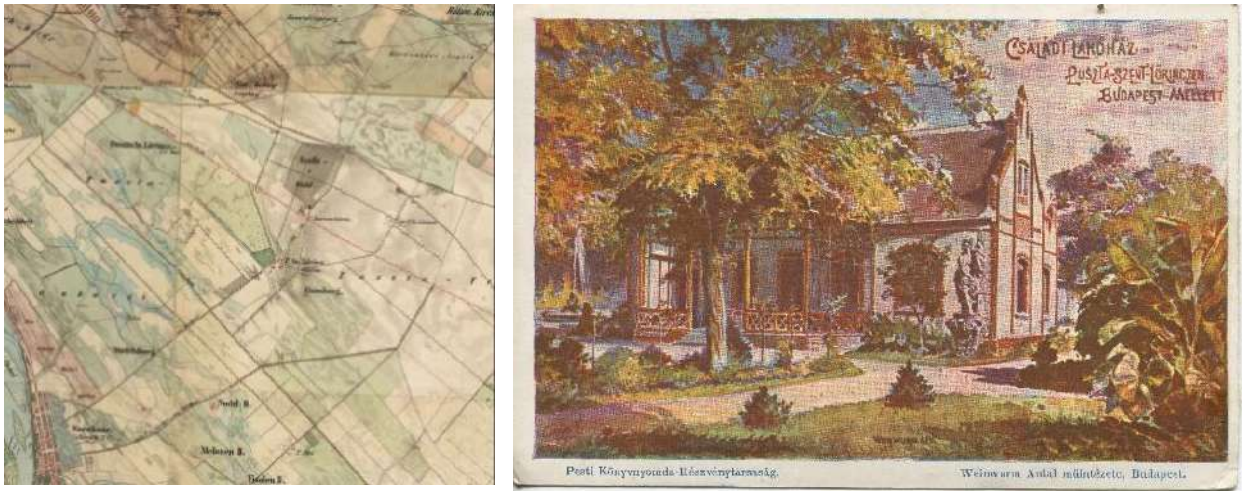

Figure 6.1.3: Historical Site Usage in Budapest: a) Historical Neighbourhood Map and b) Herrich-Kiss villa (today: Tomory Lajos Muzeum)

6.1.4 CURRENT USE, CHALLENGES AND NBS SOLUTIONS

The overview land-use map (Fig.6.1.4) shows a diversity of suburban land uses in the BP18 District. The Budapest District 18 UPSURGE demonstration site is based on the concept of raingardens. Raingardens are one of a variety of interventions that can be used to address stormwater runoff through water retention as well as, more broadly, air pollution and climate adaptability. The raingardens will be planted with pollutant-targeted plants that are not only adapted for water retention and self-sustainability in an urban environment but can also have an air quality improvement effect on specific contaminations characteristic of the district. The aim is to create small raingardens which will be built in 25 public locations, selected based on citizen

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feedback where particular spaces are affected by torrential rains. The other 25 raingardens will be created in the privately owned gardens of the citizens. In the selected sites small raingardens are located between the road and sidewalk, in front of citizens' houses, or next to a park, playground, kindergarten, or bus stop. These sites are owned by the municipality. As well as public climate adaptive gardens, it is aimed that further raingardens will be established with a special participatory residential program to educate citizens on the importance of NBS and air quality, aimed at encouraging them to create their own. Complementary mapping and matchmaking of specific plants targeting airport air pollution will also be implemented in green roofs, green walls, tree trenches, and bioswales to support clustering NBS measures.

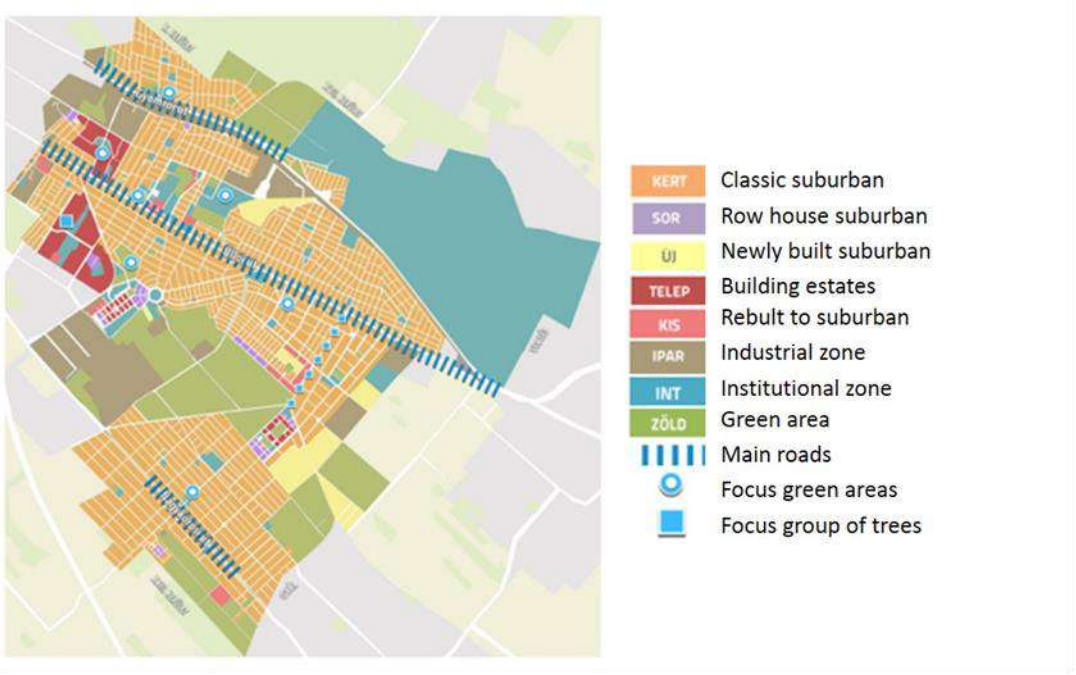

Figure 6.1.4: Budapest District 18 (BP 18) land use map

Three key sites are identified for the UPSURGE project: Zsebők Zoltán Clinic, Tomory Lajos Museum and Szálfa street.

Zsebők Zoltán Clinic (Fig. 6.1.5 a) provides specialist outpatient care in the district. To meet the needs of the district population, the district municipality opened a 1,200 sqm, 3-storey specialist clinic in July 2009 to serve the population. Surgery, dermatology, neurology, radiology, ultrasound, rheumatology, physiotherapy, physical therapy, urology, gynaecology and laboratories are included in the clinic.

The municipality plans to make green walls at the Zsebők Zoltán Clinic. The clinic lies beside one of the main roads (Üllői street) with air and noise pollution issues coming from the heavy commuting traffic near the international airport and towards the city centre. Creating these green walls will form part of an ongoing deep renovation process.

Tomory Lajos Museum (Fig. 6.1.5 b) is an independent institution aimed at making visitors more aware of the historical, cultural, and community values of district XVIII, Pestszentlőrinc–Pestszentimre (BP18). The museum's pedagogy, local knowledge, local history, and scientific education are targeted for all ages.

Raingardens and a carpark with a biodiverse lawn will be established at Tomory Lajos Museum. As an important element of cultural heritage, it will teach visitors and school kids to think in a frugal, environmentally protective way.

Szálfa street is a typical suburban residential area with mostly low-rise, loosely built-up single-family houses with relatively big gardens, built between the 1960s and 1990s. Szálfa street is an important traffic node with a train station and crossing.

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This site has a significant gradient towards one end of the street. The objective is therefore to minimize the volume of rainwater transported down the road in periods of heavy rainfall through the creation of tree trenches and bioswales.

These key sites will serve as reference or flagship sites. They will be the examples, when involving more and more the citizens and city management, to encourage them to establish raingardens / tree trenches on their properties, to mitigate against the effects of climate change and tackle air pollution.

This is a step-by-step approach, that will be followed during implementation:

1. Firstly, the raingarden at Tomory Lajos Museum will be established. Stakeholders will be invited to see the process and offer the opportunity for discussion with the landscaper and contractor. As the Museum is a public institution, with continuous events, this offers a good opportunity to present and explain the concept of a raingarden.
2. Secondly, the 25 raingardens on public properties and tree trenches at Szálfa street will be established. These NBS interventions will enable a closer engagement with citizens and allow more people to experience and observe the positive effects of NBS.
3. Thirdly there will be an open call, to find 25 property owners, who will offer their gardens for establishing raingarden, with the commitment to maintain these raingardens.

Figure 6.1.5.: Current Site Usage in Budapest: a) Zsebők Zoltán Clinic and b) Tomory Lajos Museum

6.2 BREDA, NL

6.2.1 CITY CONTEXT

Breda is a lively city in the Dutch province of North Brabant on the North-South axis between the metropolitan areas of Rotterdam (Netherlands) and Antwerp (Belgium). The city of Breda has a medieval urban core and various expansions surrounding it. Breda is known as the most important 'Nassau' city and for its beautiful old town. The Nassau family was responsible for Breda's prosperity and nine members of the Nassau noble family as well as the first Prince of Orange are buried in the city. The House of Nassau-Orange also includes the Dutch royal family. Many monuments and green areas reflect this royal influence.

The climate of the Netherlands is influenced by the North Sea and the Atlantic Ocean, resulting in cloudy and humid conditions for most of the year. Rainfall ranges between 750-850 millimetres (29-33 inches) per year, occurring throughout the year. Winter, from December to February, is cold but does not experience freezing conditions, with daily average temperatures ranging from 2.5 °C (36.5 °F) in the

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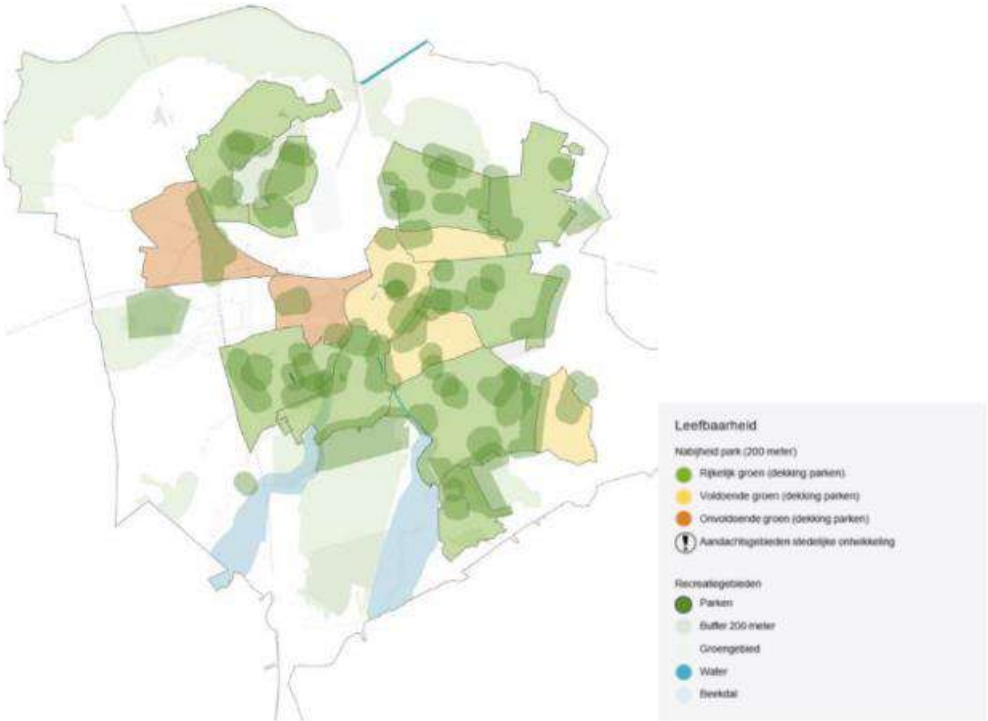
North (Groningen) to 4 °C (39 °F) on the south-western coast (Rotterdam, Vissingen). In summer, from June to August, the temperatures are generally pleasant, but the sun does not shine very often. Cool and rainy days are quite frequent, with maximum temperatures below 20 °C (68 °F). However, cooler days alternate with warmer ones, with sunshine and cloudy conditions and temperatures exceeding 25 °C (77 °F) in the early afternoon (Per Comm with Breda).

Breda covers 12,868 ha, of which 107 ha are covered by railways and 2,338 ha by residential buildings. Semi-built-up areas (construction areas) occupy 224 ha and sports grounds 278 ha of Breda. Additionally, there are 115 ha of greenhouses and 1,347 ha of forests and nature. There is a great variety of biotopes in the municipality, making Breda rich in different animal and plant species. The municipality is actively involved in protecting the various biotopes and this is bearing fruit. The Municipality of Breda has mapped out the possible climate impacts by carrying out a series of climate stress tests as part of the city climate resilience strategy (Gemeente Breda 2021 https://www.breda.nl/).

In order to encourage further intensive greening of the urban landscapes, Breda aspires to become the first European city within a park and the first city in the Netherlands to join the family of National Park Cities by 2030. Breda's 'City in a park' will become a biodiverse green metropolis connected to the greenery surrounding the city.

6.2.2 Key City Challenges

As part of the Groenkompas (green compass), the effects of green areas on the quality of life were determined for Breda. Most areas are perceived as rich green spaces. However, Doornbos-Linie is one of the districts which does not fall within the category of rich green space. The UPSURGE demo site is therefore focused on improving the quality of life of the Doornbos-Linie district (Fig.6.2.1). The Breda UPSURGE approach aims to contribute to Breda's aspiration of becoming the first European city within a park.



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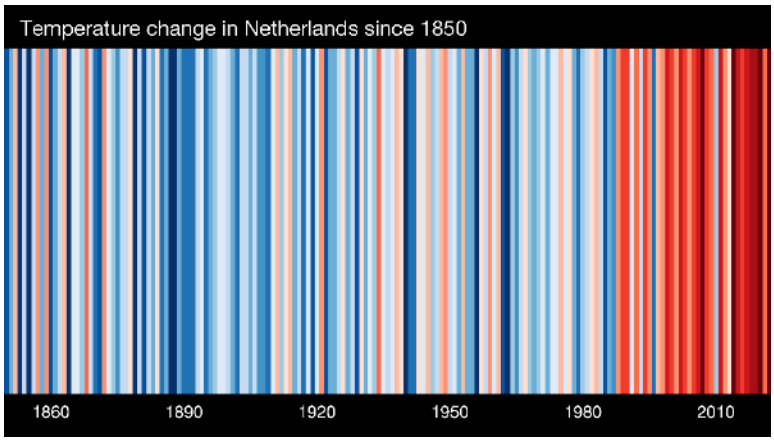

Figure 6.2.1: Key City Challenges of Breda – a) Improvising Quality of Life in Breda (Source – Gemeente Breda 2021) b) Temperature Change in Netherlands since 1850 (Source -Ed Hawkins, University of Reading)

6.2.3 Demonstration Site Context

The UPSURGE demonstration site will be implemented in the district ”Linie” – located between the railways and the Northern ring road of the city (Fig. 6.2.2). The Doornbos-Linie district can be characterized as a small-scale urban landscape with a range of land uses (Fig. 6.2.3).

Figure 6.2.2: Breda demonstration site map

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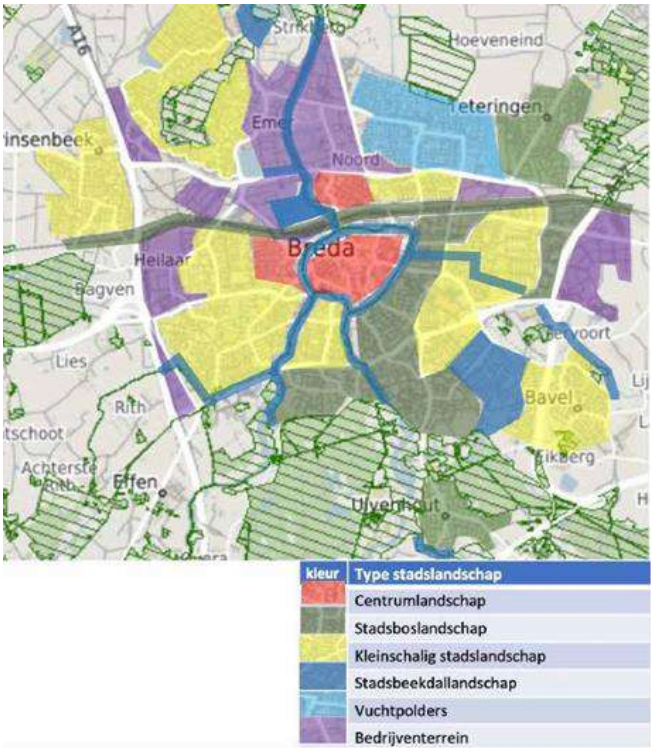

Figure 6.2.3: Breda land use map (Source: Gemeente Breda 2021)

6.2.4 CURRENT USE, CHALLENGES AND NBS SOLUTIONS

The site is currently used by the local residents for parking and other daily uses. The site is located between railways and the Northern ring road of the city within a socio-economically impoverished area. The UPSURGE demo site in Doornbos-Line is affected by heat stress and flooding. The urban jungles are designed to address the issues of heat stress and flooding and increase the overall environmental design through increased green spaces.

Breda's 'City in a Park' will become a biodiverse green metropolis connected to the greenery surrounding the city. The Breda UPSURGE approach also contributes to this goal and uses urban jungles, which are high-density re-designed areas immersed in the city to address the city's challenges.

6.3 MARIBOR, SLOVENIA

6.3.1 CITY CONTEXT

Maribor (Marburg) has a total population of 112,838 and is the second largest city in Slovenia, and is located in the north-east of the country, east of the Alps, at an altitude of 270 meters (900 feet). The city is surrounded by wine hills and Pohorje mountain. Located at the Drava River, near the Austria border and 127 km from Ljubljana, Maribor is the capital of Štajerska, Slovenian Styria. The city has a good geographical position, which makes it an important junction, linking Northern and Southern as well as Eastern and Western Europe. Historically, Maribor was an important transit, cultural and industrial city in socialist Yugoslavia. Since this time, Maribor has been affected by severe structural political, economic and demographic changes. Today these influences are still visible in the city, but Maribor is on its way to becoming a trans-regional financial, educational, trade and cultural centre. In 1975, the University of Maribor was founded, and this has helped the city to become a more popular, vibrant, and modern city.

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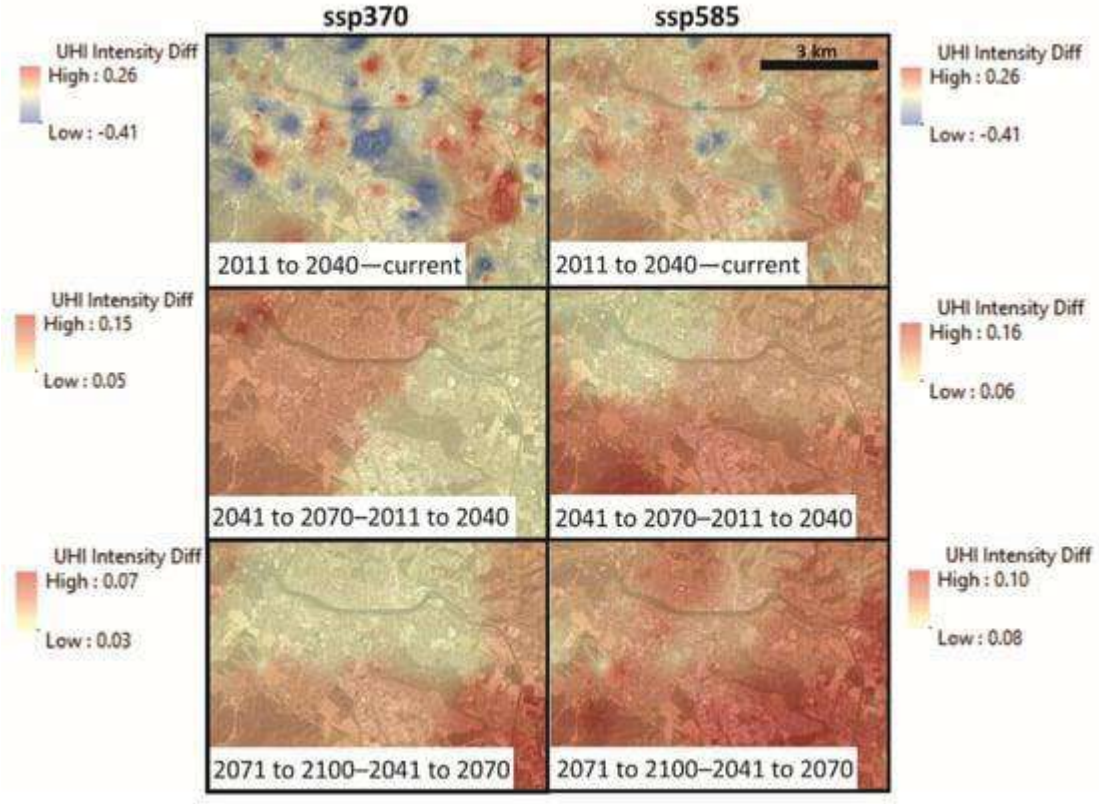
The climate of Maribor is moderately continental, with cold winters and quite warm summers. In winter, precipitation is quite frequent, and often occurs in the form of snow, although it is generally not abundant because winter is the driest season. During the most intense cold spells, the temperature can drop to -20 °C (-4 °F) or even below. The cold record is -25.8 °C (-14.4 °F), set in January 1985. Summer is quite warm, with nights usually cool. The sun shines quite often, although thunderstorms can break out, even of strong intensity. Sometimes there can be very hot periods, during which the temperature can reach or exceed 35 °C (95 °F). The heat record is 40.6 °C (105.1 °F), set in August 2013.

To further improve the living conditions in the city, Maribor's UPSURGE demonstration site will establish a biophilic-designed network of nature-based spaces throughout the waterway of Pekrski Potok, creating a seemingly free-flowing continuity of natural environments leading to a climate-resilient neighbourhood. To implement this approach, the city of Maribor will redesign its spatial planning approach while implementing biophilic-oriented solutions. Actions include, for example, greening the riparian and surrounding surfaces to combat air pollution, alleviate heat island effects, effects of flash floods and soil sealing, and provide spaces for citizens' well-being. In addition, Maribor will assess the impact of biophilic solutions on behaviour change (especially mobility), the elderly population as well as possible changes in moral/ethical values focused on sustainability.

6.3.2 Key City Challenges

The city of Maribor faces major challenges of air pollution and elevated heat in the area. The study illustrates the potential difference in UHI (Urban Heat Island) intensity concerning global emission scenarios (Fig. 6.3.1, Ziberna et al., 2021). The four-time periods under consideration indicate a gradual increase in UHI intensity. The higher concentrations of PM10 and PM2.5 were observed in colder months, which can be attributed to frequent use of heating systems and a consequence of temperature inversions (Ivanovski et al., 2021).



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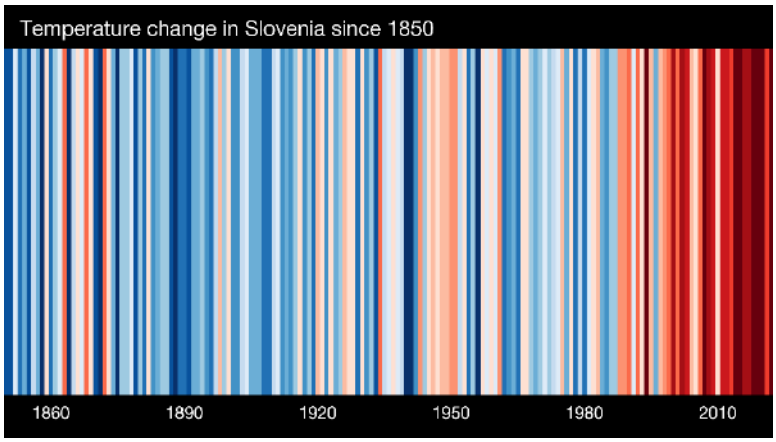

Figure 6.3.1: Key City Challenges of Maribor a) UHI scenarios (Ziberna et al., 2021) and b) Temperature Change in Slovenia since 1850 (Source -Ed Hawkins, University of Reading)

6.3.3 Demonstration Site Context

The Maribor UPSURGE demonstration site includes different housing types, on one side there are apartment buildings, and on the other side, there is a mix of individual houses and apartment buildings. The site is in a commuter zone, where people live after work and raise their families. It was developed in the 70's and 80's for industrial workers and their families, and since then there has been some change in the population demographics with an increasing ageing population. The city-wide context and overview of the Maribor demonstration site are shown in Fig 6.3.2 and 6.3.3 respectively with a historical overview shown in Fig 6.3.4.

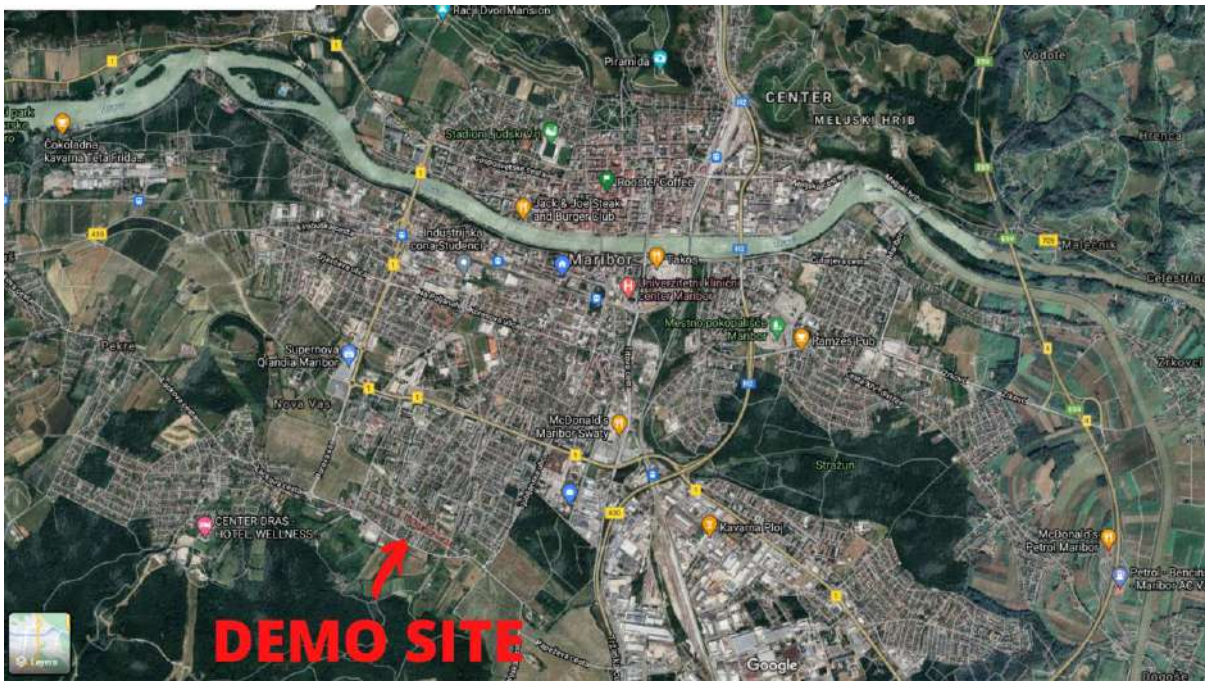

Figure 6.3.2: Location of Maribor demonstration sites within the city

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Figure 6.3.3: Maribor demonstration site

The site is connected on both sides with streets and runs between apartments and private houses. There is a pedestrian walkway through the site which is also used by cyclists. This part of Maribor city was developed in the 70's and 80's. However, the linear park was one of the parts of the city that was not developed at that time, therefore, the UPSURGE demonstration site has remained unchanged and is currently used mainly by the local residents for leisure facilities during the day.

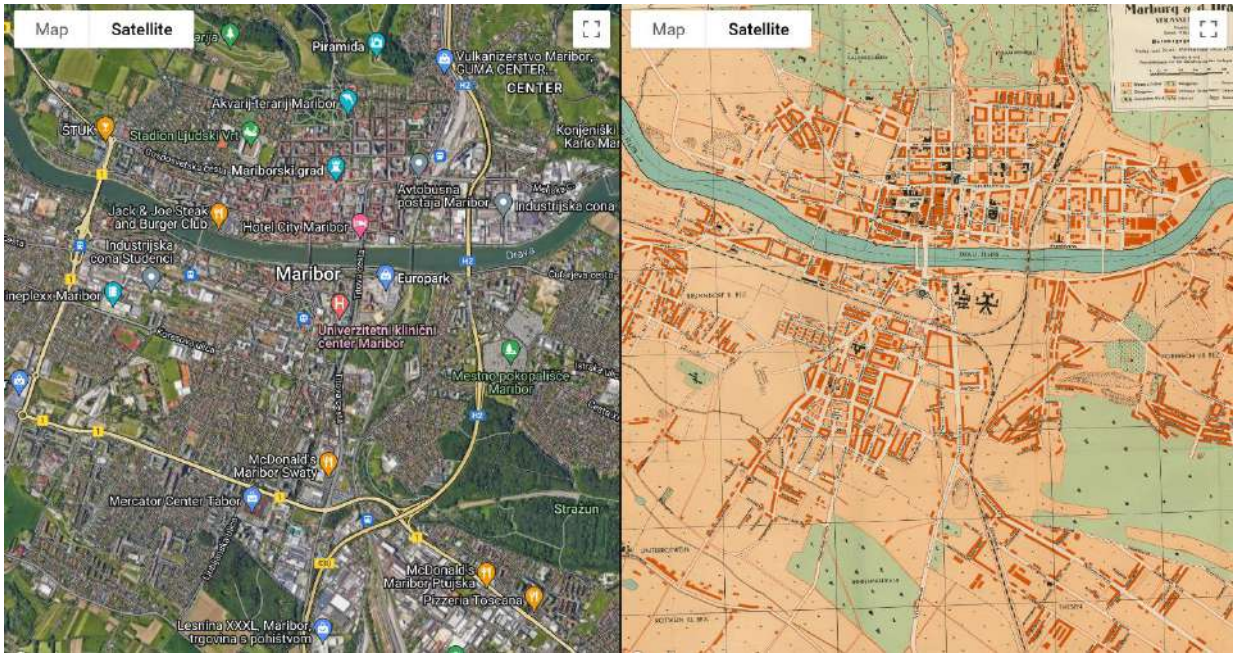

Figure 6.3.4: Historical Site Usage in Maribor: a) Site Image 2023 and b) Site Image 1941

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6.3.4 CURRENT USE, CHALLENGES AND NBS SOLUTIONS

The site is currently used by inhabitants for leisure activities. The site is mainly grassed with few trees and a creek flowing through the whole site. Since there is no public lightning, the site is underused at nighttime (Fig. 6.3.5).

The site was selected for 3 main reasons :

- This site is part of the bigger project 'Linear park Pekrski potok' that will be implemented by the Municipality
- There are currently no measuring stations for weather and air quality in this part of the city
- Plots that will be used in the demo site are owned by the municipality

The demonstration site in Maribor will establish 500m of a new green corridor demarcating the existing waterway and grey infrastructure. It will be equipped with tree species selected to target particular air pollutants (Task 2.4) prevalent in this area (Task 1.4). As part of the biophilic design approach developed and implemented in Breda, the Maribor demonstration site will also establish three pocket parks, one of which will be equipped as a meditation garden to rest and improve the well-being of citizens. The second will be equipped with an urban mobile forest with a dog park and the third will be a tree nursery where pollutant-targeted trees will be grown to transplant around the city to combat air pollution. Maribor aims also to implement a blue-green NBS using willow twigs (willow spilling) to regulate and create retention capacity for 100m of stream banks for cases of flash flooding.

Figure 6.3.5: Current Site Usage in Maribor: a) Day b) Night and c) Seasonal

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6.4 KATOWICE, POLAND

6.4.1 CITY CONTEXT

Katowice is a city in southern Poland with approximately 300,000 inhabitants. It is the capital of the Silesian Voivodeship and the largest city of the Metropolis GZM, integrating 41 cities and communes, inhabited by over 2 million people.

The city is located in southern Poland, 280 meters (920 feet) above sea level. The climate of Katowice is described as moderately continental with cold winters and warm summers. The average annual temperature in Katowice is 8.6°C, and the lowest average temperature in January is -3.6°C. The winter is cold and gray, snowfalls are frequent but generally not abundant. Sometimes, cold waves from Siberia can occur, and the temperatures can drop to -20°C (-4°F) or below. The coldest record is -30°C (-22°F) and was set in February 1956. In summer, the temperatures are pleasant and suitable for outdoor activities, although sometimes there can be rain and thunderstorms. Every now and then (and more often in recent years due to global warming), there can be short heat waves, with maximum temperatures exceeding 30°C (86°F). The highest record is 37.2°C (99°F) which was set in August 2013.

Katowice is an important transport hub: it has two motorways, national and regional roads, a modern railway, and public transport creating an extensive communication network with almost every corner of the country and Europe. For most of its existence, there were mines and heavy industry plants in the city. After 1989, transformation processes in the city led to a radical change in the structure of the industries. Traditional industry has been largely replaced by high-tech companies and centres of creative industries, based on modern technologies and innovative sectors.

6.4.2 KEY CITY CHALLENGES

The main challenges for the city of Katowice include reducing heat island effects, reducing PM2.5 and PM10 emissions, improving low retention, and improving the living comfort of the city's inhabitants. Katowice is a city with extensive experience in mitigating the effects of many years of environmental degradation. The main focus for the city of Katowice is heat stress, therefore greening the areas is the primary goal for the city. Recent studies reveal drastically increased surface UHI in highly built-up areas with morning temperatures above 30°C. The surface UHI can be reduced by increasing green space but reducing air UHI over large built-up areas like Katowice conurbations requires more effort (Fig 6.4.1, *Nadudvari, 2021*).

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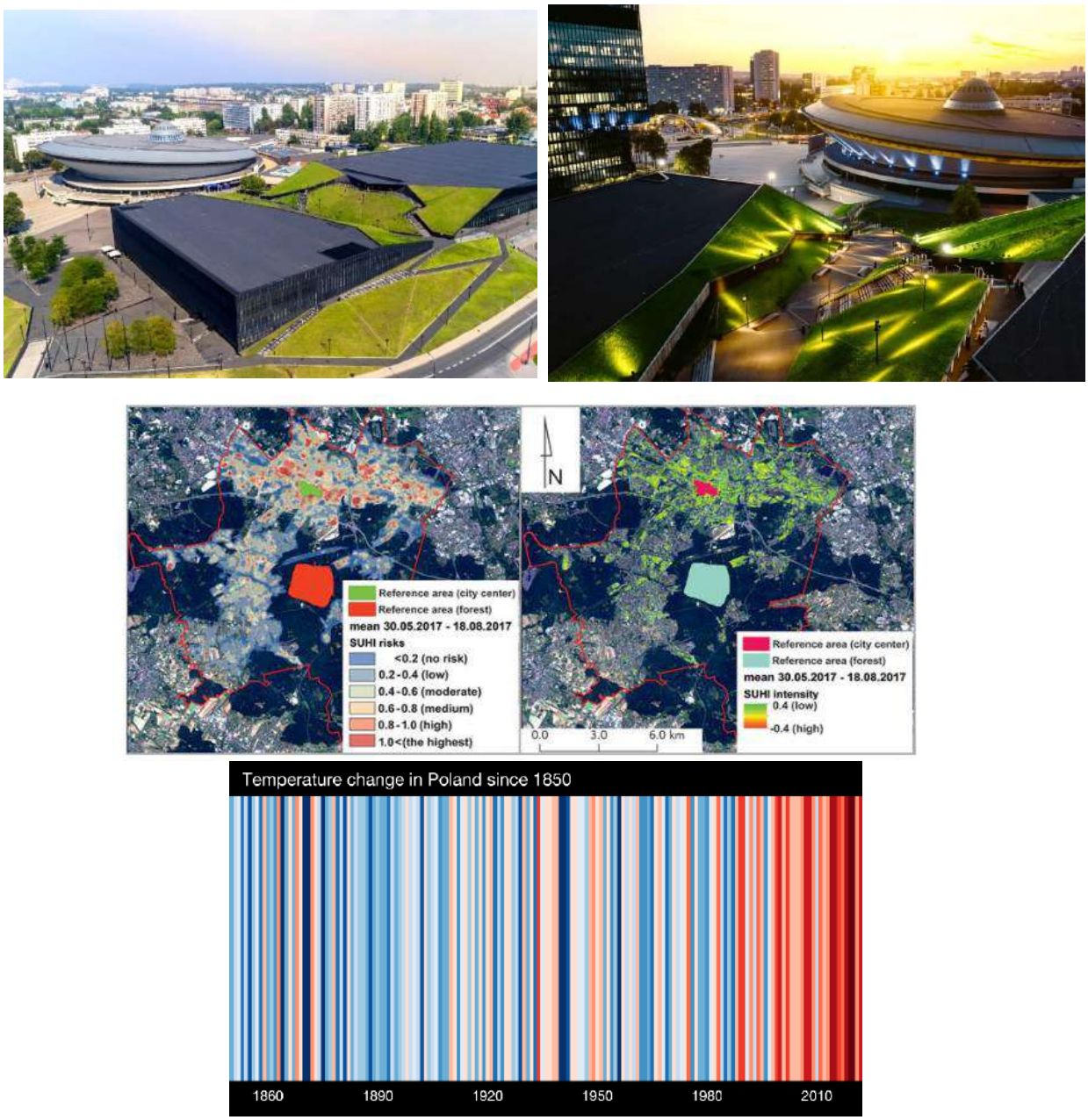

Figure 6.4.1: Key City Challenges of Katowice – a) greenery as a priority b) the heat stress for Katowice (Nadudvari, 2021) and c) Temperature Change in Poland since 1850 (Source -Ed Hawkins, University of Reading)

6.4.3 Demonstration Site Context

There are several locations proposed for the UPSURGE demonstration sites (Fig. 6.4.2) The proposed demonstration sites are currently bus stops, places for changing to another means of transport (Fig. 6.4.3 Historical and present day). The sites are also located alongside pedestrian routes (Fig. 6.4.4). The sites comprise:

No. 1-Ziołowa Street in Katowice; plot no. 86/8, 87/1, 86/5 km 107 precinct 0003 Ligota.

No. 2-Jagiellońska Street in Katowice; plot no. 237 km 56; 236 km, 56 precinct 0002 Bogucice Zawodzie.

No. 3 - Market Square in Katowice plot no. 84/2 km 40, plot 82 km 27 precinct 0002 Bogucice Zawodzie.

No. 4-Chorzowska Street in Katowice plot no. 43 km 14, 52 km 14 precinct 0001 Śródmieście – Załęże.

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No. 5-Chorzowska Street in Katowice; plot no. 1 km 18 precinct 0018 Tysiąclecie.

Figure 6.4.2: Location of Katowice demonstration sites within the city a) Before b) Now

Figure 6.4.3: Historical Site Usage in Katowice: a) Historical Neighbourhood map and b) Historical Site Image

Currently, in this heavily urbanized space, there is a space for passengers with a bus shelter. This place is deprived of greenery and natural screening which discourages use, particularly in the hotter months.

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Figure 6.4.4: Current Site Usage of the Katowice Demonstration Site

6.4.4 Current Use, Challenges And NBS Solutions

The overriding goal of the Katowice UPSURGE demonstration site is to develop an innovative approach to improve air quality in a highly urbanized area. To this end, system solutions will be developed to respond to the problems of modern cities and facilitate their adaptation to climate change.

The concept is based on unsealing the ground as much as possible, to plant shrubs and trees. The overriding goal is to develop an innovative approach to improving air quality and shading in highly urbanized areas by replacing the bus shelter with a longer and wider structure with a green roof. The sites are shown in Figure 6.4.5 (a-e).

The site at Ochojec Hospital (Fig. 6.4.5 a) is located next to a large parking lot where air pollution is high and there is a large number of concrete surfaces. Taking into consideration below-ground infrastructures including the power grid and rainwater drainage systems, smaller trees and shrubs are to be planted on the slope and next to the bus stop. The proposed plan is to develop the location with low greenery in the form of ornamental shrubs, grasses and perennials. The choice of greenery is crucial to selecting species that are resistant to air pollution and periodic droughts. The selected plants need to be easy to care for and not require regular irrigation and fertilization. One design option is greening the roof of the bus shelter using sedum matting.

The Ochojec Hospital location is a built-up area, with high levels of traffic from cars and city buses, high noise levels and high temperatures. The location has a high level of use including patients and visitors to the hospital. This is a highly urbanized area with a huge amount of traffic due to the vicinity of a three-lane communication route, lack of vegetation, high levels of noise, and air pollution. Currently, pedestrian areas are underused due to the uncomfortable conditions associated with the accompanying infrastructure and the complete lack of greenery.

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The Jagielońska site (Fig. 6.4.5 b) is located among buildings, where there is a lack of shade, which has created the development of an "urban heat island effect", high air pollution, and a lack of water retention. Underground infrastructure is concentrated in the area of this bus stop, which makes the planting of trees unsustainable. The area requires unsealing, i.e., removal of part of the hardened areas to increase the natural retention of the area, to allow the introduction of greenery in the form of low shrubs, perennials, grasses, vines, resistant to periodic droughts, winter road salting and air pollution. New plants need to be easy to care for and not require regular irrigation and fertilization.

The urban area between Korfanty str. and Market Square (Fig. 6.4.5 c) is the location of another selected site in the very centre of the city, surrounded by buildings and pavements. The phenomenon of the urban heat island effect is observed here as well as a lack of shade, and dryness. This is a problematic place in terms of planting trees, due to underground infrastructure. However, there is the possible introduction of greenery in pots and climbers on trellis-type structures. In areas of unpaved surfaces, there is the possibility to introduce ornamental shrubs as well as perennials and perennial grasses. The selected plants need to be easy to care for and not require regular irrigation and fertilization.

The site at the "Oak Church" bus stop at Chorzowska street in Katowice (Fig. 6.4.5 d) is located on a very busy street. The place is characterized by high noise levels, air pollution, and cobbled surfaces. The area lacks shade and is exposed to intense gusts of wind. The underground network of technical infrastructure, in the form of a power line and rainwater drainage systems, is quite densely located, and any work needs to consider the tram traction located close by, as well as land ownership issues. The most appropriate approach is to introduce low greenery in the form of ornamental shrubs, perennials, grasses as well as vines. The species selection needs to consider the difficult urban conditions, i.e., plant species must be resistant to temporary droughts and saline environments. Selected plants need to be easy to care for and not require regular irrigation and fertilization. In this location, the greening of the roof of the bus shelter is considered in the form of a sedum mat.

The "Park Śląski Zoological Garden" bus stop at Chorzowska street (Fig. 6.4.5 e) in Katowice is very problematic, with an urban heat island phenomenon, noise, lack of shade and unfriendly terrain. The nearest neighbourhood to the discussed point is a very busy street, therefore, air pollution is high in this locality.

As in other sites, there is underground infrastructure in the form of power and telecommunication networks to consider. Here, lower-growing trees would be the most appropriate solution with a crown starting at a minimum height of 220 cm. However, bridge infrastructure at this location may be problematic, as this may impact the planting of trees. The introduction of a large amount of accompanying greenery in the form of ornamental shrubs, perennials, and grasses, is preferable including the use of vines on supports in this location. New plants need to be easy to care for and not require regular irrigation and fertilization. In this location, a suitable approach is the greening of the roof of the bus shelter in the form of a sedum mat.

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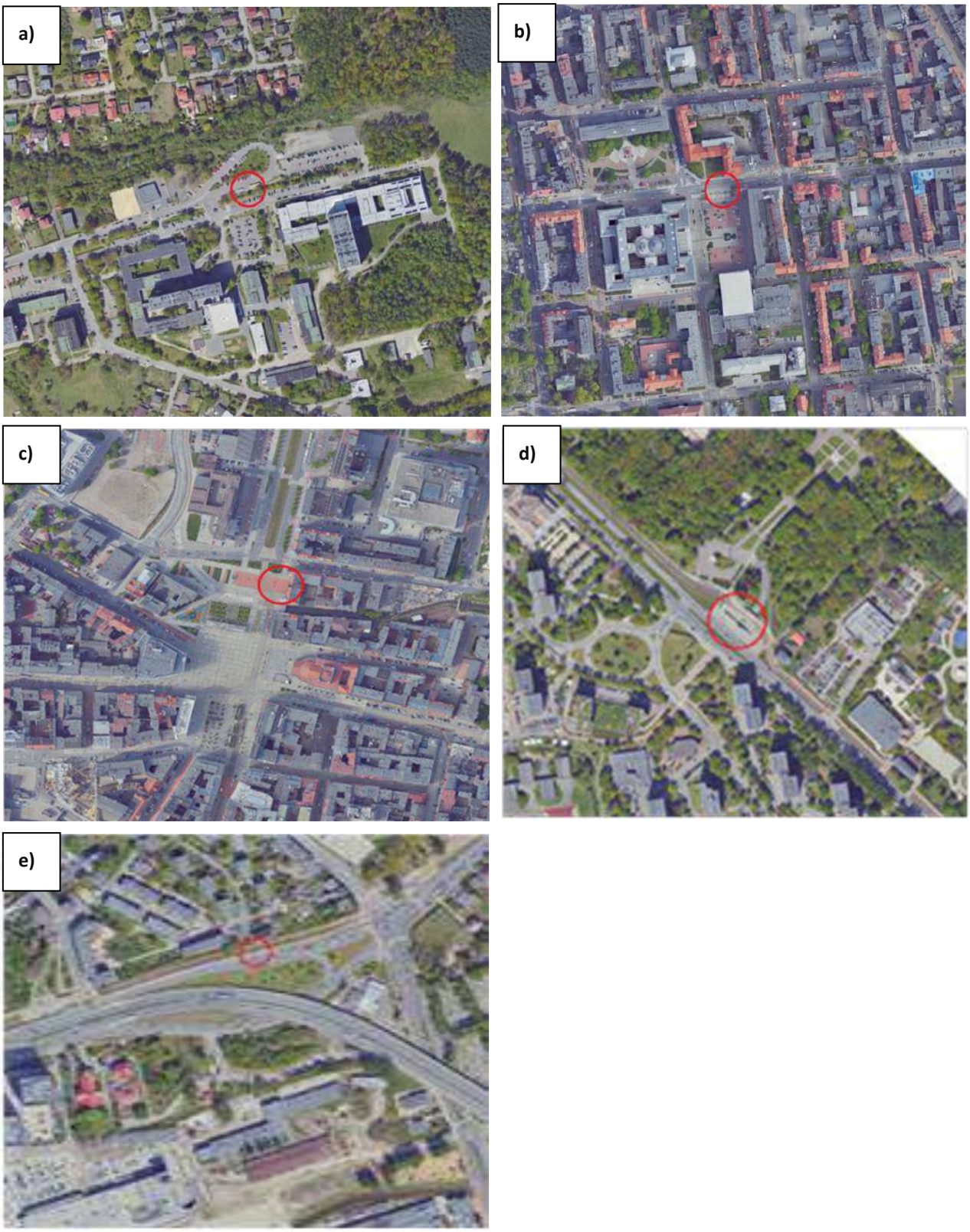

Figure 6.4.5: Katowice demonstration sites (a) to (e)

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6.5 Belfast, Northern Ireland, UK,

6.5.1 City Context

Belfast is the capital city of Northern Ireland and is a maritime city located along the river Lagan and the mouth of the Belfast Lough. The local government district had a population of 345,418 in the 2021 census but the metropolitan area is much larger than this, containing 37.1% of NI's population according to 2011 figures. It is one of the youngest cities in Europe with young people up to the age of 21 making up nearly a third of the city's population, while a fifth of the city is under 15 years old. Belfast has 24.88 persons per hectare, compared with the average for Northern Ireland of 1.34 (Census 2011) making it the densest local government district, however, there is an ambition to densify and grow the population of the city by 66,000 more people by 2035 (Belfast Agenda, 2018).

Northern Ireland has a stable climate due to the moderating effect of the Atlantic Ocean, resulting in mild winters and cool summers. The indented shape of the coastline and the presence of high ground introduce localised differences in weather. July is normally the warmest month with temperatures varying from 17.5 °C to 20 °C. The wettest months are between October and January. The average annual temperature in Belfast is 9.2°C (Fig.6.5.1 a).

Belfast city accounts for 18% of the population of NI and 30% of all jobs amounting to over 220,000 people. 93% of jobs are in the services sector, with almost one-third in the public sector. The median gross weekly pay in 209 was £575. The city is growing older, with 15% of the population being 65 and older. By 2035 this will rise to 20%. Life expectancy for males is 75.9 years, whilst for females it's 81.1 years. However, the gap between the 10 percent most deprived and least deprived areas of NI is 10.7 years for males and 7.7 years for females.

Belfast has a high number of physical barriers, largely located in the inner city, which causes issues for active travel, and sustainable service provision and contributes to carbon emissions through more people using a private car for transport. It is a very car-dominated city despite around 40% of households having no access to a car or van and has several Air Quality Management Areas shown below (Fig. 6.5.1 b).

Belfast has 66 parks, totalling an area of 946.6 hectares, 38 growing spaces, totalling 1.8 ha, and overall, a total of 2388.4 ha of open spaces including playing fields, play areas, amenity space, civic spaces and cemeteries as well. The city has several statutory designations including the Belfast Lough SPA and RAMSAR site (428.64 ha), Belfast Lough Open Water SPA (5,591.73 ha), 17 priority habitats and several important wetlands, one Area of Scientific Interest, 3 Nature Reserves, and Lagan Valley Area of Outstanding Natural Beauty, and six areas of Earth Science Interests and Assets, among other local natural designations.

6.5.2 Key City Challenges

Developed through a city-wide assessment, the Belfast Resilience Strategy (2020) identified several shocks and stresses facing the city (Fig 6.5.1 c). Existing and potential future shocks facing the city area include infrastructure capacity, public health, cyber resilience, the condition of existing housing stock, flooding and extreme weather events and the UK Exit from the EU. The stresses facing the city are its economic recovery capacity, climate change, mental ill health, poverty and inequality, housing supply, use of prescription drugs, population change, segregation and division, governance and financing of risk and carbon-intensive systems.

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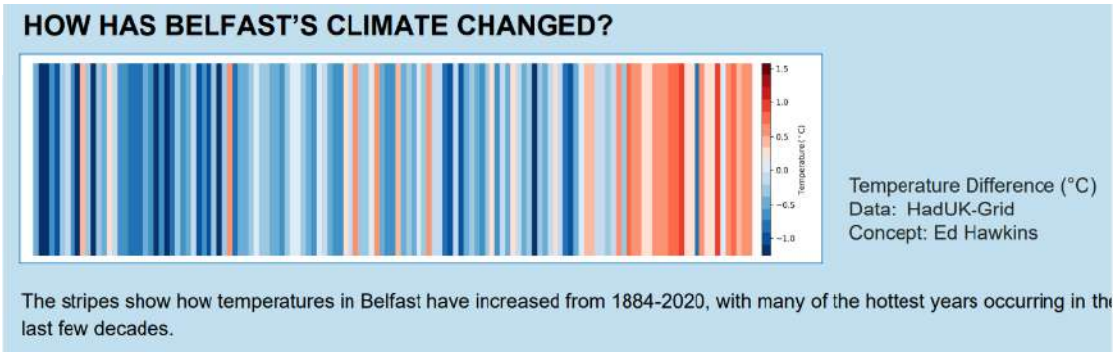
a)



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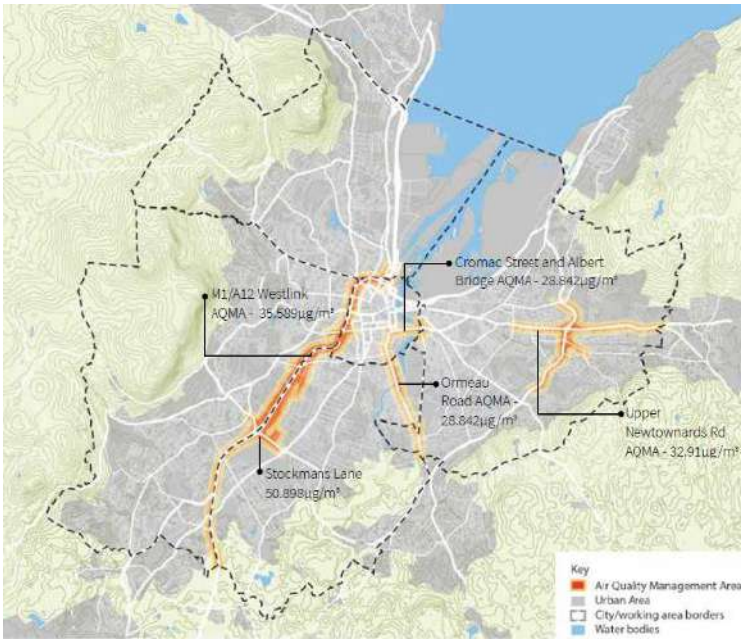

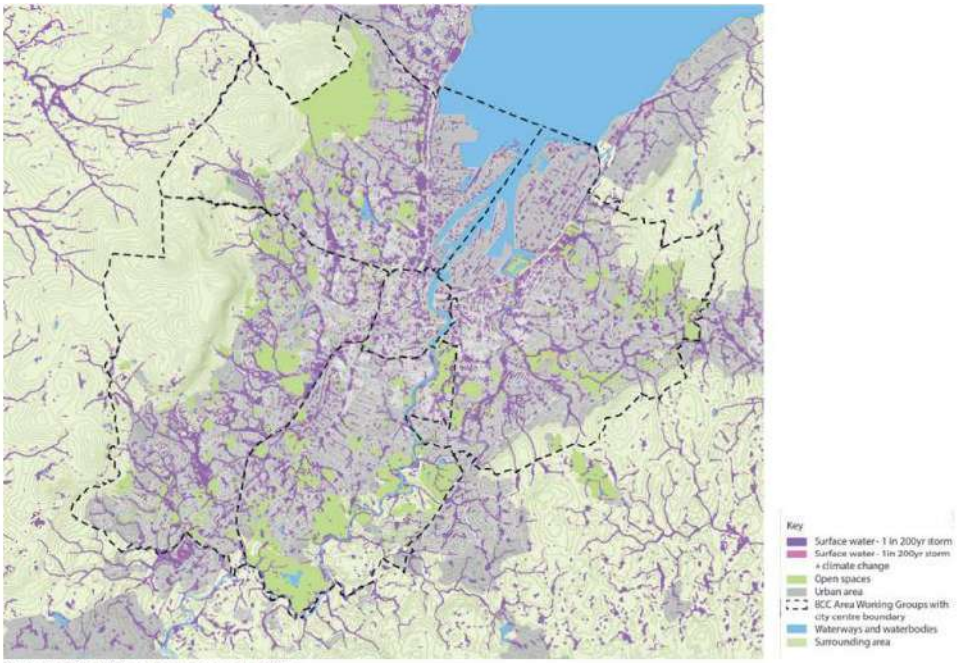

Figure 11. Flood risk and open spaces in Belfast

Figure 6.5.1: Key City Challenges of Belfast a) Belfast's changing Climate (Source: Belfast City Pack, Met Office, 2022) b) Air Quality Management Areas in Belfast (Source: Belfast Green and Blue Infrastructure Plan), and c) Flood risk and open spaces in Belfast (Source: Belfast Open Spaces Strategy)

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6.5.3 DEMONSTRATION SITE CONTEXT

The site is located in the south of the city (Fig. 6.5.2) and is considered part of the Botanic Gardens, which is a designated Historic Park, Garden and Demesne given its history and character. Whilst not within the conservation area, the site sits adjacent to Queen's Conservation area, the first to be designated in Belfast in 1987. It is also recognised as a Local Landscape Policy Area and sits adjacent to the Lagan Valley which is a Special Protected Area and a RAMSAR site of European importance.

The UPSURGE demonstrator site is known locally as Lower Botanic and runs along the Stranmillis Embankment facing into the River Lagan to the east. To the north, it joins the Botanic Gardens and Queen's University, whilst to the west it sits adjacent to some housing and the Lyric Theatre (Fig, 6.5.3).

The Lower Botanic site is easily accessible by bike, car and by walking from all sides, however, access through the Botanic Gardens is usually limited to daylight hours. It sits within the larger Queen's Quarter of South Belfast which is an area of the city with a large student population and a large university estate. The Holylands is a residential area with a large number of Houses of Multiple Occupation which is a short walk along the embankment from the site.

Figure 6.5.2: Location of Belfast demonstration site within the city (Source QUB)

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Figure 6.5.3: Belfast demonstration site

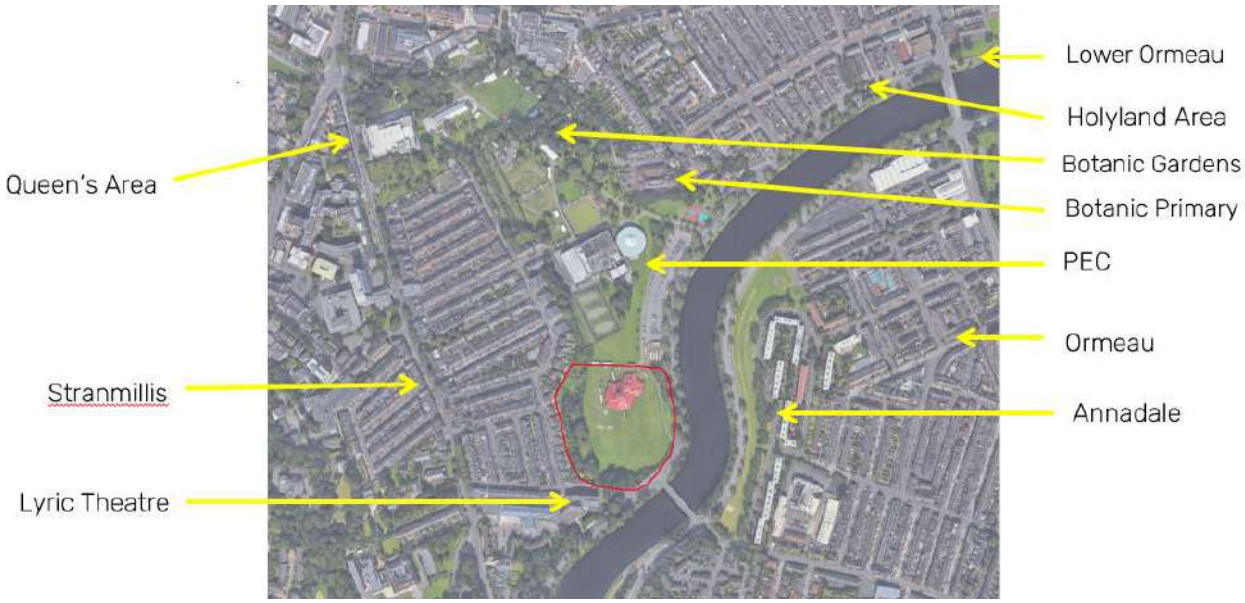

Figure 6.5.4: Belfast demonstration site zones

The former Botanic Gardens, later adapted as a public park (14.3ha), lie on the western bank of the River Lagan, some 1.5km directly to the south of Belfast City Centre (Fig. 6.5.4). Botanic Gardens today is a heavily used public park and thoroughfare, which has excellent features and planting. It was established in 1828 by the Belfast Botanic and Horticultural Society in response to demands for a botanic garden for Belfast and was open to Society members (Fig. 6.5.5 a). Belfast Corporation purchased the property in 1895 and they were opened to the public. The park contains historical buildings of European significance such as the Palm

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House and Tropical Ravine. The Lower Botanic site for a period housed the Jaffe Memorial Fountain, erected by Otto Jaffe, Belfast's first Jewish Lord Mayor, in commemoration of his father who funded Belfast's first synagogue. This has since been restored and returned to its city centre location.

Throughout the history of Botanic Gardens, the location has been used as an events space, hosting garden fetes, flower shows and private events. It hosted the first Irish balloon ascent, as well as the Great International Fruit and Flower Show of August 1874. The area where the UPSURGE site is located was an additional piece of ground acquired along the River Lagan, which was less developed than the formal gardens but also used for growing.

From 1946, during the post second world war housing shortage the site housed temporary prefabricated huts for use as accommodation (Fig.6.5.5 b). They were known as Botanic bungalows. These were present until clearance of the site for use as the Ulster 1971 Convention, a large festival held from May to September, originally conceived to mark the 50th anniversary of the establishment of Northern Ireland.

The site has remained undeveloped and is identified on historical maps as playing fields. It has more recently been used for events such as music concerts and circuses. There is evidence of asbestos, and waste materials from previous use have been found in recent site investigations.

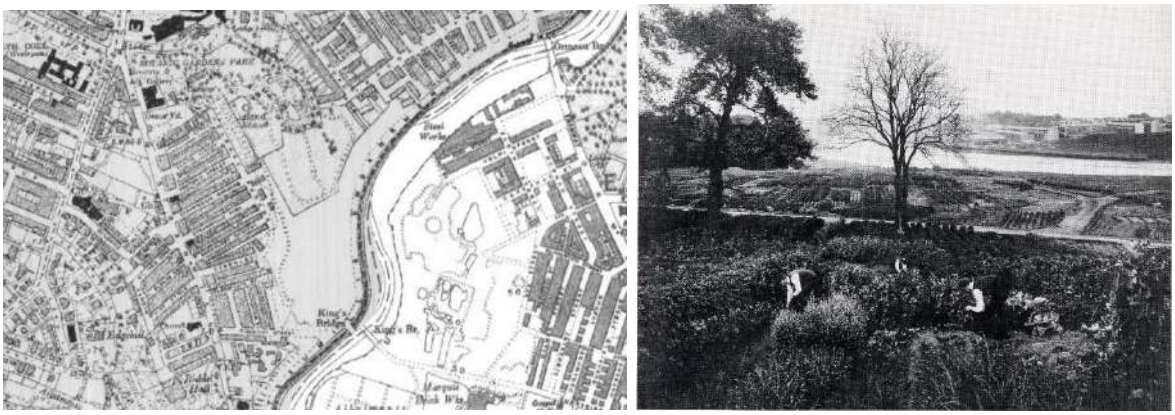

Figure 6.5.5: a) Historical Site Usage in Belfast, OSNI Historical Fourth Edition 1905-1957 and b) Historical Site Image

6.5.4 Current Use, Challenges And NBS Solutions

Figure 6.5.6: a) Current Site Usage in Belfast, Dog walkers at the site doing litter picks (Source: Friends of the Field, 2022) and b) Wildflower beds were planted along the main path in Autumn 2022 (Source: Friends of the Field)

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During the day the site is used mainly by dog walkers, as it is a quiet, informal piece of grass and open space contained on several sides by fences and walls (Fig. 6.5.6 a and b). At night the site is unlit and not used, however, nearby sports pitches are utilised up to late evening time. The site is overlooked by the Lyric Theatre, QUB's Physical Education Centre, Botanic Primary School, and Botanic playpark. A large car park utilised by the PEC sites is adjacent to the site and so the site benefits from natural daytime surveillance but limited night time surveillance. Local adjacent neighbours would report that the site is used on occasions for drinking and at times anti-social behaviour.

A path links the site to the Botanic Gardens, QUB's PEC, and sports facilities which are used by cyclists, walkers, and school children during the day to connect residential neighbourhoods along the Stranmillis Embankment (a National Cycling Route) Ormeau, Holylands, Stranmillis and the wider South Belfast area. Botanic Gardens closes at night so connectivity through the site is cut off out of daylight hours.

The existing biodiversity of the site is limited to its fringes, with some native trees, and evidence of invasive species such as Japanese knotweed, as well as non-native planting of bamboo from a previous 'Japanese garden planted on the western periphery of the site. A badger sett has been identified on the site, and an ecological assessment currently being carried out will identify existing biodiversity at the site.

The site, known locally as Lower Botanic, has been chosen as it is an underutilised piece of open space currently within the Council's estate that is close to a range of surrounding and diverse communities. The site is linked and part of the Botanic Gardens, a designated Historic Park and Demesne with a rich history of botany, growing, civic and community uses. The park already benefits from a local group of community interests, the Friends of Botanic and has a substantial operation of park staff that currently maintain, develop, and act as stewards for the park itself. The site has significant potential for contamination due to its previous uses over many years and so offers a unique opportunity to test soil decontamination through growing and other nature-based solutions. Lower Botanic is close to Queen's University Belfast and so offers a high level of access for research activities to take place on the site.

The proposed NBS implementation plans for the Belfast site include several elements:

Research Plots

A designated research area will be created within the demonstration site in conjunction with Queen's University Belfast (QUB). The objectives of the research site are 1) to measure bio-accessibility values from soils and vegetables grown onsite in non-amended and biochar-amended soils, and 2) to measure carbon and nitrogen isotope values from soils (and potentially vegetables) grown onsite in non-amended, biochar, basalt and biochar+basalt amended soils in conjunction with QUB and Antwerp University. This research contributes to the city's challenges around health and Brexit, identifying ways in which a more sustainable food system might be achievable in Belfast through food growing, and remediation on contaminated land. A sustainable food system is one of the ambitions of the Belfast Resilience Strategy (2020).

Rewild and boarded nature walk

Areas of the site will be 'rewilded' to encourage biodiversity and increase ecosystem services in the area. This will also encourage more wildlife habitats and provide pollination and food to support improving biodiversity in the city and citizens will be encouraged to help record, monitor and track how these changes across the site as the NBS is established.

Agroecology community garden & community education space

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This space will provide growing opportunities for groups and residents to engage with the site. Various health benefits are known from shared growing and engaging in urban green spaces in a city, and this will also provide a space to overcome segregation and division that is built into the physical layout and residential make-up of the city. It is also hoped that this space will help tackle poverty and inequality by developing opportunities for social enterprise through making, growing, creating, etc. Giving young people and older people a space to work alongside one another will help create a more inclusive, age-friendly environment.

RHS growing space

This space will encourage the development of horticultural skills among groups such as the Friends of Botanic and a growing volunteer base for Botanic Gardens. Accredited courses could be run to help enable skills growth and stewardship of Belfast's natural and green spaces.

Communal tree nursery

Brexit has created challenges for the sustainable and bio-secure supply of trees to Northern Ireland. There is also the need to develop an awareness of the climatic benefits of trees.

6.6 Mitigations to Address Risks - Summary of NBS Demonstration Amendments

Due to several economic challenges resulting from conflict, cost inflation, post-COVID shortages and Brexit (Belfast), which could not have been predicted at the application stage, the demonstration cities considered the proposed work and the extent of work that was feasible within the timescale of the project. As a result, to primarily address these challenges, some of the demonstration cities were required to reduce the scale and ambition of their planned NBS projects by reducing the number of demonstration sites or establishing a phased work plan. Amendments to NB projects at the demonstration sites have been made to mitigate against risks by recognising these challenges and taking action to redress their scope of work to address issues at this stage in the project. Further reflections on the challenges affecting the demonstration cities are provided in Section 8.

The next section (Tables 6.6.1-6.6.5) details the original proposed NBS and amendments which have been made by each city.

*Table 6.6.1: **Budapest BP18, Hungary** – Mitigations to address risks*

Original Proposal	Amendments
T5.2.1 Construction of Demonstration Sites	
• The proposed plan included the establishment of: • 1) a 10 m² community climate-adaptive garden at the Hetényi-Kiss Villa (Tomory Lajos Museum site) • 2) 50 climate-adaptive gardens combining public and private efforts to accelerate NBS uptake and to create a local green network of climate-adaptive gardens. • A green roof and green wall on the building of the Municipality, both using only rainwater for irrigation, with the aim to test specific plant species expected to have an air-purifying effect regarding contamination coming from the airport • An agreement to be made with a private investor currently preparing a large property development in the immediate vicinity of the Municipality (Üllői street 404) to have to apply water retention NBS in	• The establishment of a community-adaptive Garden will be 34m^2 at the Hetényi-Kiss Villa (Tomory Lajos Museum site) • Implementation in Sub-Task 5.2.2 – Deployment of Demonstration Sites (M24 – M 48) in 2024 • Green roof will not be implemented. The location of the green wall is modified. This will now be implemented at Zsebők Zoltán Clinic instead of the Municipality building. It will be an assembled green façade with a metal holding structure, plant boxing, and irrigation.

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the development: green roof, green wall, raingardens and bioswales • A demo street to be created using water retention NBS: tree trenches and bioswales, as above featuring plant species expected to have air-purifying effects related to the specific air quality situation of the district. The currently non-paved, 900-metre-long Kerékvágás street is planned to be paved. However, it will be done in an air-quality and flash-flood conscious way: applying various traffic buffers and a close-to-natural, non-asphalted pavement giving room to tree trenches and bioswales to ensure water retention	• Investment is put on hold, so the agreement with the private investor cannot be made at this stage. • The location of demo street has been changed to Szálfa street, where tree trenches will be implemented • Also, a gravel lawn parking lot will be implemented in front of the Tomory Lajos Museum
Task 5.2.2 Deployment of Demonstration Sites	
• As extension to the existing Municipal program of handing out water-barrels to individual households in order to enable them to collect rainwater, a citizen involvement program will be started supporting the establishment of 25 smaller climate adaptive gardens on private property, as well as 25 on publicly owned, but privately handled green pavements in front of private properties. • Private owners will be educated on how to establish, treat and keep up the gardens, of which they will have to undertake a 5-year sustention. • Plants and more importantly, knowledge and practical support will be provided to citizens, i.e. the garden will be created with the effective physical help of municipal experts.	The citizen involvement program remains unchanged

Table 6.6.2: Breda, Netherlands - Mitigations to address risks

Original Proposal	Amendments
T5.2.1 Construction of Demonstration Sites	
• Different species of plants and trees effective in improving air quality are going to be planted in and around two already existing underused and undermanaged green areas. • This will be 2.320 m² of redeveloped green area in Breda equipped with particular air pollution and climate mitigation species enhancing the demo area's mitigation effect on pollution and climate-related events. • This area will be turned into an "urban jungle" in Task 5.2.2 – resulting in a redesigned high-density green area, building on the example of Prato's Urban Jungle	• No major amendments reported • The design and the planting plan are aligned with the investment specifications
Task 5.2.2 Deployment of Demonstration Sites	
• The final co-design process in Task 5.1 carried out with the municipality, housing corporations and Ennatuurlijk B.V. (the district heating company) involving residents will ensure locals are committed	• During the co-design process, some minor adjustments were made to the design due to technical implementation in the plan and feedback from the residents

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to the maintenance and management of the urban jungles and allow the space to become a community-belonging area that offers activities creating social cohesion within a diverse community, considering the society's characteristics. • Educational activities and events will be organized in the urban jungle by groups of volunteers and will inform on different NBS that can be implemented in private spaces to tackle climate-related issues as well as on how air quality can be measured by the health of biodiversity – e.g., the presence of insects, the health of plants • These educational activities will actively mobilize the local community and are going to be connected to already existing momentums of the city – such as national tree planting days and butterfly & bee counting days	For example: locations of parking spaces and set up one-way traffic in 2 streets • Consultation took place with the agricultural and horticultural schools to gauge interest in participating in the project. • Together with some advisors and residents, a process was started to make citizens aware of climate problems and how NBSs can help with this • The national tree planting day and the "week of the water" are opportunities to promote the application of NBS.

Table 6.6.3: Maribor, Slovenia - Mitigations to address risks

Original Proposal	Amendments
T5.2.1 Construction of Demonstration Sites	
• Maribor demonstration site will establish 500 m of a new green corridor demarcating the existing waterway and gray infrastructure, equipped with bilateral tree planting based on species targeting particular air pollutants (Task 2.4) prevalent in this area (see 1.4.2.1) • Maribor demo will also establish 3 pocket parks, 1 of which will be equipped as a meditation garden to rest and improve the well-being of citizens, 1 will be equipped with an urban mobile forest - dog park area and 1 as a "tree nursery" where pollutant-targeted trees will grow for further targeted transplants around the city to combat air pollution • Maribor will implement a blue-green NBS for regulation of critical 100 m of stream banks, which will increase the retention capacity of the water body for cases of flash floods during downpours with willow twigs (willow spilling)	• No major amendments reported
Task 5.2.2 Deployment of Demonstration Sites	
• During the final co-design process in Task 5.1, particular engagement events will be proposed to citizens and carried out after infrastructural applications, supporting well-being activities targeted especially at the elderly and children, activating citizens to cooperate in establishing and nursing the tree nursery, providing engagement event to teach citizens meditation activities in the mediation garden, and organizing educational activities alongside the newly infrastructure, NBS, renaturation activities that can be taken up by citizens, etc	• No major amendments reported

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Table 6.6.4: Katowice, Poland - Mitigations to address risks

Original Proposal	Amendments
T5.2.1 Construction of Demonstration Sites	
• Katowice will implement 5 NBS demonstrations at strategically chosen points throughout the city, where the presence of people and pollution is the highest to establish a developing NBS network of Katowice. • Green Market - green benches in the area of the Market Square / Flower Square in Katowice is a paved area, located in the centre of Katowice that will be unsealed, renatured with greenery, setting green benches, and several green shelters. • At the second location, a corner with greenery and xerothermic plants with elements of education in the area of the reservoir at Tyska Street (above underground storage reservoirs with a capacity of 1,540 m3) be created. • The third and fourth NBS interventions will establish green bus stops located at Chorzowska and Warszawska streets; the surfaces will be unsealed and equipped with targeted NBS determined through Tasks 2.3 and 2.4 improving air quality, retention capacity and the overall comfort of people using the stops for their everyday traveling. • The last NBS demo will create a sensory garden in front of the hospital in the "Ochojec" district to reduce the stress of patients in combination with the extension of the green zone in this area	• The location of the NBS construction site was changed from Tyska Street to the area of the Dąb Church bus stop on Chorzowska Street • The second change in this area is the relocation of construction from Warszawska Street to Jagiellońska Street, due to the collision of the investment carried out on the entire Warszawska Street • The development of a retention basin on Tyska Street in Katowice will not take place • The development of green benches in the Market Square in Katowice was reconsidered in favour of the possibility of unsealing a larger concreted area • The changed locations and amendments provide an opportunity to develop a wider area, extending beyond the bus stop. This will enable a greater area to be 'unsealed' to introduce more greenery. These changes will provide a better ecological, social and scientific impact.
Task 5.2.2 Deployment of Demonstration Sites	
• Katowice will use this newly established network of different NBS interventions as a network for education of citizens through research stations and information boards, to educate citizens on the importance of vegetation, retention, air pollution and heat islands. • NBS network will also be used to promote various smaller NBS interventions people can implement in their homes (either on balconies or gardens) to become parts of the Katowice NBS network	No major amendments reported

Table 6.6.5: Belfast, Northern Ireland, UK -Mitigations to address risks

Original Proposal	Amendments
T5.2.1 Construction of Demonstration Sites	
• Demonstration site will be prepared for the application of soil and urban equipment as a basis for establishing the community gardens	• The development of the community garden was delayed due to a delay in the production of final designs and conversations with stakeholders

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• Tailor-made urban soil specifically purposed for ecological gardening and contributing to the recarbonisation of soil will be prepared and applied at the gardens • The soil, previously researched and verified in the Urban Soil 4 Food project44, will consist of excavated soil currently mostly discarded by the construction industry during earthworks, compost made of biological waste and biochar as the bridge back to organic farming that reverses the destruction brought about on the earth by conventional farming and is a valuable tool to accelerate the recarbonisation of soil • The prepared soil will be applied to the demonstration site prepared for urban gardeners in Task 5.2.2	• The use of 'in-ground planting' was not recommended as per the contamination survey therefore re-carbonisation of the overall site soil will not be possible at present • Internal conversations ongoing to access bio-matter from Belfast Zoo • Work is ongoing to encourage stakeholders to explore the use of household waste for composting • Biochar is being used in the research plots
Task 5.2.2 Deployment of Demonstration Sites	
• Within Task 5.1, the finalized co-design and co-creation process will be carried out with a target group of citizens presenting a cross-section of future urban gardeners ensuring that the agroecology approach will be taken-up by users • The city will be responsible for the selection of users and for management and supervision of the community garden providing a fail-safe as a last result for cases of non-compliance. The gardeners will be chosen via a variety of methods, including open calls and invitation-based, and their commitment to the agroecology gardening practices will be among the determining factors • The operational start of community gardens will be supported by various agroecology-based educational lessons for the education of users to sustain the initial practices by showing their undisputed benefits. Further mentoring activities on how to use the produce of urban gardens to decrease malnutrition and economically empower the producers will be carried out	• Capacity Building Support – Engagement has taken place with the conservation Volunteers • Citizen involvement program remains unchanged– No major amendments to commitments reported

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7 PUBLIC CONSULTATION AND DESIGN PLANS

7.1 OVERALL CO-DESIGN METHODOLOGY

Table 8 sets out the general methodological approach to co-designing NBS in the UPSURGE project. It specifically focuses on the activities to date in Work Package 5, deliverable 5.1. The methodology is outlined as a stepped, chronological approach aligned with a general 'Plan of Work' (Table 7.1) and associated design stages relevant to this point in the project. The methodology charts the activities carried out in the pre-design stage, in line with pre-UPSURGE activities. These include setting out the challenges and priorities for the city and identifying suitable NBS and sites to test these. At this stage, co-design processes are helpful to set out an inclusive and well-considered brief of requirements therefore developing initial stakeholder outreach here is important, paying attention to the quintuple helix. The methodology highlights three design stages: concept, developed and detailed design, though some cities use different place-specific terminologies in this report. While designers lead these stages, since designs are required to be produced by qualified professionals, design outputs must be produced collaboratively. At each stage of the design process, co-design approaches are encouraged to continually involve quintuple helix stakeholders to develop the design for and with a mix of citizens, providing multiple opportunities for meaningful engagement and feedback before the final design is agreed upon and constructed.

Table 7.1: Aligned with a generic 'Plan of Work', this table sets out an overview methodological approach taken by the UPSURGE cities to co-design NBS for demonstration sites

'Plan of Work' Stages and Descriptions			UPSURGE activities relating to WP5	General Methodological Approach to Co-Designing NBS
Pre-Design	0	Strategic Definition	Pre-UPSURGE activities	City challenges and priorities are identified. These may be informed by municipal policies and/or strategies.
	1	Preparation & Brief		Suitable NBS and sites to address challenges and priorities are queried and agreed through co-design approaches with stakeholders, such as through workshops, to prepare an initial brief of requirements.
Design	2	Concept Design	Co-creation, Preparation and Final Design for Infrastructural Demos (T5.1)	The concept is developed by designers using co-design approaches. The UPSURGE team provides additional support for NBS and stakeholder selection. Feedback is sought internally and from Quintuple Helix stakeholders. Adjustments are made to the concept design based on feedback.
	3	Developed Design		The developed design is created by designers using co-design approaches. Adjustments are made to the developed design based on feedback internally and from Quintuple Helix stakeholder.
	4	Detailed Design		Designers complete the detailed design. Feedback is sought internally and from Quintuple Helix stakeholders prior to final sign-off ahead of construction, co-design processes are encouraged

As stated in Task 5.1's description of work (DOW), 'all 5 infrastructural demonstrations were co-designed pre-UPSURGE in intensive participatory processes including citizens and other stakeholders.' While this is the case, the DOW also requires that each city 'organize at least 1 public consultation before finalizing the design plans to potentially update and modify the demo design to correspond to the current needs of citizens. The consultation will be organized with the help of the local UPSURGE ambassador outreaching out to the citizens. Special attention will be given to including the elderly, children, and youngsters in the design finalization process.'

The next section outlines the engagement activities carried out by individual cities informing the development of the final demonstration site designs. Some of these activities happened before UPSURGE, while others happened during the project. Each city took a different approach to engaging with citizens in the demo site co-design, for example, some cities used co-design workshops, and others used on-site exhibitions and door-

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knocking. Chronological flow diagrams depict the commonalities and divergences in approaches across the demonstration cities.

7.2 BUDAPEST BP 18 CONSULTATION AND DESIGN

The diagram (Fig. 7.2.1) highlights the processes taken by Budapest's 18th district municipality (BP18), to prepare for the construction of NBS on their demonstration sites. The diagram highlights the activities that happened before and during the UPSURGE project. Before the project, and informed by climate policy recommendations, city challenges and priorities were analysed. These highlighted the prevalence of flash flooding in the city. At the same time, initial stakeholders of interest were identified. From this process, NBS to tackle flash flooding was selected as the key challenge and from this, an initial design concept for a raingarden was developed by experts within the municipality. This city took a multi-site approach to address several issues identified in the city Climate Strategy (2019-2020), some of which are key to the UPSURGE project. Large public sites were selected internally before the UPSURGE project to monitor air quality changes through the implementation of NBS. The second issue, flash flooding was seen to require a two-stage approach. First, through a social media call, suitable public sites were selected to build upon and test the raingarden concept. This diagram depicts the process of designing this raingarden in more detail by nominating a design contractor and conducting a further stakeholder analysis, with a particular focus on the users of these public demonstration sites. Soil and geodetic surveys supported technical design development regarding plant specifications suggested by WP2. An external consultation on this design informed amendments to the detailed design. The next steps will be to construct the public raingardens and at the same time, begin the process of identifying private raingardens to replicate the concept through an amended bottom-up approach focused on citizen science and education.

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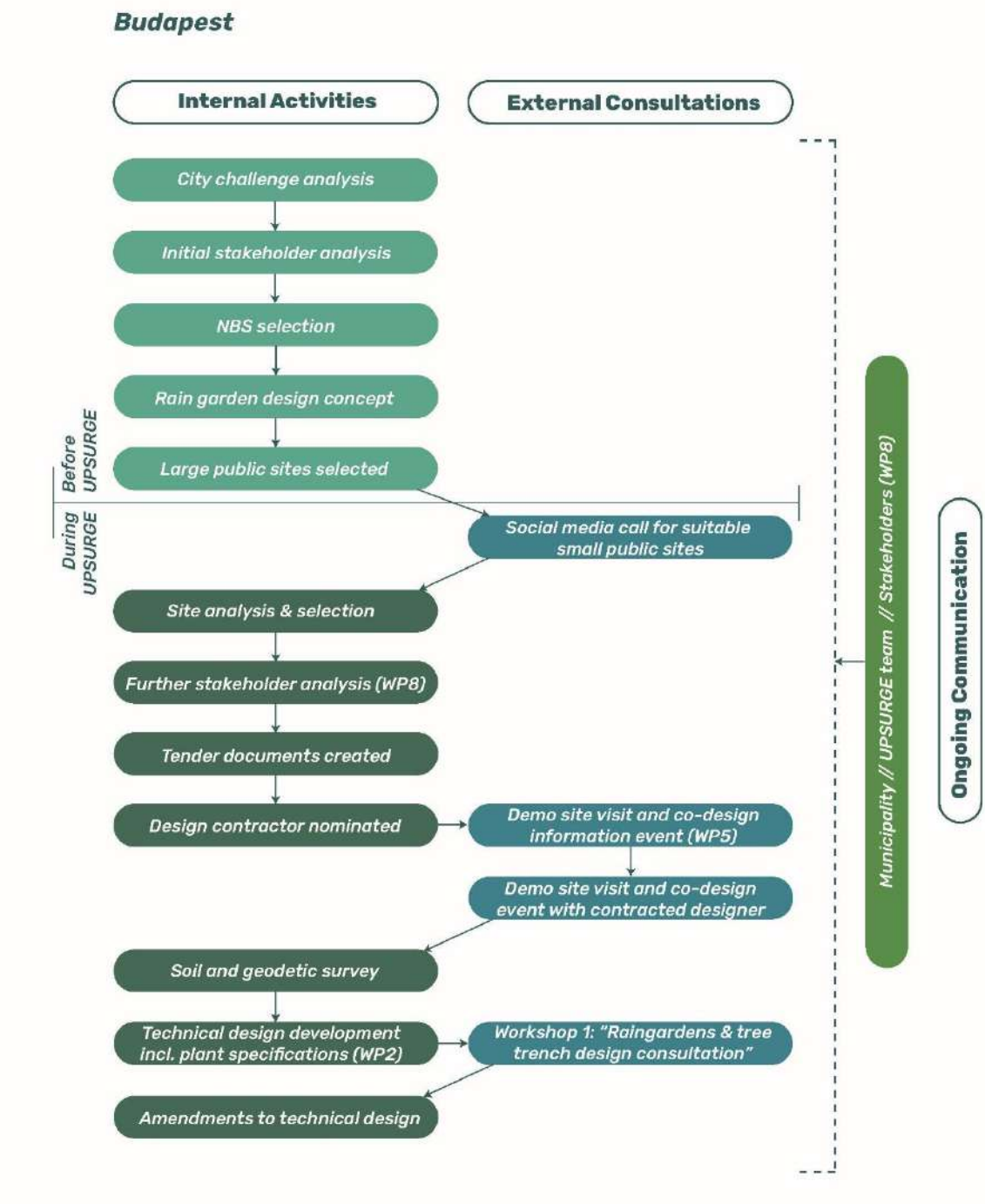

Figure 7.2.1: Process diagram depicting internal activities and external consultations to co-design Budapest's NBS demonstration sites

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7.2.1 CONSULTATIONS ON THE DESIGN

Initial consultation

During the development of the Climate Strategy (in 2019-2020) key priority issues were identified, including air pollution and flash flooding. According to climate models for BP18, the number of sudden heavy rainfalls is predicted to increase, while annual precipitation is expected to decrease. The number of flash floods is predicted to increase due to anthropogenic interventions, such as an increase in the number of paved surfaces. The main sources of air pollution are local and through traffic, domestic heating and the proximity of the airport. The Climate Strategy identified actions to decrease the problems, including sustainable green infrastructure development and management.

The most critical areas were identified in two ways, in terms of city capacity and the needs of local residents. The geological and environmental conditions and attributes were incorporated into the overall city and district Urban Plans. The green space, landscape and nature conservation conditions, the environmental protection areas at risk, and the protection and restriction areas, in addition to the water, rainwater and sewage networks were evaluated. A participatory method was chosen to respond in the best way possible to issues raised by local residents and businesses.

The **stakeholder interaction took place via social media in Budapest** (Fig. 7.2.2)- BP18 Municipality placed an open call in January 2022 on the BP18 Municipality Facebook site. The citizens were asked to send locations, where torrential rains cause problems for them. In total 51 responses were received, with some overlapping responses. These locations were visited by technical experts and assessed to determine suitable locations for 25 public raingardens. The actively engaged citizens are key to the ongoing stakeholder engagement process (Table 7.2.1)

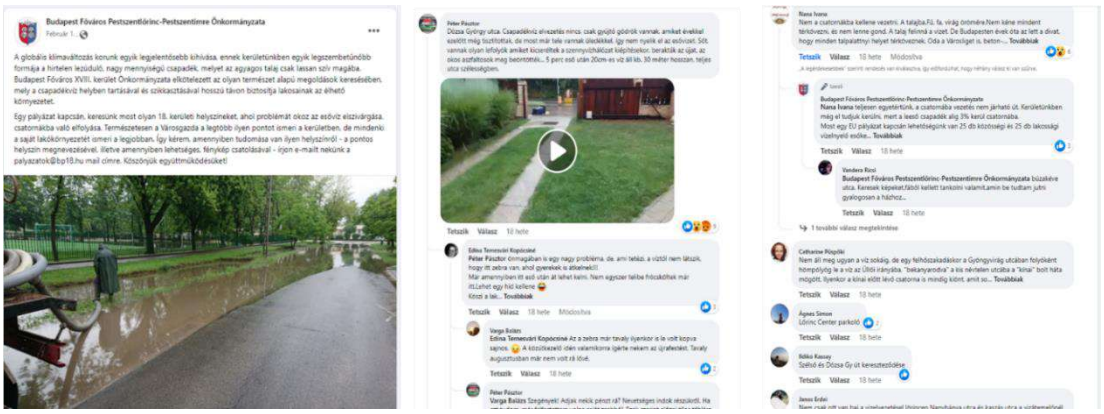

Figure 7.2.2: Budapest Social Media Consultation

Table 7.2.1: Budapest Consultation on social media

Budapest Consultation 1		Aim of the consultation	Content of the consultation	Feedback/ Output. How has this impacted design?
Date	January 2022	To identify locations, where the effects of torrential rains cause a major	Citizens were asked to identify sites where large amounts of precipitation have a	Based on the feedbacks, the 25 locations for public
Place	BP18 Facebook group			

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Total Attendees	51	problem for BP18 citizens.	negative effect on their everyday lives.	raingardens were selected (after expert consultation).
Academia (%)	0			
Civil society (%)	100			
Industry/Business (%)	0			
Government (%)	0			
Social/Environmental Groups (%)	0			

Stakeholder Mapping (March 2022) – The UPSURGE project relied highly on stakeholder mapping and participatory decisions made in the City Climate Strategy. The relevant actors in BP18 and the wider environment were mapped who have an interest in, or can contribute to, or influence the implementation of mitigation and adaptation measures. The stakeholder list was reviewed to focus on UPSURGE's priority areas. The stakeholder list was updated, and additional actors were added. The interest-influence matrix was prepared, and the way of involvement was re-evaluated.

Preparation of Workshop - The workshop aimed to maximise the impact on the NBS design. The BP18 project team, BURST and the landscape designers evaluated the list of key stakeholders, potential participants and the most appropriate communication approaches.
The importance of the maintenance of the demo site after the project directed the focus on the property owners and residents, mostly affected by the UPSURGE implementations, where the 25 public raingardens will be established. It is important to note that these lands are owned by the Municipality of the 18th district but have to be maintained by the property owners on Szálfa street. In total, 55 differentiated invitation letters were posted to them, with a photo of the current state and an image of the NBS. Unfortunately, the engagement response was low with only 2 property owners attending the co-design workshop.
As education is another strong focus of the UPSURGE project, eco-focused schools and kindergartens were also invited to the workshop. An especially high interest was shown from kindergartens, with 20 participants. Local NGOs and educational institutions were found to be key actors of dissemination and were involved in the design process and will be key stakeholders in the UPSURGE PlaceLabs (WP8).

Consultation workshop to finalize design (Feb 2023) – This workshop was held on 15/02/2023, at Tomory Lajos Museum (Fig. 7.2.4 and Fig. 7.2.5), which will be the flagship site of the various NBSs. Citizens, impacted by the raingardens and tree trenches received direct invitation letters. The invitation was also published on the BP18 website and FB site.

https://bp18.hu/hirek/keruleti-hirek/item/23276-esokertek-es-fas-arkok-termeszetalapu-megoldasok-a-18-keruletben

https://www.facebook.com/BP18K (13/02/2023)

Although there was a low response from local citizens, the process attracted local green organizations, schools, and kindergartens with an interest in ecological matters. Several colleagues from the environmental department of the Mayor's Office and leaders from the Municipality were present. Every attendee welcomed the nature-based approach and shared an acknowledgment of the importance of climate protection. As the plans have a strong hydrological background, the co-design process targeted the topic of the plants and maintenance and included educational purposes as well.

The workshop was held in Tomory Lajos Museum, one of the NBS sites (raingarden and green parking lot). The participants were seated so that they could see the presentations as well as work in smaller groups. An Agenda script and supporting materials were prepared and printed for the workshop.

The welcome words by the Vice Mayor of the municipality focused on local problems and the importance of the project in solving them. After the participants' introductions, UPSURGE DAC member

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Enikő Korpos gave a short presentation about climate change adaptation issues and presented the UPSURGE project. Then the main designer, Orsolya Novotny presented the locations and the potential design solutions for the public raingardens. She explained the solutions and options in the upcoming projects, with a small demonstration.

The participants started to work in small groups. Each table received a layout, aerial view pictures of a public raingarden location and potential plant assortment cards. The cards were used to make recommendations about the raingardens. Discussion topics: What are the most important considerations - what do we want to achieve in any case? Further suggestions -what are our preferences? Is there anything else that didn't come up from the cards?

The recommendations were presented by each table and the priorities and most important actions were identified to implement into the ongoing design. The participants' preferences included colourful, wide-seasonal range solutions that can be maintained by locals and would not disturb everyday life.

The participants were asked about the future steps and the upcoming private raingardens. The participants were invited to discuss if they could imagine having one in their garden and discuss their main concerns. The participants were also asked what information they would find useful for the information booklet.

Figure 7.2.3: Budapest Co-design Workshop

Figure 7.2.4: Outputs of Budapest Co-design Workshop

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Table 7.2.2: Budapest Consultation on design

Budapest Consultation 2		Aim of the consultation	Content of the consultation	Feedback/ Output. How has this impacted design?
Date	15/02/2023	To check if prepared design plans correspond to the current needs of citizens. If needed, modify the demo design accordingly. The workshop has an educational purpose as well, to gain the acceptance of citizens towards NBSs.	To develop the first version of design plans on public raingardens and tree trenches.	Important points for the attendees, to be considered in the final design: Plant selection: suitable for our climate & aesthetic. Maintenance works: every raingarden should be "adopted" by citizens / green schools, and kindergartens. Importance of education: info boards at the sites. Should not disturb everyday life.
Place	Tomory Lajos Museum			
Total Attendees	41			
Academia (%)	48			
Civil society (%)	8			
Industry/Business (%)	14			
Government (%)	22			
Social/Environmental Groups (%)	8			

Outcomes and Reflections of Workshop -

The workshop proved to be useful in many ways (Table 7.2.2). The participants gained a better understanding of NBS and how the solutions of UPSURGE will provide a healthier built environment. The design ideas from the workshops were able to be implemented in the final designs. Key and active actors were identified for the PlaceLabs (WP8).

Some specific outcomes:

- the site layout at Tomory Museum was discussed and rearranged according to the activities of the museum garden area
- the plant selection was adjusted to local needs, including aesthetics and maintenance minimization
- the importance of having an adoptive approach for all raingardens was highlighted, to ensure the maintenance
- the importance of follow-up to ensure that NBS addresses climate change, address actual needs
- information boards would be welcomed at the demo sites about the actual NBS

A report was created and published about the workshop on the BP18 homepage, FB site, and video site:

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- https://archive.bp18.hu/hirek/keruleti-hirek/item/23327-termeszet-alapu-megoldasok-a-keruletben
- https://www.facebook.com/BP18K/posts/pfbid0e8whMGMZVYEXYL7vNBu17Zi8rQQSC6C8h3K7261AcX2wLxkELL4iyBYmcbP49e7El
- https://www.facebook.com/televizio18/videos/558820782839203

Future Consultations

The importance of education was highlighted. It is proposed to have an invitation to stakeholders for the construction of a 34m^2 raingarden and parking lot with a biodiverse lawn at Tomory Lajos Museum. This will provide an opportunity to show examples of good practice, and how to combine functions at their own properties in an eco-conscious way. This will draw attention to the importance of NBS and air quality and encourage citizens to create their own raingardens. The participatory residential programme will start with an open call, to establish a further 25 raingardens in privately owned gardens, within the framework of the UPSURGE project.

7.2.2 CONCEPTUAL DESIGN

Adaption of Concept Design to the Final Design

At Tomory Lajos Museum, according to the original concept, it was planned to create a 10 m^2 raingarden with a 20-45 cm thick planting medium. However, based on hydrological calculations and the factors of the site, a much larger raingarden is planned with a surface area of 34 m^2 with a 60 cm thick planting medium. Based on the soil tests, it was found that precipitation infiltrates into the soil too quickly (>300 mm/h), so to retain rainwater in the planting medium of the raingarden, it will be necessary to increase the amount of organic matter (50% of existing soil and 50% good quality, high organic matter compost mixture). It was found to be not necessary to lay a gravel drainage bed under the soil layer.

In the case of the Margó Tivadar Street parking lot, the original concept was the creation of gravel lawn parking spaces and the placement of some shade trees. The final plan also included the creation of low, rainwater-absorbing plant strips (53 m^2 in total) planted with ground-covering shrubs. After examining several options for the layout of the parking lots, it was finally decided to establish 7 parallel parking spaces.

The original concept on Szálfa Street was the replacement of the original ditches with treetrenches on both sides of the road. However, based on the results of water engineering calculations and soil mechanics tests, as well as on-site conditions, it was found feasible to establish a total of 9 drainage ditches with a total floor area of 248 m^2. In total 7 trenches will be completely newly built and planted with plants. These can be created on the north side of the street, as there is available min. 2.5 – 3 m wide area for the construction of trenches. On the south side of the street, due to the narrow available area and the water pipe running in the ground, only 2 grassy ditches, partly converted and partly newly built, can be created. Due to the gas pipeline running in the ground on the north side of the street, the newly constructed drainage ditches are shallower than the original concept, larger plants and trees can only be planted on the edge of the ditch, outside the protective distance of the gas pipeline.

Concept and main aspects of the design

The purpose of the raingarden at Tomory Lajos Museum is to collect, retain, and distribute the precipitation from the roofs and covered surfaces of the area. The aim is to reduce the negative effects of climate change, increase water retention, improve air quality, and reduce the heat island effect of

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coverings. The use of diverse plant species will increase biodiversity and provide a habitat for various animal species (e.g., butterflies, bees, birds). The creation and subsequent maintenance of the raingarden will take place with the involvement of the local population. This underlines the importance of the community-forming impact.

The location of the proposed planned raingarden is in the northeastern part of the museum's garden, bordering the Bókay garden. In this area, the terrain slopes slightly towards the museum building, and here, in the area closest to the entry point of the runoff it is possible to retain a significant part of the rainwater.

The proposed plan is to fill the trench of the raingarden with a special soil mixture adapted to the composition of the existing, typically sandy subsoil (50% existing soil and 50% humus compost). It is necessary to cover the soil between the plants with hardwood (e.g., acacia) or mineral (e.g., washed gravel) mulch for better water retention. Mulching facilitates the infiltration of rainwater, prevents soil compaction and reduces weed growth.

The purpose of the design at Margó Tivadar street is to rearrange the parking lot in front of the Tomory Museum. The surface is covered currently with slag crushed stone and the soil is compacted. The concept is the construction of a parking lot with a gravel lawn, without irrigation or with a low need for irrigation, covered with an extensive grass seed mixture. The gravel lawn design reduces the negative effects of climate change, increases water retention, improves air quality, reduces the heat island effect of pavements, and the species-rich lawn surface increases biodiversity.

The gravel lawn is a green, seepage-active and flexible, 30-50 cm thick layer of crushed stone, which can be used as an alternative to asphalt or concrete paving stones for less frequently used parking spaces. The gravel lawn is not suitable for long-term parking of cars, because the plant surface needs light to grow. Unlike traditional pavements (asphalt, concrete), the gravel lawn allows the precipitation to infiltrate evenly into the soil, and in addition to its favourable microclimatic effect, the sight of a green surface is also more pleasant.

The base layer of the gravel lawn can be made of gravel or recycled materials, which are mixed with soil and compost in a specific ratio. The ingredients must be layered according to the specified grain size, and then the seed mixture consisting of suitable grasses and dicotyledons can be sown on this base layer. The parking spaces are separated from the connecting pavements by a sunken curb, and from the erosive green surface by a raised curb created with openings (sections with sunken curbs).

At Szálfa Street the planning aims to create draining ditches planted with plants and grass on the approximately 900 m long section of the street, by converting the current, paved or open-surface drainage ditches and keeping the vegetation as much as possible.

In and around the trenches, a multi-level plant population with trees, shrubs and perennials should be created, so that the precipitation will not remain and evaporate from the paved surfaces but is partly absorbed in the ditches and partly evaporated by the vegetation. This solution reduces the negative effects of climate change, increases water retention, improves air quality, and reduces the heat island effect. The use of diverse plant species increases biodiversity and provides a habitat for various animal species (e.g., butterflies, bees, birds). According to the plans, local residents will also participate in the subsequent maintenance of the vegetation of the ditches.

Newly constructed drainage trenches must be filled with a special planting medium (50% existing soil and 50% humus compost) adapted to the composition of the existing loose, sandy-muddy, sometimes gravelly subsoil to a thickness of 30-40 cm. As a result, trenches with a depth of 15-20 cm, which can be said to be shallow, are created, but they exert a draining, water-retaining effect on a wider surface. It is not necessary to lay a gravel drainage bed under the soil layer. The soil between the plants must be covered with hardwood (e.g., acacia bark) or mineral (e.g., crushed stone) mulch to better retain water. Mulching facilitates the infiltration of rainwater, prevents soil compaction and reduces weeding.

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The design of the drainage ditch is proposed as the same as the design of the raingarden, but the planting medium will be thicker and the mineral mulch more favourable, especially in the deeper part of the ditch. Sediments and silt catchers lined with larger river pebbles and stones are to be constructed near the edges of the ditches on the roadside, which prevent siltation of the bed, thereby helping to clean the ditches as well.

It is noted that next to the road, a grassy bench with a width of at least 1 m, slightly sloping towards the ditch, must be left intact.

Key specific aspects which need to be considered as a result of the feedback from the consultation on the design include the importance of: -

- the use of drought-tolerant plants suitable for the city climate
- use of flowering plants
- variety in plant selection (colours, habits, heights)
- evergreens
- shrubs or semi-shrubs
- creating a natural effect
- simple maintenance
- limited interference with daily activities and traffic
- no stagnant water
- education
- considering the rainwater coming from the roof (Tomory Museum raingarden)
- ensuring that water does not reach the foundation of the building (Tomory Museum raingarden)
- establishing a wider bench to the side of Szálfa street, where the area is more neglected but sufficient space exists.
- public utilities paying attention to the depth of the ditches (Szálfa Street drainage ditches)
- establishing smaller, island-shaped trenches (Szálfa street drainage ditches)

After the initial planning, the implementation of the raingardens will also be realized with the involvement of the residents of the area.

It is planned to communicate general information about raingardens, their advantages, why they are important not only for our immediate environment but also for settlements, as well as how they can be created and maintained. Information boards including descriptions and benefits of the NBS implementations will be placed next to the established raingardens/ditches,

7.2.3 Final Design

The design task is focussed on three main areas-:

1. Bp. District XVIII, garden of Tomory Lajos Museum, Margo Tivadar u. (street) 116. Construction of a raingarden for rainwater management
2. Bp. District XVIII, the common area in front of Margo Tivadar u. (street) 116. Construction of a parking lot with a gravel lawn surface
3. Bp. District XVIII, a section of Szalfa u. between Kettős-Koros u. and Oszko u. Construction of infiltration trenches with trees planted on both sides of the road

An additional task is to prepare type plans for small, public, and residential raingardens, which can be adapted to the locations selected by the residents.

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The design task includes obtaining the expert opinion and approval of the special authorities necessary for preparing the permission design, as well as the consent or permit of all relevant utility or public service providers for the demonstration sites, if required. In addition to the design tasks, UTIBER Kft. has also undertaken to carry out the designer project management tasks necessary for the implementation of the plans at the demonstration sites.

A **geodetic survey of the design** areas and soil mechanics consultation – including the results of the infiltration tests – have been completed. The BP18 design plans include the soil testing report, and **architecture, landscape architecture, landscaping and water drainage plans** prepared for the garden of Tomory Lajos Museum. The **utility data** included in our designs were obtained through the e-public utility system.

1. **Bp. District XVIII, garden of Tomory Lajos Museum, Margo Tivadar u. (street) 116. (Fig. 7.2.6 and Fig 7.2.7)**

Planned rainwater management plan for Tomory Lajos Museum - The amount of rainwater received from the surrounding areas was determined based on **hydrology calculations**. With this knowledge, it was possible to calculate the size and quantity of hydro-engineering structures required for the collection and storage of rainwater. The intensity of rainwater is determined based on the precipitation values from the database of no. 53 Budapest Pestszentlőrinc-outer area meteorological station which is located ~650 m from the Museum and therefore provides relatively accurate values for the site. Based on the hydrology calculations, the task is to **design a trench (raingarden)** that safely collects and stores the standard precipitation volume. To accommodate the rainwater received from the direction of Bokay-kert, the location of the reservoir-infiltration trench (raingarden) near the gate between the two properties, on the southwest side of the educational trail is designed to be constructed, in accordance with the previously prepared landscape design and the needs of the operator. In this way, rainwater flowing from the garden can be managed by guiding it in the SW direction, with minimal landscaping, and it will not affect the lower parts of the garden of the Museum. According to the hydrology calculation, the precipitation volume produces a theoretical dimension for the sloping trench (raingarden marked “A”). Based on the soil testing report, the **infiltration test** was carried out in the area to determine a filtration coefficient. In the **planting of the raingardens** (Fig. 7.2.5), it will be important to consider the height, flowering time, colour, and habitus of each plant. To create a long flowering period, plants that bloom at different times will be used. The raingarden can be divided into different moisture zones. In the deepest part of the garden (Zone 1), plant species that can tolerate occasional root waterlogging for a few days will be planted. In the transitional, higher Zone 2, plants that typically prefer moist soil conditions and are characteristic of waterside environments may be placed, while drought-tolerant plants are more suitable for the Mediterranean areas of the garden (Zone 3). Many native plants are excellent for the raingarden and generally adapt to local conditions, but cultivated ornamental plants can also be used if they do not have invasive characteristics or problematic pests.

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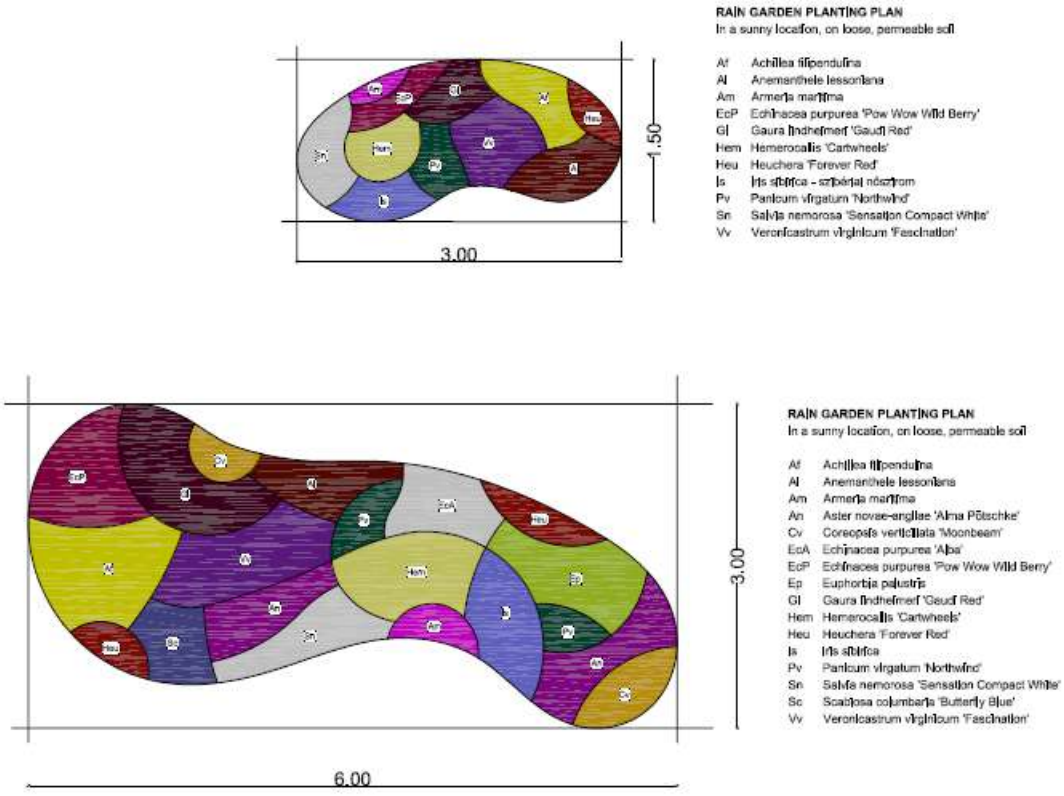

Figure 7.2.5: Planting plans created for UPSURGE project (standard design for different locations and soil type) (Annex BP18 design plans Chapter 3.1 and 3.4)

Semi-arid Green Infrastructure Toolbox (Bioretention) - Bioretention includes a family of practices that treat stormwater naturally by filtering runoff through vegetation and soil before it either recharges groundwater through deep infiltration or is discharged to a surface drainage system such as culverts or ditches. Bioretention systems typically include an overflow device to bypass runoff volumes larger than the storage capacity of the practice to prevent ponding and scouring of the bioretention surface. Annex 4 refers to the toolbox used for reference, created by the US EPA.

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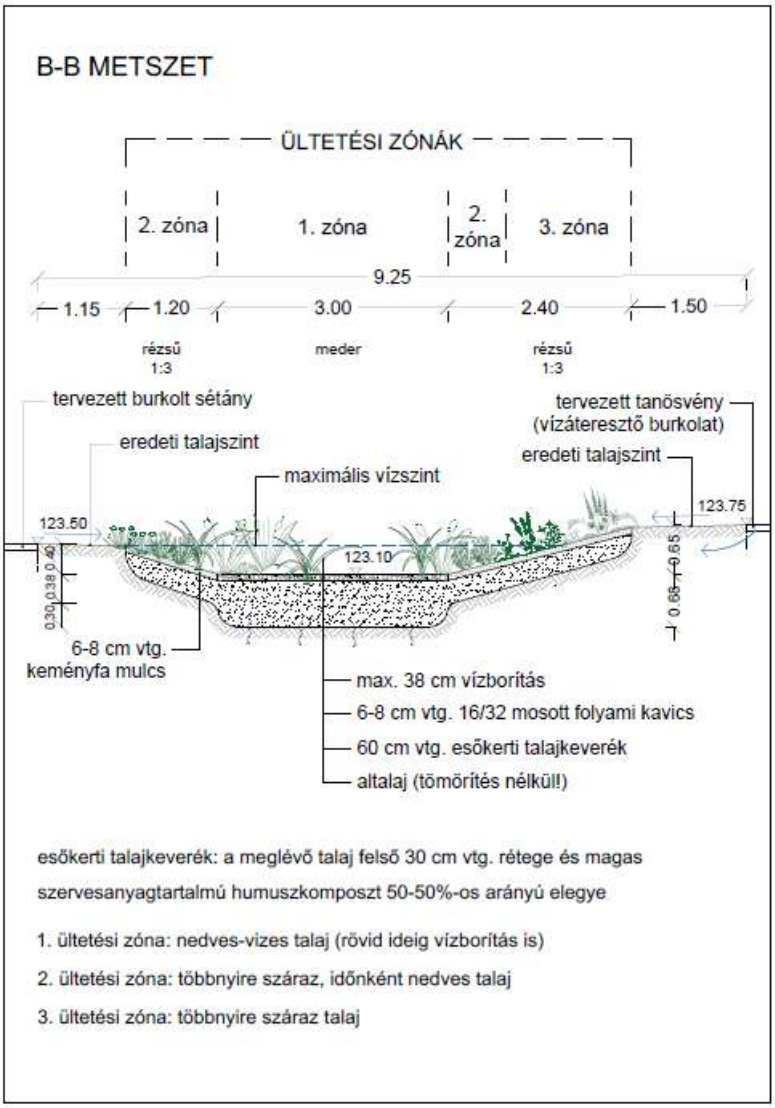

Figure 7.2.6: The construction of raingardens is described in detail in BP18 design plans (Annex BP18 design plans Chapter 3.1)

Three small raingardens with a total infiltration surface of 83 m^2 will be constructed on the design area – as a means of rainwater retention as a nature-based solution – based on the results of hydro-engineering calculations and soil mechanics tests. At the request of the Museum's management, smaller rain gardens with a total area of 57 m^2 were planned. The location of the planned raingarden A, with an area of 34 m^2 (~3.05 m x 11 m) is in the north-eastern part of the garden of the Museum, adjacent to Bokay-kert, near the gate at the meeting point of the planned footpath to lead to the gate and the educational trail. This area slopes gently towards the Museum building, and a significant proportion of rainwater may be retained in the area closest to the point of entry for rainwater runoff.

The proposed layout of the raingarden is shown on site plan No 43714.F.04.02 and earthworks drawing No 43714.F.05.02 while the planned structure of the layers is on sectional drawing No 43.714.06.02.

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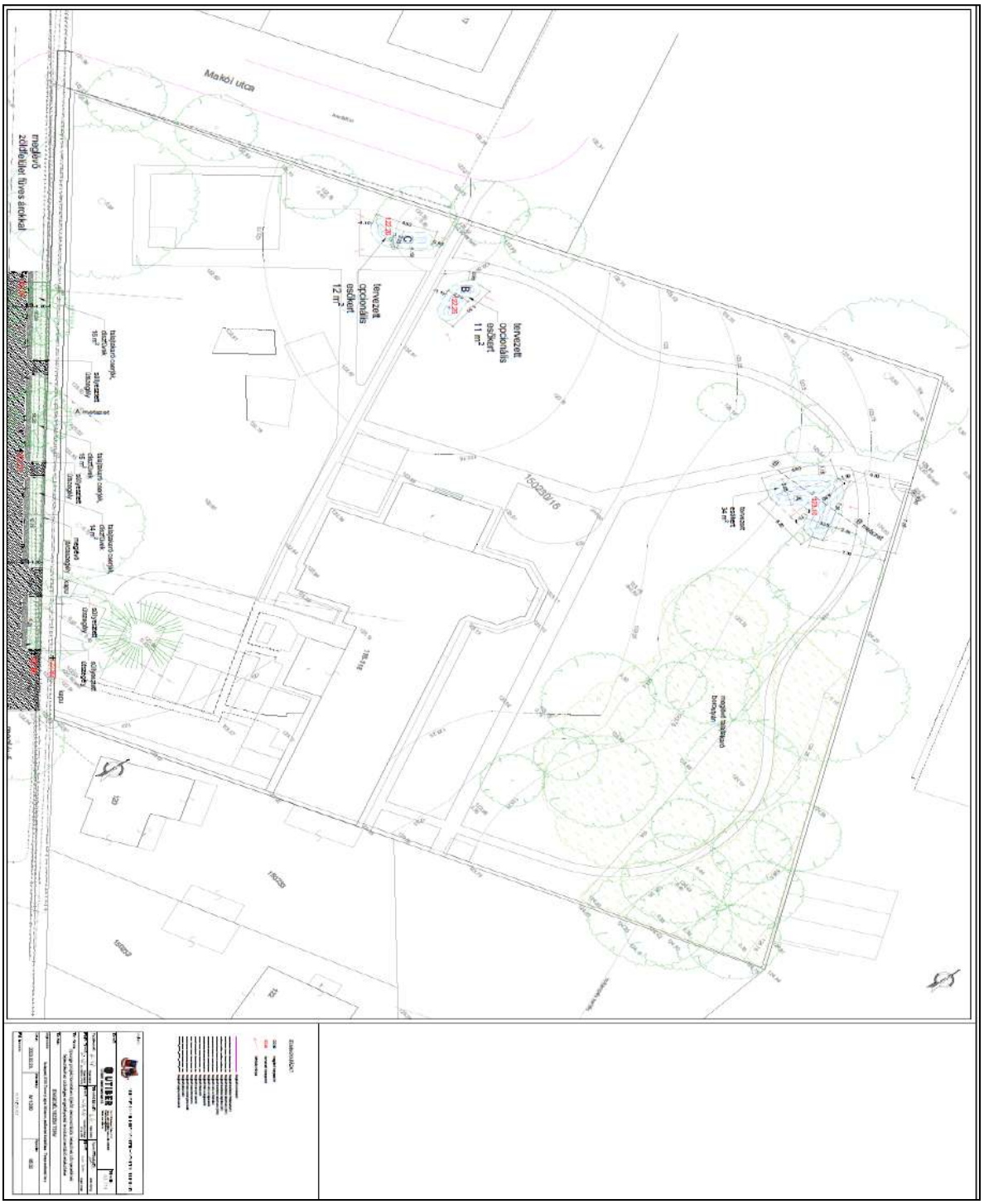

Figure 7.2.7: The proposed layout of the Tomory Lajos Museum

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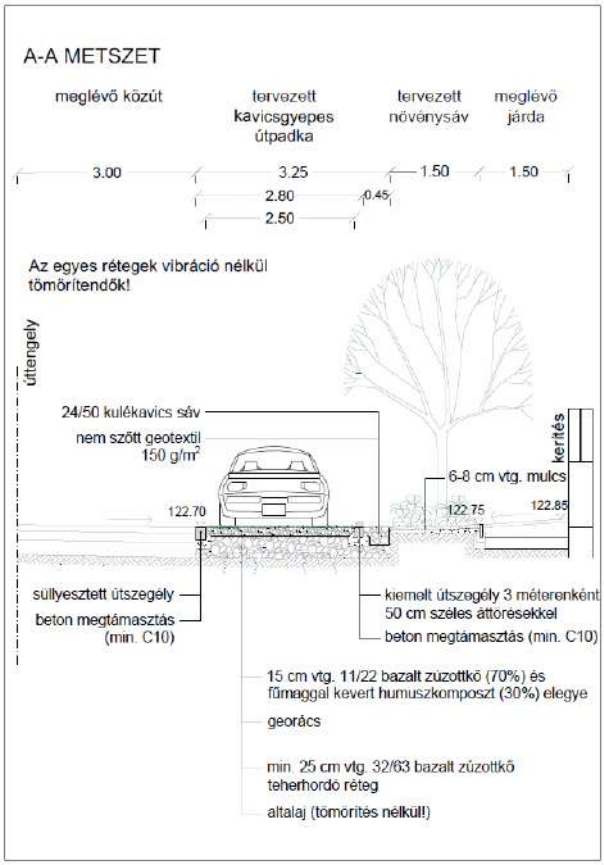
2. Bp. District XVIII, the common area in front of Margo Tivadar u. (street) 116. (Fig. 7.2.8)

Margó Tivadar utca (street) – construction of a gravel-grass surface lining -: The design is aimed at creating parking spaces in front of Tomory Museum, in an area currently used for parking, covered with slag and compacted; the new parking lot will be covered with a so-called gravel grass surface with no or low irrigation requirements, covered with a grass seed mix that is easy to maintain. The gravel-grass cover reduces the negative effects of climate change, increases water retention, improves air quality, reduces the heat island effect of paving and the rich grass surface rich in species increases biodiversity.

In the design area, an infiltration surface of 156.5 m^2 (gravel-grass covered) and 53 m^2 green area with plants and trees shall be constructed, as a nature-based solution of rainwater retention – based on the results of hydro-engineering calculations and soil mechanics tests.

A total of 7 parallel parking spaces can be constructed with gravel-grass surface.



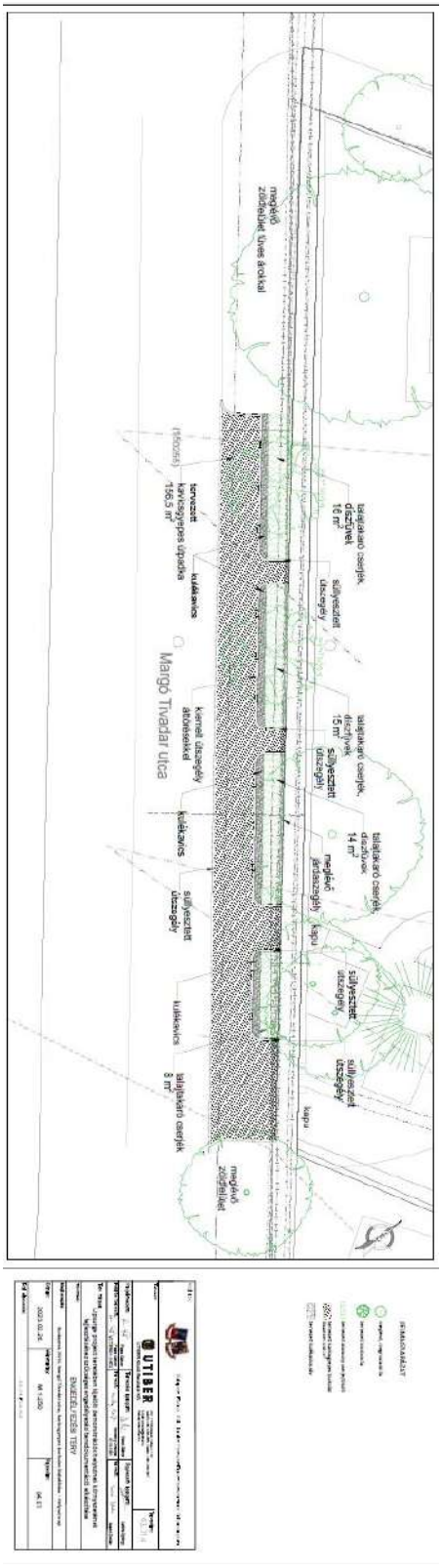


Figure 7.2.8: The layout of the common area in front of Margo Tivadar Street

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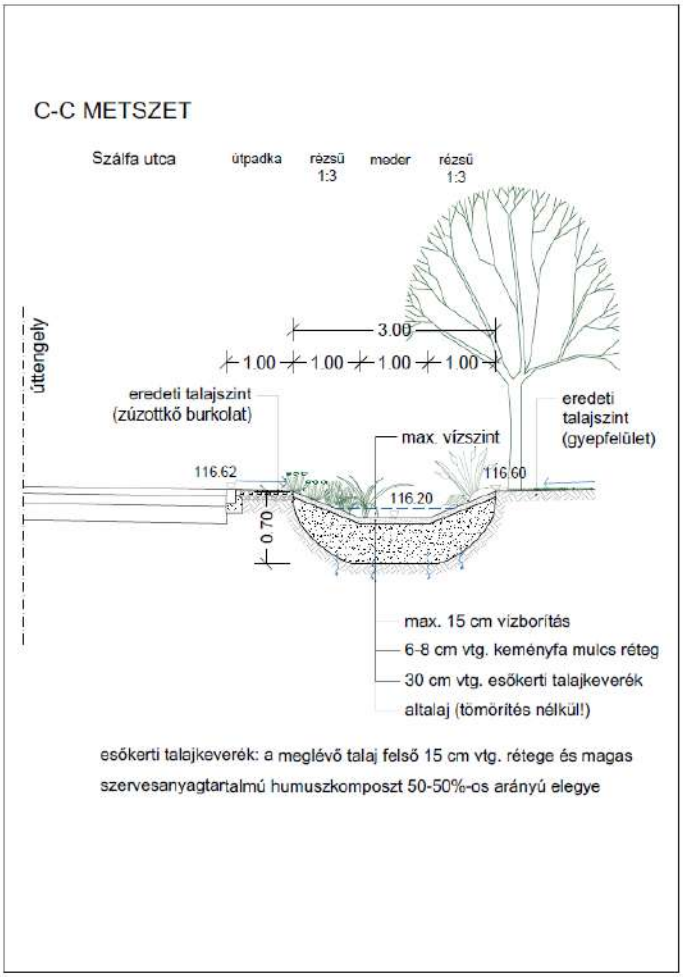
3. Bp. District XVIII, a section of Szalfa u. between Kettős-Koros u. and Oszko u. (Fig. 7.2.9)

Szálfa utca (street) – construction of infiltration trenches with trees planted -: The design is aimed at creating infiltration trenches with grass and plants along the approximately 900 m long section of Szalfa street between Kettős-Koros and Oszko street, by transforming the currently existing, paved or unpaved infiltration trenches by retaining the flora as much as possible, on both sides of the road.

A total of 9 infiltration trenches with a total area of approx. 248 m^2 may be constructed on the design area – as a means of rainwater retention as a nature-based solution – based on the results of hydroengineering calculations and soil mechanics studies. All of these can be constructed on the north, even side of the street since a minimum 2.5 – 3 m wide area is available there for the construction and widening of the trenches.



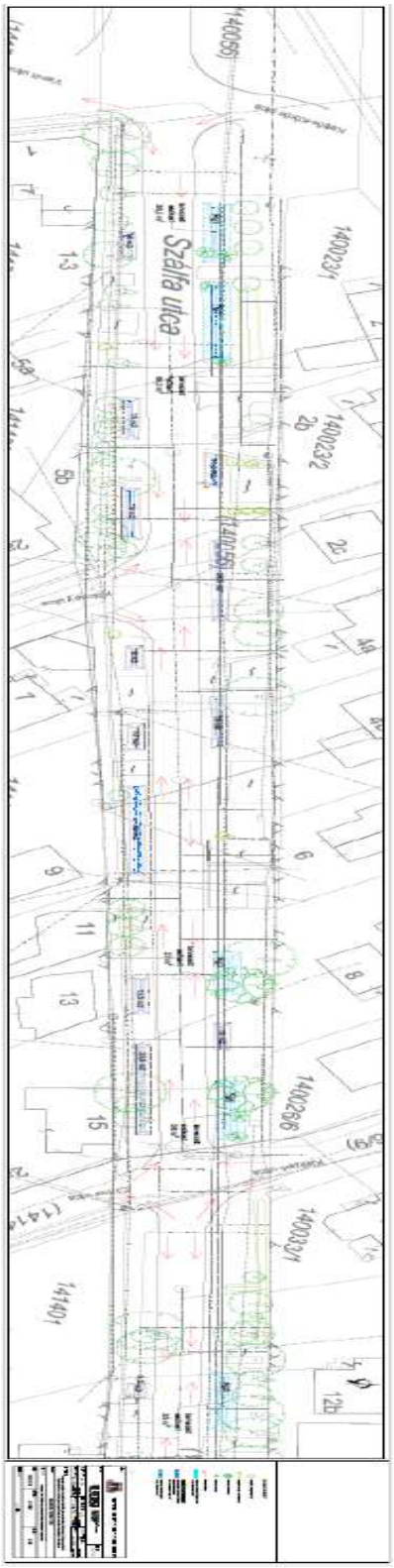


Figure 7.2.9: The location, type and layout of a section of Szalfa street

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7.3 BREDA CONSULTATION AND DESIGN

The diagram (Fig. 7.3.1) highlights the processes taken by the municipality of Breda, to prepare for the construction of NBS on their demonstration site. Before the UPSURGE project, the site was selected by the municipality. Immediately after this, tender documents were created to nominate a suitable design contractor. Once nominated, a period of initial engagement with stakeholders began. Particular attention was paid to engaging with residents through an on-site market where scoping interviews took place. From these interviews, an online survey was developed to expand the conversation to a wider group of stakeholders. Survey responses were collected and presented, leading to further online feedback. The information gathered informed a concept that was developed by the designer. The concept was presented at the doors of residents and then in a presentation on the site as well as a follow-up survey. These informed the preliminary design which followed a similar engagement approach. The preliminary design was adjusted as well as permits and tender documents prepared for the detailed or final design. The next stage will be to follow a similar approach for the final sign-off of the design before moving into the construction stages.

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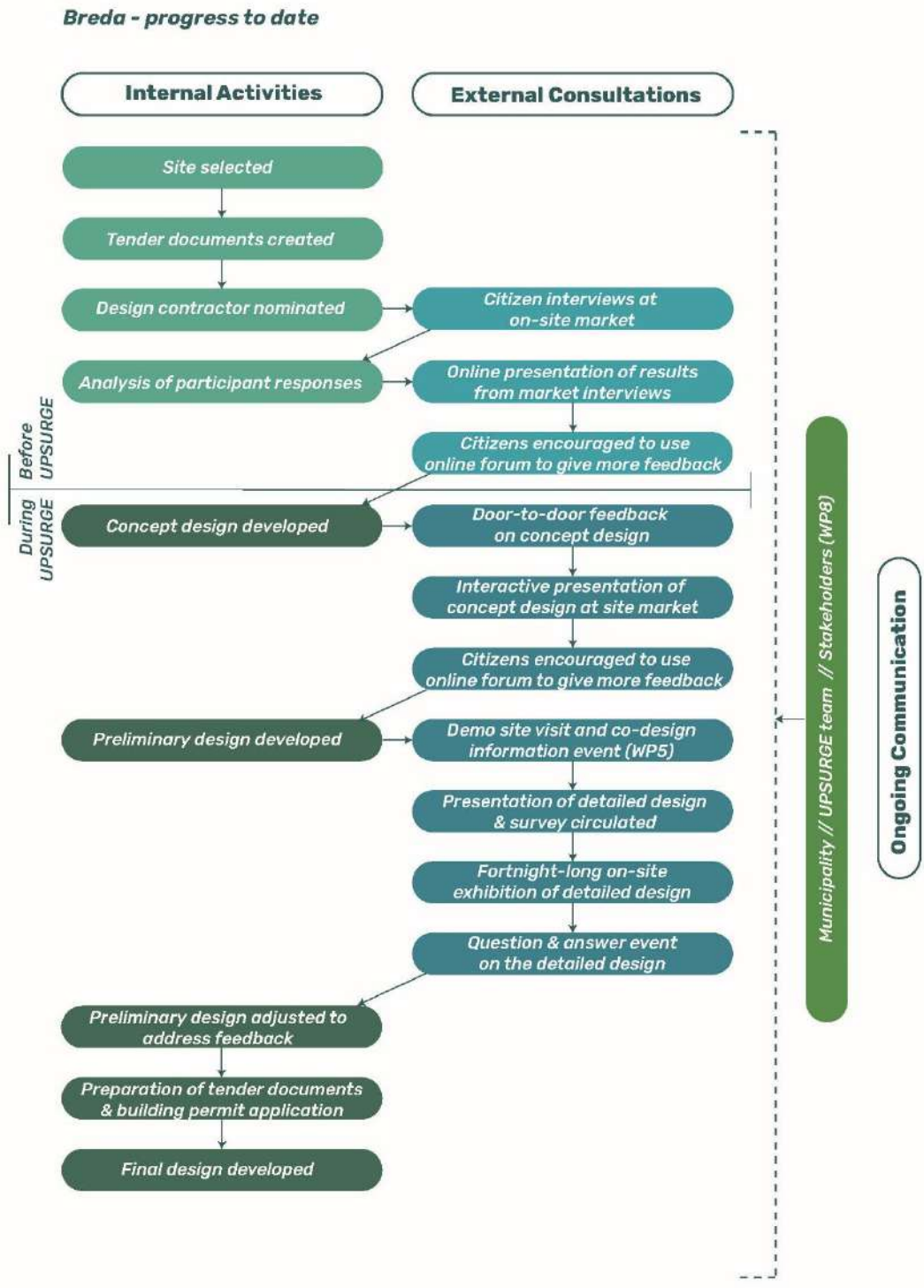

Figure 7.3.1: Process diagram depicting internal activities and external consultations to co-design Breda's NBS demonstration site

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7.3.1 PRE-UPSURGE CONSULTATIONS

The Breda "Linie Zuid" project was an existing project and was proposed for the UPSURGE demonstration site. Within the project scope of Linie, greening and climate-adaptive design of public space was a primary initial focus. The consultation methodology conducted in Breda aims to develop a widely supported design consisting of several components. An integral aspect and also the greatest challenge in the reconstruction of the Breda public space was to ultimately make a design to accommodate all residents. Therefore, Breda municipality, set up a broad participation process where residents have been involved at different stages in the process so that there is strong engagement in the final design.

Discussions have been held with residents at various strategic stages

In the first meeting, the focus was on getting to know each other and highlighting existing qualities and points for key attention in relation to the current public space. In the session that followed, the findings from the first meeting were presented, including which elements were included in the designs for the streets and other recreational places. This created a transparent process, with an opportunity to explain choices made and increased support for the design

Talking to residents in an inspiring setting

In a neighbourhood where people are less used to participation, it was deemed important to set up participation in an accessible and inspiring way. All meetings were therefore held in the district. For example, the first meeting was in the form of a small outdoor market on one of the public squares. At another meeting, plants were handed out to inspire residents to design their front or back gardens in a more climate-adaptive way, and a poster exhibition was set up in the neighbourhood. In addition, door-to-door engagement was used to encourage residents to engage in conversation with as many residents as possible. In addition, (interim) designs were developed into 3D visualisations to assist residents in understanding and visualizing the impact of the NBS designs.

Design-questions

In the first phase, the residents were asked to indicate which places in their neighbourhood they disliked and liked. These spatial qualities or points of attention were used as important inputs for design assumptions. Later residents gave feedback on the design scenarios presented. They didn't have to choose but were asked to give comments on the scenarios using questions such as 'What do you like about the first and what about the second scenario? And what do you dislike most'. Furthermore, reference images were used to ask the residents which form of recreational elements they liked most. From a landscape perspective reflection question included 'what is the current green structure of the neighbourhood', 'how can we upgrade or expand this green structure of green framework', also 'which areas need to be upgraded and made more climate proof and nature inclusive' and 'how we can design different squares linked to the needs and wishes of the inhabitants'.

Breda municipality conducted several meetings with local inhabitants pre-UPSURGE, which are detailed in the following sections.

The city organized a market on-site (September 2020): Residents of the area were asked to indicate the qualities and points of interest of the neighbourhood. A market was organized by the city where

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people were interviewed and invited to write and draw on several provided maps. The Illustrative photos from the market are available in Fig. 7.3.2.

Key findings and outcomes:

Linie Zuid was described as a nice neighbourhood to live in with many existing trees which encourage a lovely atmosphere and should be kept. People in the neighbourhood are active, and several activities take place year-round.

The neighbourhood is less accessible as a place for cars: safety is compromised by speeding cars, and people who don't live in the neighbourhood use parking lots which results in a high level of cars in the streets.

Attention was drawn to the maintenance of the greenery in the neighbourhood and the space/facilities for children and adults to play, meet, and play sports.

Online presentation of the results of the market (January 2021): People were able to see and comment on the outcome of the 1st meeting through www.planbreda.nl. Key outcomes: Several minor additions were made as outlined below.

7.3.2 CONSULTATIONS ON THE DESIGN

Sketch Design presented to inhabitants (July 2021): The inhabitants of the area were invited to respond to the presented Sketch design. On the first day, residents were interviewed by a door-to-door survey, with a small market a few days later, where the sketch design was presented. People were invited to give their opinions by pasting green and red stickers and by writing responses on posters or having a face-to-face discussion with the City team. Plants were handed out to stimulate the greening of the neighbourhood the residents (Fig. 7.3.2)

Key outcomes:

1. There was a favourable response to the new street proposal from residents: they were interested in facade gardens and responded favourably to parking and greenery proposals (except for the Vuchtstraat, where some adjustments were suggested). In all streets, a need was identified for parking and planting areas to be better designed to allow people to be able to reach and cross the parked cars more easily.
2. All kinds of pluses and minuses have been noted in the designs for the two squares and the playground: people have expressed their preferences for several elements in the designs. Overall, there was a positive response to the locations being more attractive to play, to play sports, and meeting each other. The idea of combining water retention areas in these places has also been well-received.

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3. Residents were concerned about the maintenance of the proposed planting and an issue which was raised was the concern that green areas might attract pests.

Figure 7.3.2: Stakeholder Engagement at a pop-up exhibition in Breda

Feedback on sketches: During and after each meeting people could respond to the questionnaires and sketch designs through a public website of the municipality: www.planbreda.nl. Urban Synergy (urban and landscape design office) made the Sketch design together with the municipality of Breda and the housing corporation Alwel. Feedback from the first meeting provided a basis for the design. Design ideas were discussed in several meetings with the project team of the municipality and checked against practical, technical, and social issues.

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7.3.3 Conceptual Design and Drawings

Presentation of preliminary design (June / July 2022) Figs. 7.3.3-7.3.4- Breda Municipality held a 3rd presentation of the preliminary design, informed by the outcome of the 2nd meeting where inhabitants were asked to respond to the Preliminary design. For two weeks, the team held an on-site exhibition to show the outcome of the 2nd meeting and the Preliminary design. People filled in a questionnaire about the positives and negatives of the presented design to gather reactions to finalize the design. One afternoon, the team was available onsite to answer questions and discuss the Preliminary design with the residents (Fig. 7.3.3). Approximately 50 people from the neighbourhood attended the second meeting.

Figure 7.3.3 Preliminary design of the Breda site

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Figure 7.3.4: Adjustment to design in Breda site

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Workshop Results - The workshops gave a good overview of what the municipality of Breda, the social housing corporation and the inhabitants wanted. In general, there was a lack of green in the public space, the public space was of not good quality, playgrounds where not linked to the target groups, parking in the neighbourhood was not well organized and due to heavy rainfall, there were problems with too much water on the streets. And in certain streets cars drove too fast, resulting in unsafe areas for pedestrians.

Concept design adapted into the final design - Streets were upgraded by formalizing parking lots (more efficient parking and an upgrade of the spatial quality), and green structures were extended and upgraded with new trees and green borders. These green borders are important for water retention, upgrade of spatial quality and addition to biodiversity. The playground where upgraded, including new seating elements, trees and lower vegetation for shade and new play elements were introduced.

7.3.4 FINAL DESIGN

The design plan was developed at the end of the preliminary design phase. Based on the feedback from citizens some adjustments were made to the design (Fig. 7.3.4). In some areas, more parking spaces have been created (this will result in less greening but meets the requirements of the residents). The implementation and maintenance of the NBSs will be integrated into the contract for the reconstruction of Linie Zuid. The planting of trees and shrubs will add biodiversity and improve air quality for local residents. The designed space will be used by local residents. Ongoing discussions will determine how the space will be managed during the construction and after the project, but the city team plans to work with local residents.

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Consideration of Materials (Fig. 7.3.5) -Parking along the sidewalks will be increased. The parking bays can raise the spaces when there is no parking part of the sidewalk and the domain of the pedestrian. This makes using it sidewalk more multifunctional, and the width of the roadway is visually narrower. The parking spaces will be marked with gray concrete pavers. This color matches the 30x30 sidewalk tiles. The parking spaces along green areas will be executed with grass pavers and there will be a greener street scene that becomes a green area visually widened. The grass pavers are combined with recycled brown-red paving bricks. This forms one unity with the brown-red paving bricks of the roadway. Along the parking bays ridge tiles are used as exit strips. The cobblestones are reused and applied like an ornamental detail on the sidewalks that go through repeatedly throughout the district. This ensures a recognizable appearance. The facade gardens are marked with 1 stretch 30x30 tiles. These can be done by the residents themselves are removed to a facade garden. The standing stone can be used as a retaining strap.

Fig. 7.3.5: Adjustment to design elements in the Breda site to include a consideration of materials

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Consideration for Rainwater Collection and Infiltration (Fig. 7.3.6)- Where possible, downspouts will be disconnected from the sewer through which the rainwater can flow and infiltrate into the adjacent green areas. As such the sewer is relieved during peak showers and there is more rainwater retained in the area. On the squares, rainwater will be collected from the adjacent roofs cushioned and slowed down discharged. Water-permeable paving will be used. Optimally greening the streets and on the squares can infiltrate a lot of rainwater. Through above-ground outflow facilities raingardens and a water square become the rainwater made visible to residents. This impact will increase the educational vision of the Breda demo site.

Figure 7.3.6: Adjustment to design elements in the Breda site to include consideration for rainwater collection and infiltration

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Design and layout of squares (Fig. 7.3.7)- The squares will be kept free as much as possible from parking. The squares will be decorated with lots of plants. The surface hardening becomes minimized. A conscious choice will be made to use it as in the northern part of the Linie, the squares to give it its own character. This contributes to the recognizability within the neighbourhood that is characterized by stamp construction (repetition of housing units). The park on the Vuchtstraat is part of it of a larger green structure along the Doorboslaan. Swammerdamplein which is particularly targeted as a recreational area (play and stay). The Jan van der Heijdenplein is dominated by some large chestnuts and there is not much space in the undergrowth area for planting. From feedback from the residents, there was an emphatic wish for several parking spaces.

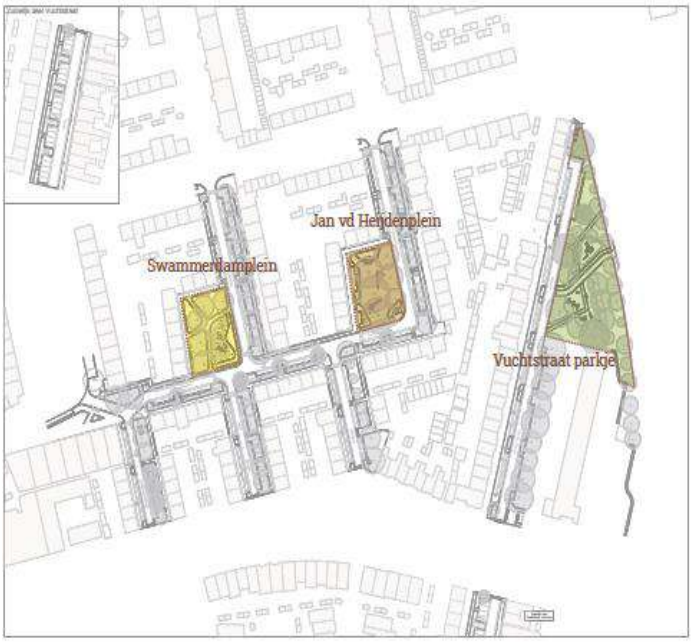

Figure 7.3.7: Adjustment to design elements in Breda site to include a consideration for residents' feedback on the use of recreational areas (stay and play) balanced with the need for parking

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Planting Plan (Fig. 7.3.8)- The substrate is (humus-containing) sand, and groundwater at -1.50m from the ground level. Where possible, we will widen the green sections. Greenery will be used at side walls and property boundary facades realized through climbing plants. Space will be reserved along the facades where residents can have a facade garden layout. The choice of planting has been taken into account with biodiversity and plants chosen to attract bees and butterflies. The choice of planting has also been taken into account with the planting list with planting to have a positive impact on air quality. Existing trees will be preserved as much as possible.

Figure 7.3.8: Planting design elements for Breda site

Key concepts and considerations of the design (Figs. 7.3.9 and 7.3.10)

Green structure is an important framework within this process. Initially, this was fragmented and in the design process green structure has been made more coherent and connected. This green structure gives identity to these (formal 'stoney') streets and playgrounds. The green borders and one water square take care of temporary water storage and prevent sewage from being overloaded with too much rain at the same time. By adding more flowery vegetation the spatial quality of the area is upgraded and this benefits biodiversity.

Impact of feedback from stakeholder consultations on the site design

The design process involved a collaboration with experts from the municipality, housing corporation, inhabitants, and Urban Synergy. Experts from the municipality, for example, the mobility expert, helped with looking at how many parking lots were required in the area, how to slow down car traffic and how to optimize parking lots. With the people from green and water management interventions were considered to make the neighbourhood climate-proof, and resistant against heavy rainfall and draught

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for a longer time. Effective communication with green experts from the municipality has resulted in the selection of trees and lower-level growing vegetation which can resist heavy rainfall or draught and moment with many days with elevated temperatures. In consultation with the housing corporation, the city municipality will involve shorter-term renters and longer-term residents in the process to inspire them to participate and even make their front or back gardens greener.

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Figure 7.3.9: Final Design for Breda UPSURGE Demonstration site

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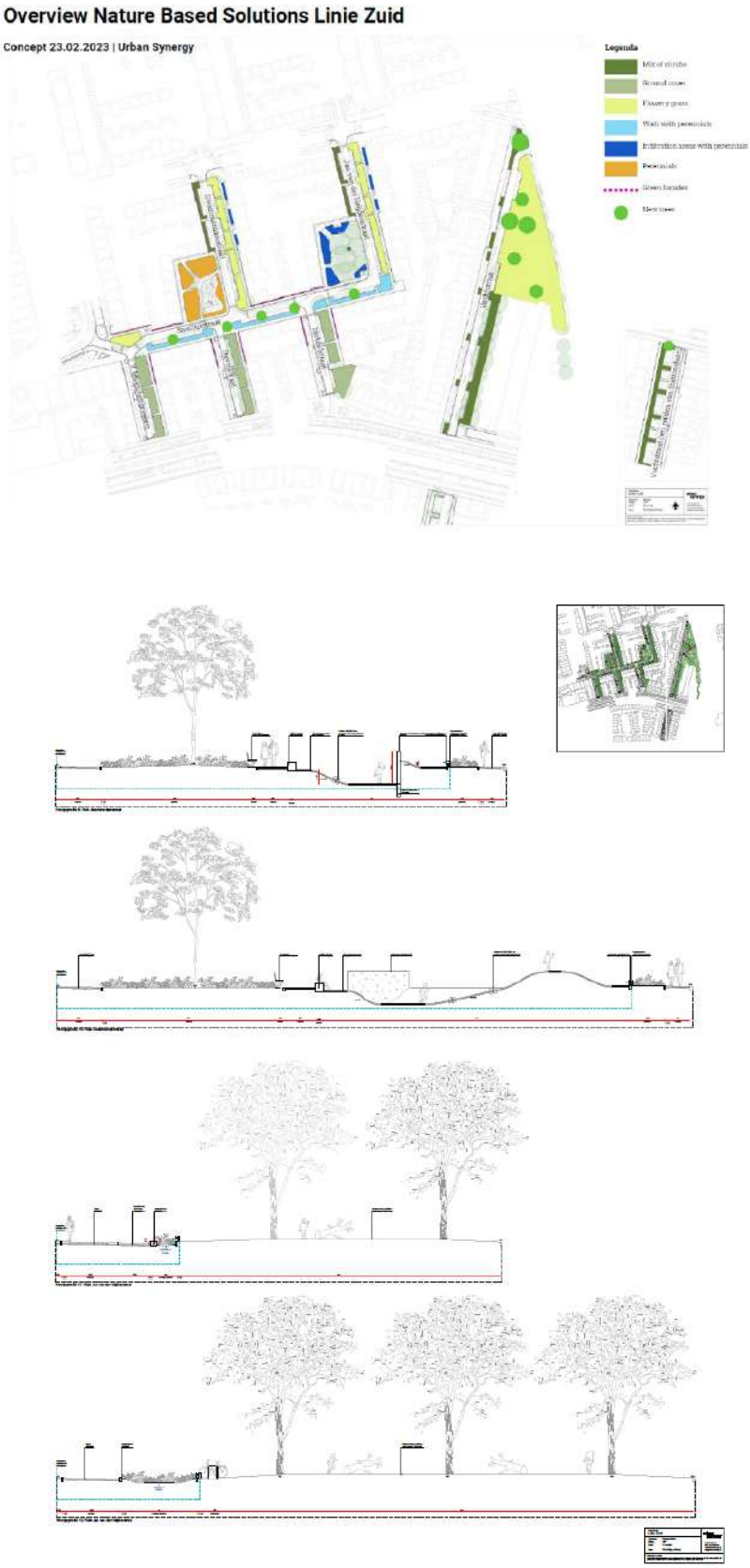

Figure 7.3.10: Overview of NBS for Breda UPSURGE Demonstration site

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7.4 Maribor Consultation and Design

The diagram (Fig. 7.4.1) highlights the processes taken by the Municipality of Maribor, to prepare for the construction of NBS on their demonstration site. The UPSURGE demonstration site was the subject of a decades-long campaign by residents who highlighted its need for regeneration. Before the UPSURGE project, extensive community-led activities took place to explore and define a brief for the site's future, discuss public tenders for the site and a community walk and discussion on the site. From this, the city developed a set of tender documents and launched a design competition. The results of this competition were exhibited offering a wide mix of solutions from designers. One successful design team was chosen, and their concept proposal was exhibited again. During the UPSURGE project, the nominated design team developed a detailed design, which was presented several times online to stakeholders as well as internally to inform design tweaks. Once the municipality was happy with the design, two stakeholder meetings were held to agree on the final design, after which it was agreed internally ahead of the construction phase.

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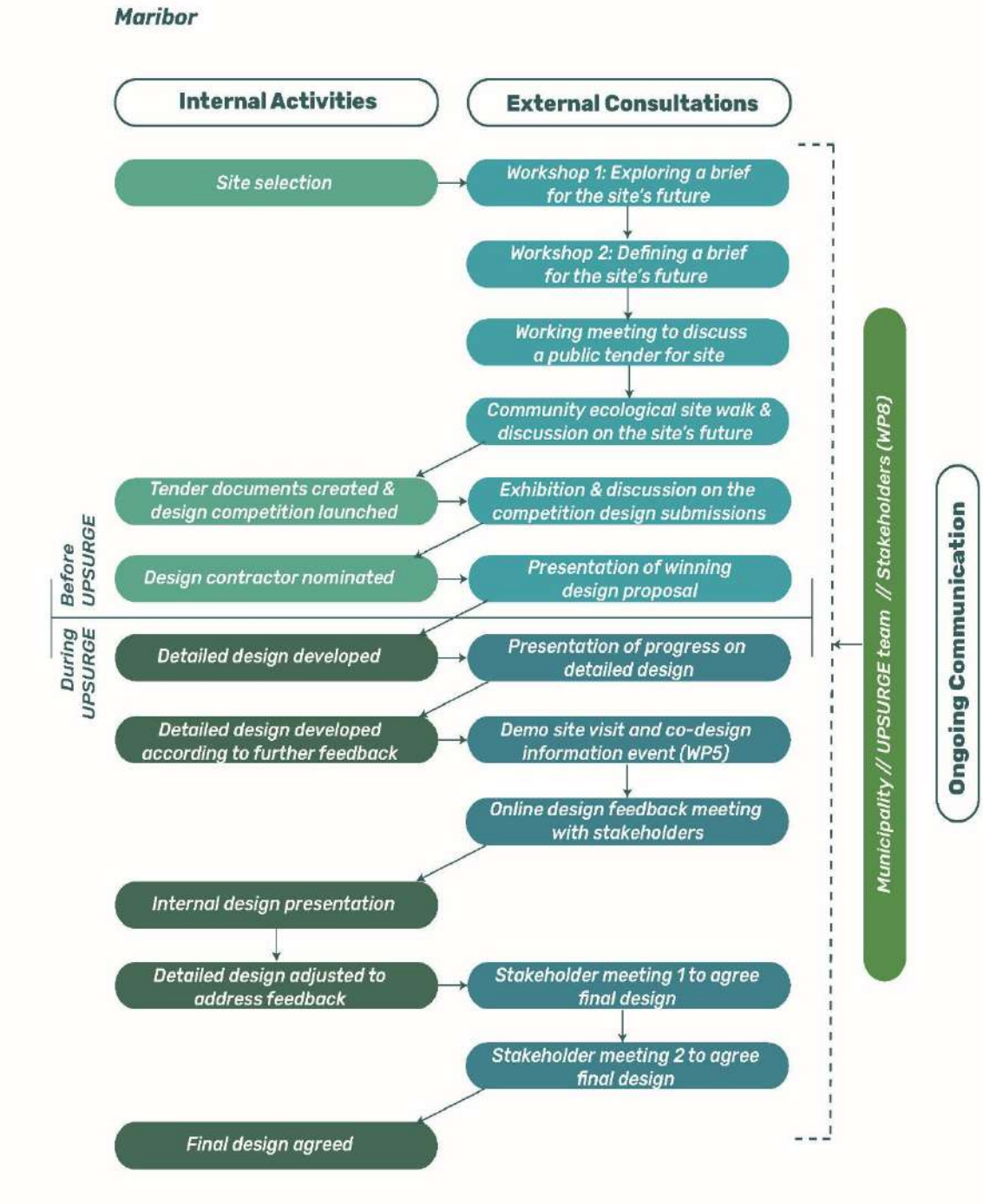

Figure 7.4.1: Process diagram depicting internal activities and external consultations to co-design Maribor's NBS demonstration site

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7.4.1 PRE-UPSURGE CONSULTATIONS

Maribor conducted various pre-UPSURGE consultations, which are mentioned in the following sections. Pekrski potok (google.com) is the site of civil initiative where all activities from 2017 are well documented.

Initial Ideas about the demonstration site - The demonstration site has been a focus of the Municipality of Maribor since before the start of the UPSURGE project, as it represents a green oasis in the middle of a densely populated residential settlement. As the area of Pekrski potok had not been properly maintained for several years and it was planned by the Municipality to arrange it as soon as possible, this location was selected for the UPSURGE project, which was also in line with the desire of the local residents.

Stakeholder Selection - The choice of stakeholders was quite evident; as the owners of the demonstration plots, there was strong engagement with the Municipality of Maribor before the official start of the UPSURGE Project, as certain permits were required for interventions on the land from them. Additionally, the demonstration site is in close proximity to a kindergarten, which was included in the consultation from the outset due to the planned installation of an air quality monitor in the kindergarten area. The civic initiative of the residents of the residential settlement near Pekrski Potok was essential, as a key aim was to consider their desires and integrate them into the redevelopment plans. Throughout the implementation of the demonstration, there will be involvement as required from the public utility company, arborists, and other experts from different institutions.

Workshops on the arrangement and regulation of Pekrski Potok (October and November 2017, Fig 7.4.2). The first workshop was held based on the question 'What kind of Pekrski potok do we want as part of the assemblies of the citizens of the city quarters Nova vas and Radvanje?' Invited representatives of the Municipality of Maribor, City Quarters, and planners, were present at the assembly, in addition to experts in the field of urbanism, landscape architecture, and the environment. The aim was to help to co-create the park development project along Pekrské potok for all interested parties. The participants of the second workshop agreed that it was timely that the southern part of Maribor also gets a well-organized park area, which was already planned during the construction of residential neighbourhoods but never realized. They emphasized that the area for the park should be determined precisely, the stream revived and the habitat for (near) water plants and animals should be recreated, and then the project should be upgraded in phases. Participants agreed that the park should offer attractive content for all generations and connect residents in a common space.

Figure 7.4.2: Maribor stakeholder engagement workshops 2017

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Working Meeting on the preparation of the Public Tender (February 2018, Fig. 7.4.3) - the meeting was conducted to determine the area of the Park Pekrski potok project and the course of further activities. The processing area agreed extends from the path under Pekrska Gorca to Ljubljanska Street. It was concluded that the most appropriate method of implementation would be a "mini" competition.

Figure 7.4.3: Working Meeting for Tender in Maribor (2018)

Jane's Walk with the thematic "Flora, fauna, stream and park" (May 2018, Fig. 7.4.4) - took place from the urban gardens in the western part of the future park along Pekrské Potok to the cycling training ground in the south-eastern part. The participants expressed their wishes, suggestions, and expectations regarding the planned park.

Figure 7.4.4: Jane's Walk on Maribor Site (2018)

Exhibitions of competitive solutions (December 2018/2019, Fig. 7.4.5)- It was agreed that there was to be a presentation of the selected solution by the authors and the competition committee, as well as a public discussion in which the participants will present their suggestions, which will be taken into account in the design phase.

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Figure 7.4.5: Exhibition of NBS approach in Maribor (2018/2019)

Presentation of the winning solution for Pekrski potok (February 2020, Fig.7.4.6) - Maribor Municipality has agreed on a contract with the author of the first prize-winning solution for the arrangement of the park along the Pekrské potok for the production of professional foundations which will be included in the process of preparing the operating plan. The competitive solution offers the opportunity for the renaturation of the Pekrské potok, the arrangement of pedestrian and bicycle paths, and the arrangement of individual substantive activation areas.

Figure 7.4.6: Meeting to discuss a working version of the NBS approach in Maribor (2020)

7.4.2 CONSULTATIONS ON THE DESIGN

Status of the Pekrské Potok Park (PPP) project (December 2021) - The purpose of all of the meetings was to get a clear picture of the current progress of the project, and at the same time to re-emphasize the interests, desires, and needs of local women and men, not only for Nova vas and Radvanje Municipalities but also for Park ob Pekrské potok. Key aspects were the preparation of documents for obtaining a building permit (DGD) for water management regulation (VGU) and the creation of project documentation for implementation (PZI).

Dialogue with locals (June 2022) Fig. 4.4.7- Several written exchanges and online meetings took place between representatives of the BRUTO office and representatives of local residents. In particular, the team was asked about ideas and wishes regarding the arrangement of community areas. Such dialogues will undoubtedly contribute to the final design and implementation of the park and acceptance by the residents.

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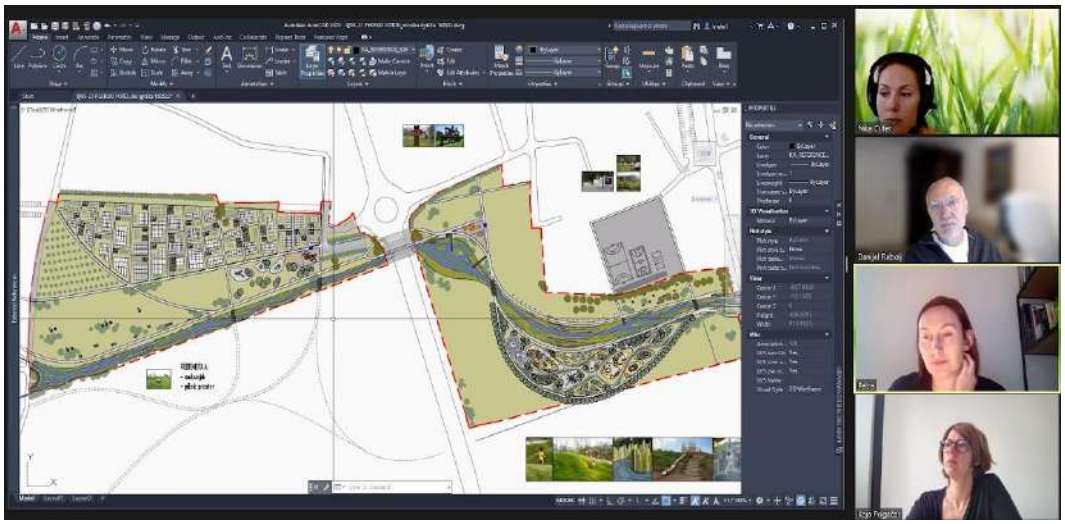

Figure 7.4.7: Stakeholder Engagement during co-design workshops in Maribor

Internal Concept Project Presentation (December 2022) Fig. 4.4.8- The contractor of the project, BRUTO, landscape architecture, presented to the mayor of Mestna Občina Maribor (MOM or Municipality of Maribor) and the team the final approval of the project for the arrangement of the Pekrski Potok Park and accompanying topics related to the implementation of the VG arrangement of anti-flood measures - DGD VGU and accompanying projects - UPSURGE RA MB Podravje. The presentation included an overview of the proposed arrangements in relation to the adaptations of the project solution in such a way that the route of the JE DN 500 water pipeline is preserved to the greatest extent possible and, in principle, is not moved or interfered with. The presentation also included the placement and arrangement of the pump track programs and the ice rink in the park, accompanying children's programs playgrounds and community areas, arrangement of traffic areas of parking lots and underpasses/passages, architecture, communal collection, building structures, urban equipment, lighting and overall graphic image. The total estimated value of the investment and the proposed phasing of the project implementation were presented.

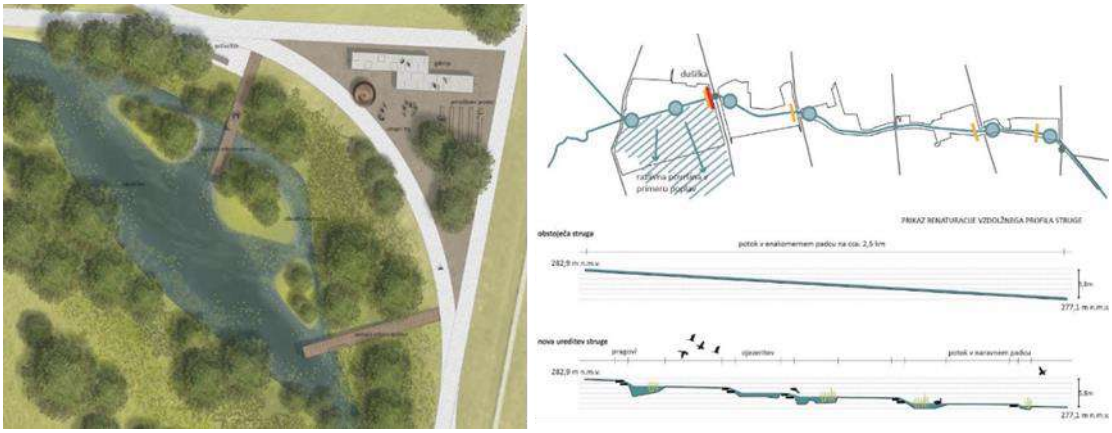

Figure 7.4.8: Conceptual design for renaturation in Maribor

Dialogue and Final Workshop (June 2023) - At the beginning of the year, the dialogue between the Civic Initiative and the Municipality of Maribor continued, primarily regarding the timeline and final redevelopment plans. Discussions also involved experts in flood protection measures, whose recommendations were taken into account in the landscape design project. In June 2023, the final workshop with the Civic Initiative was conducted, during which all projects of the Municipality of Maribor planned in the Pekrski Potok area were presented in detail, including the final landscape design

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plans for the UPSURGE project. The workshop's agenda provided a comprehensive overview of all planned, including long-term projects, aiming to give the local residents a broader understanding of and insight into the various stages of the development. The last workshop did not impact the design of the UPSURGE project itself, as the final plans had already been established by that time and incorporated the comments and wishes of the residents up to that point.

7.4.3 Conceptual Design and Drawings

The design plan was influenced by the choice of trees and other plants in other parts of the park close to the demo site. The prepared suggestions were accepted by architects and civil initiatives so trees and plants will be planted to address the project goals. The planting of trees and other plants will address the challenge of urban heat. The site will be used by the current residents and hopefully, there will be more users once the site is completed and provides a better NBS experience than currently available. The proposal is that the site will remain open for public use during construction. As it is now, there will be no major changes. All that will change is that young trees will be protected so that they can grow and provide benefits for generations to come.

The final design is not yet complete as it still has to be confirmed by all stakeholders. A planting plan will be completed by the end of 2023. The timeline for the completion of the project for the whole park depends on available finances from the Municipality. The space will continue to be managed by the Municipality. A proposed usage overview and the preliminary design for the Maribor site are presented (Fig. 7.4.9 and Fig. 7.4.10)

Figure 7.4.9: Future Proposed Usage of the Site in Maribor

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Figure 7.4.10: Preliminary design for the Maribor site

7.4.4 FINAL DESIGN

Possible reconfigurations and fundamental concepts for Pekrski Potok were initially devised by the Municipality as the landowner before the commencement of the UPSURGE project. However, these plans were subsequently altered to accommodate the desires of the local population. A public tender competition was used to develop the project that best suited both the residents and the Municipality of Maribor. This project underwent further changes during UPSURGE workshops to incorporate the preferences expressed by the residents and to fulfill the project's requirements. The Maribor Final

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Design for the Demonstration Site is presented (Fig. 7.4.11 and Fig. 7.4.12). The design of the embankment area, which will be developed as part of the UPSURGE project, includes vegetation planting with enhanced air-cleansing properties to facilitate air quality monitoring within the area adjacent to Pekrski Potok, situated between Radvanjska and Kardeljeva Street in Maribor. A list of suitable plant species has also been harmonized with the city's arborist. The planting is divided into three distinct phases. The planting design aligns with the spatial characteristics, namely the stream, and the content layout of the future park in connection with the existing urban characteristics. The park is structured with primary tree-lined paths along the stream, and secondary tree-lined paths around activation points such as squares, streambank vegetation, parkland planting, and clusters of indigenous vegetation. The majority of the park's vegetation consists of tall woody plants, creating volume and linear features through rows of trees. Stream planting includes tree and shrub varieties typical for riparian zones in the Podravska region.

The selection of vegetation takes into account the arborist's recommendations for air-cleansing species, growth conditions, habitats, and criteria for each vegetation type based on its purpose in the space (structural, biological, aesthetic/visual, orientational, purifying, dividing, shading, etc.).

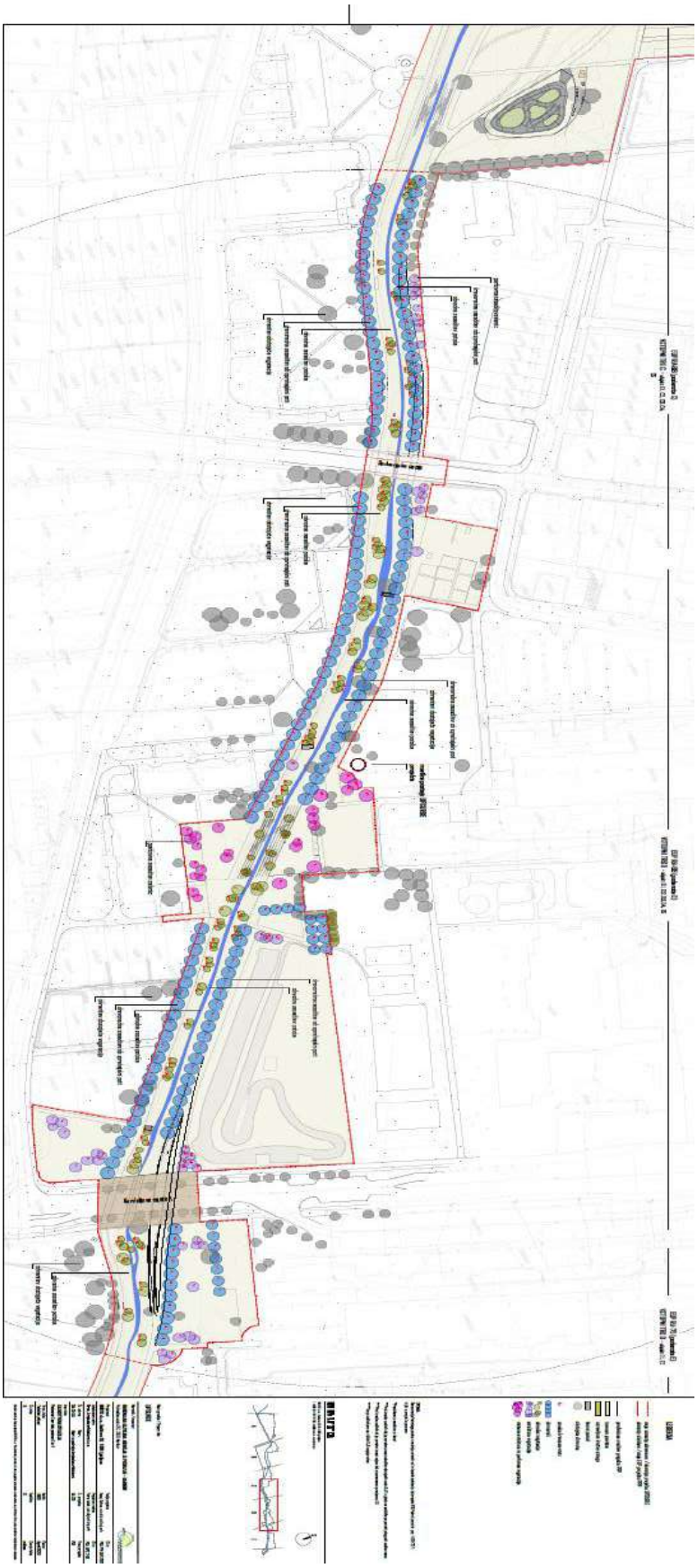

Figure 7.4.11: Maribor Final Design of the Demonstration Site

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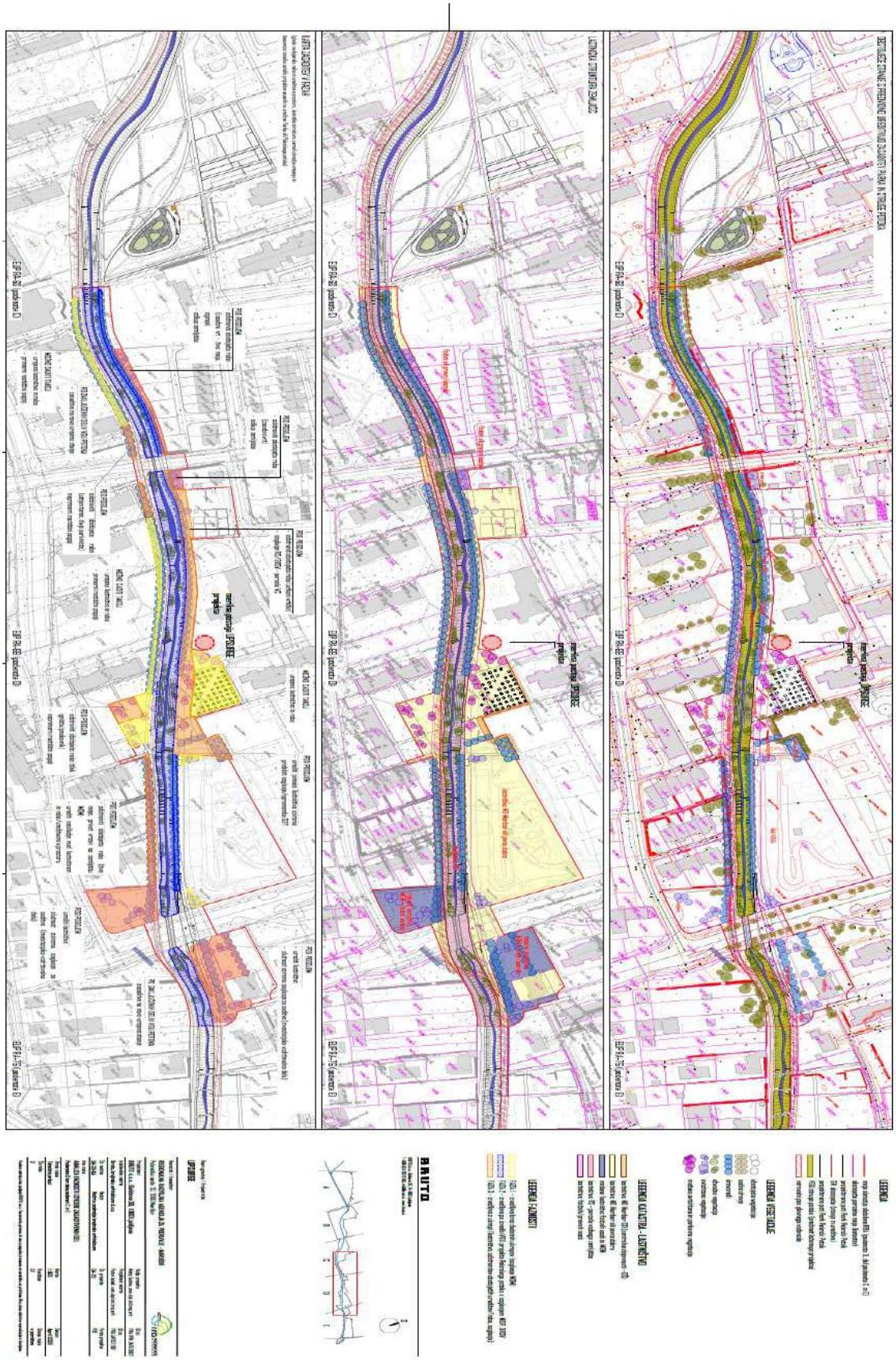

Figure 7.4.12: Maribor Final Design of the Demonstration Site

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Planting of trees and shrubs outside the streambed is managed using a special root system maintenance regime due to the subsequent construction of pathways, squares, children's playgrounds, urban furniture, and structures as part of park development, planned by the Municipality. This system allows for later transplantation of vegetation with minimal negative impact or stress on the saplings.

The maintenance regime enables the saplings to be easily temporarily excavated and transplanted or stored nearby as necessary, to accommodate subsequent elevation adjustments to the terrain and construction work related to pathways, paved surfaces, structures, equipment, and the relocation or establishment of new utility networks. Throughout the entire process, the designer has taken into account the responses from the Municipality, the community, project requirements, and the natural characteristics of the demonstration area. All of this will also be considered in the public procurement process and the actual implementation of the Pekrski Potok redevelopment.

7.5 Katowice Consultation and Design

Public Consultation and design

The diagram (Fig. 7.5.1) highlights the processes taken by the municipality of Katowice, to prepare for the construction of NBS on their demonstration sites. Before the UPSURGE project, the sites were selected to combat issues related to the urban heat island effect in the city. The initial concept of urban fixtures was developed to implement NBS in city infrastructure in a way that could be easily replicated at a wider scale. At the beginning of the UPSURGE project, stakeholder and site analyses were carried out the work. At this point, a landscape contractor within the municipality was nominated to carry out the work. After this, two rounds of workshops were done for each demonstration site, ten workshops in total. During this timeframe, a design contractor was nominated, who supported the second round of workshops. Since the second round of workshops, the concept designs have been developed with the detailed designs due for completion in November 2023.

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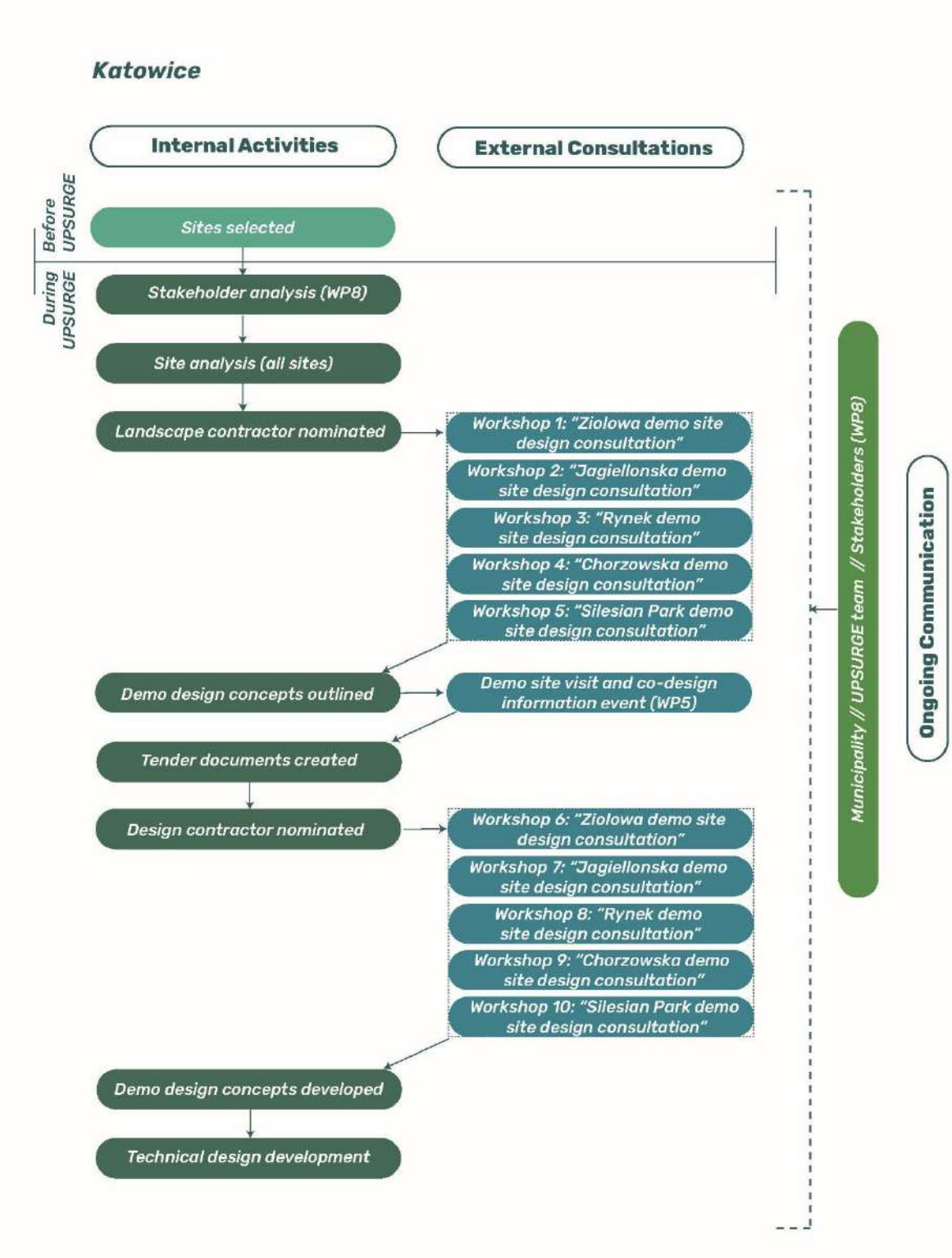

Figure 7.5.1: Process diagram depicting internal activities and external consultations to co-design Katowice's NBS demonstration sites

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7.5.1 PUBLIC CONSULTATIONS

Initial Ideas about the Demonstration Sites - NBS points were selected from sites with a high indication of an urban heat island effect. The sites were also chosen due to their use by residents of Katowice. The concept is based on unclogging the ground as much as possible, planting shrubs, perhaps planting trees, and therefore heavily concreted sites were selected. The overarching goal is to develop an innovative approach to improving air quality in heavily urbanized areas by replacing bus shelters with a green roof structure.

Stakeholder Mapping (March 2022) - Potential stakeholders were informed about the UPSURGE project through various communication channels, including:

- Announcement in local media (Radio Katowice, Radio Eska) to reach residents in a wider area.
- Use of social media, such as Facebook (Katowice City Hall and Municipal Greenery Unit Katowice) and Twitter (Katowice City Hall), to reach younger audiences and those who are active online.
- Posting information on the project's website and the relevant ZZM Katowice platform (www.zzm.katowice.pl).
- Contacting potentially interested individuals and institutions by phone and email

An important aspect of the meetings that took place in 2022 was the participation of people from different industries and backgrounds. For example, the meetings were attended by representatives of the Polish Geographical Society, who were able to contribute their knowledge of spatial-geographical issues, including analysis of plant species suitable for the Polish climate. The Polish Green Roofs Association represented expertise in sustainable development and green solutions in urban space. The participation of people from different sectors and backgrounds in these meetings was crucial to understanding the diverse needs and perspectives of bus stop users. The meetings, which took place in 2023, were held to consult the resulting (designer-created) concepts for each of the 5 NBS points.

Preparation of Consultation

The consultation aimed to network with entities that will be involved in testing innovative solutions to respond to the problems of climate adaptation through NBS in Katowice. The consultations focussed on gathering ideas from the people on how to develop selected spaces. The consultations were carried out in the form of workshop meetings, in which external entities from the immediate vicinity of selected areas, as well as councillors of district councils, social bodies representing the inhabitants of a given district, and councillors of the Katowice City Council were invited to participate. In addition to the above, the meetings were attended by representatives of the scientific community and municipal units that manage a given area. The social concepts of space development will be passed on to selected designers, setting the direction of design activities.

First Consultation and Site Visits (September 2022, Table 7.5.1)

The purpose of the 2022 consultation was to gather ideas from the public side on how to develop the selected spaces. Taking into account the assumptions of the UPSURGE project, the following areas were identified for development:

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- the area on Ziołowa Street, near the entrance to the hospital (Piotrowice - Ochojec district)
- the area around the bus stop on Chorzowska Street, near the Silesian Park (Osiedle Tysiąclecia)
- the area on Jagiellońska Street - near the bus stop "Sejmu Śląskiego Square". (Downtown district)
- the area on Chorzowska Street, the bus stop on Dębowa Street (Dąb district)
- the Market Square in Katowice near the former premises of the Silesian Museum (Śródmieście district)

The consultations were organized in September 2022 close to the five demonstration sites to attract relevant stakeholders. All the consultations consist of 12-21 people. The diversity of stakeholders represented were Academia (10%), Civil Society (50%), Government (10%) and Social/Environmental Groups (30%). During each workshop, at least two proposals for the development of the areas in question were obtained, with an indication of how we should adapt the space for people using it.

Table 7.5.1: Location and Schedule of the Five Consultations in September 2022

Location	Date	Time	Venue
Ziołowa Street - at the entrance to the Hospital	September 2, 2022	4 p.m.	Upper-Silesian Medical Centre of the Silesian Medical University in Katowice ul. Ziołowa 45 / 47
Jagiellońska Street - by the Silesian Seym Square 47	September 5, 2022	4 p.m.	Faculty of Biology and Environmental Protection, University of Silesia, 28 Jagiellońska St.
Market Square in Katowice - by the Silesian Museum building	September 6, 2022	4 p.m.	Katowice City Hall, Mlynska 4, room 4/5
Chorzowska Street - by Dębowa Street	September 7, 2022	4 p.m.	Municipal House of Culture "Koszutka" Branch "Dąb", Krzyżowa Street 1
Chorzowska Street - at the entrance to the Silesian Park	September 8, 2022	4 p.m.	Silesian Park - Directorate, 2 Różana Avenue

The Consultation meeting in September 2022 included:

- Introductions and opening of the meeting by the Department of Urban Greening
- Overview of project survey by Institute for Ecology of Industrial Areas (IETU)
- Presentation on the UPSURGE project by the Department of Urban Greening
- Presentation of conditions for the projected NBS points (including information on technical networks, ownership of land for the projected NBS points and measurements with a thermal imaging camera)
- Presentation on climate change - Institute for Ecology of Industrial Areas
- Presentation of the development design of the selected area
- Design questionnaire II - Institute for Ecology of Industrial Areas (IETU)

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The consultations were carried out in the form of workshop meetings, to which external entities from the immediate surroundings of the selected sites were invited, as well as district councillors, i.e. the public body representing the residents of a given district, and Katowice City Councillors. In addition to the space users mentioned above, the meetings were attended by residents, representatives of the scientific community and municipal entities that manage the area in question. Social concepts of space development were handed over to the selected designers, setting the direction of design activities.

During the workshop part of the meeting, participants went on a short research walk, which allowed them to become more familiar with the area, its layout and its functions.

The data collected during the 2022 meetings was passed on to the design studio. After analysing the technical and territorial possibilities, etc., the designers created concepts that were presented for consultation at the 2023 meetings. In connection with the above (current design phase), a project is being created which is to be submitted to the Department of Urban Greenery in Katowice in November 2023.

The information obtained during the 2022 consultations formed the basis for creating a bid specification to select a designer.

Second Series of Consultations (March 2023, Table 7.5.2)

The 2023 workshop, focussed on determining and creating the concept of NBS points.

Table 7.5.2: Location and Schedule of the Five Consultations in March 2023

Location	Date	Time	Venue
Chorzowska Street - at the entrance to the Silesian Park	March 1, 2023	4 p.m.	Silesian Park - Directorate, 2 Różana Avenue
Ziołowa Street - at the entrance to the Hospital	March 2, 2023	4 p.m.	Upper-Silesian Medical Centre of the Silesian Medical University in Katowice ul. Ziołowa 45 / 47
Chorzowska Street - by Dębowa Street	March 10, 2023	4 p.m.	Municipal House of Culture "Koszutka" Branch "Dąb", Krzyżowa Street 1
Market Square in Katowice - by the Silesian Museum building	March 22, 2023	4 p.m.	Katowice City Hall, Mlynska 4, room 4/5
Jagiellońska Street - by the Silesian Seym Square 47	April 17, 2023	4 p.m.	Faculty of Biology and Environmental Protection, University of Silesia, 28 Jagiellońska St.

The Consultation meeting in September 2022 included:

- Opening of the meeting by the Department of Urban Greening
- Presentation on the UPSURGE project by the Department of Urban Greenery

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- Presentation of the concept of the discussed NBS item - Pracownia 44STO
- Discussion on the concept - submission of ideas and preferences
- Field inspection (due to needs) with possible improvement of the concept taking into account the possibilities.

Figure 7.5.2: Stakeholder Engagement during co-design workshops in Katowice

Figure 7.5.3: Outputs of co-design workshops in Katowice

Summary of the results of the consultations and how it impacted the design

The workshop meetings held in 2022 (Fig. 7.5.2), enabled the consultation groups to become familiar with the scope of the area that had been earmarked for the project, the status of the land ownership and its landscape. Due to the site visits, stakeholders were able to better adapt their "projects" to the needs of bus stop users. During the workshop part of the meeting, the participants went on a short research walk, which allowed them to get better familiar with the area, its shape and functions. The walk also allowed for conversations directly with other people using the space. By observing the NBS points, it was possible to estimate which social groups most often use the designed places and thus create places that meet their needs during the project.

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Workshop meetings conducted in 2023, allowed stakeholders to review the concepts of selected NBS points prepared by the design studio (Fig. 7.5.3). After reviewing the designs, a discussion was held on the previously selected solutions. When the need to further refine the design to meet needs was noted, a field visit was organized during which ideas were refined.

Stakeholder engagement since the co-design workshops, reflecting on the challenges, breakthroughs and key decisions during this timeframe

Stakeholders, as can be seen by the number of people attending the meetings, showed considerable interest in both the first phase of meetings (2022) and the second phase (2023). Each NBS point has its own individual challenges:

- Ochojec Hospital stop - agreement on facilities for each social group, e.g., it was proposed to install squats to improve the comfort of hospital visitors.
- Stop Jagiellońska / Sejmu Śląskiego Square e.g. adjusting the project to the "Concept of development of Silesian Square in Katowice". This includes the area directly adjacent to the bus stop covered by the UPSURGE project) by Meritum Projekt;
- Market - Korfantego Street - after consultations in 2022, a concept was created and consulted again twice in 2023. After the site visit which took place within the framework of the workshop meeting on March 22 this year, it was shown that the pedestrian route passes through the designed plantings. Therefore, it was decided to better adapt the NBS and consult again during the meeting on Jagiellońska Street (near the Silesian Seym Square), to which the Silesian Provincial Conservator of Monuments was also invited. After the meetings, the concept was modified to adapt this NBS point to more appropriate conditions to reflect the needs of the stakeholders.
- Stop Dąb – Kościół at Chorzowska Street - the adaptation of the stop to reflect the needs of social groups using this stop, considering the possibilities and limitations.
- Silesian Park stop - adaptation of the stop to reflect the needs of people using it.

The key decision was to modify the concept of the NBS point in the Market in consultation with stakeholders based on observations during the field visit.

7.5.2 Conceptual Design and Drawings

The conceptual design of all the demonstration sites (Fig 7.5.5 a to j) is being developed.

- **Market Square – ul. Korfanty (Fig. 7.5.4):** The main aim is the creation of new rebates referring in shape to the existing development of the Market Square in Katowice and inscribing them in the surface drawing. Maximum removal of concrete surfacing of the area, while maintaining its functionality will reduce surface runoff and increase low retention. Planting trees to minimize the urban heat island effect in the future. Planting resistant grasses, perennials and shrubs will increase the visual value and increase biodiversity.

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Figure 7.5.4 The design concept created based on the first consultation (a and b) and the concept created on the conclusions of the second consultation and field visit (c and d) for Market Square in Katowice – ul. Korfanty

- **Ochojec-Hospital stop** - The main conceptual assumptions are to design two bus shelters with roofs covered with greenery and to introduce diverse street furniture: benches, squats, litter bins, ramps and renovation of stairs, planting the escarpment and creating a sensory area at the top of the escarpment and plant several trees. The expected benefit would be the introduction of diverse street furniture and ramps which will increase the comfort of users with special needs. Planting the escarpment with diversified vegetation will increase the visual attractiveness of the area and biodiversity. Planting a tree will increase the shaded area over the years, which will reduce the heat island effect.

- **Silesian Parliament Square Stop –** The aim is the adaptation to the "Concept for the development of Plac Śląski in Katowice" by Meritum Projekt. This will be achieved through the removal of concrete surfaces, without negatively affecting their functionality. The plan also includes planting attractive bedding plants, resistant to urban conditions, insect-friendly and melliferous. The expected benefits would be to increase the areas covered with vegetation which will reduce surface runoff of rainwater and increase small retention. The diversified plantings will increase the biodiversity and visual attractiveness of the site. Planting a tree will increase the shaded area over the years, which will reduce the heat island effect.

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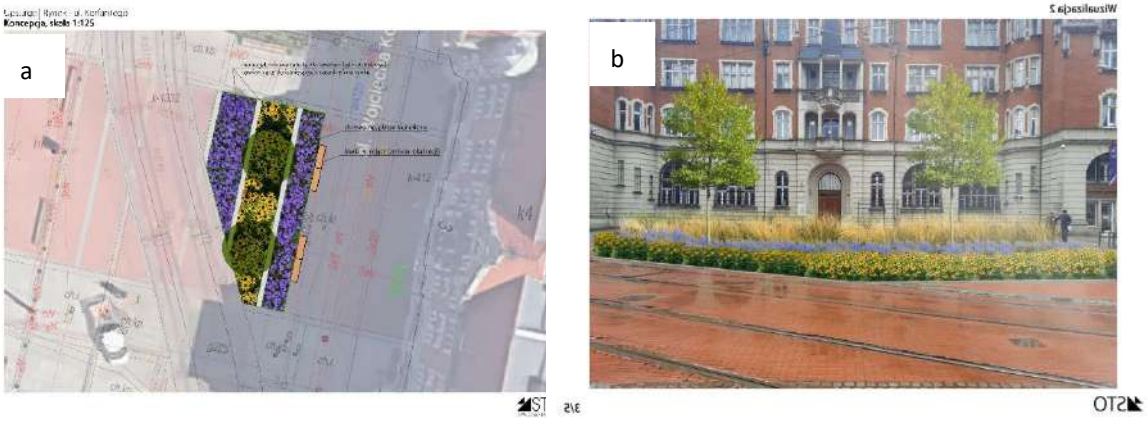

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Figure 7.5.5 The conceptual design for (a and b) Market Square in Katowice – ul. Korfanty, (c and d) for Ziołowa Street near the entrance to the hospital in Ochojec, (e and f) Stop at Silesian Parliament Square, (g and h) Chorzowska Street near the Chorzowska bus stop, (i and J) Silesian Park stop

7.5.3 FINAL DESIGN

Following the second round of workshops, the concept designs for the Katowice demonstration site have been developed. The detailed designs are therefore not available for this reporting timescale but are due for completion in November 2023.

7.6 BELFAST CONSULTATION AND DESIGN

The diagram (Fig. 7.6.1) highlights the processes taken by the municipality of Belfast, to prepare for the construction of NBS on their demonstration site. Located in South Belfast, next to Queen's University and several neighbourhood zones, the demonstration site was chosen as an underused green space within Belfast's Botanic Gardens. One of the big challenges in Belfast is social cohesion, and community gardens have become a common way to bridge new links between communities. stakeholders and site analysis took place, building on this context while considering ways to support climate education and engagement. Quintuple helix stakeholders were considered from the beginning of the project. Three workshops with stakeholders were used to co-design solutions across different scales to consider the wider opportunities for NBS implementation in the city of Belfast. In the third workshop, the concept design, developed by in-house designers was presented for feedback. At this point, the design contractor was nominated to develop the developed and detailed design. Several surveys were carried out to support this process and the internal designers created a design guide on implementing NBS for

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the design contractors. The Research Gardens were implemented first, shortly followed by the community garden. Quintuple helix stakeholders were kept informed on an ad-hoc informal basis across this timeframe.

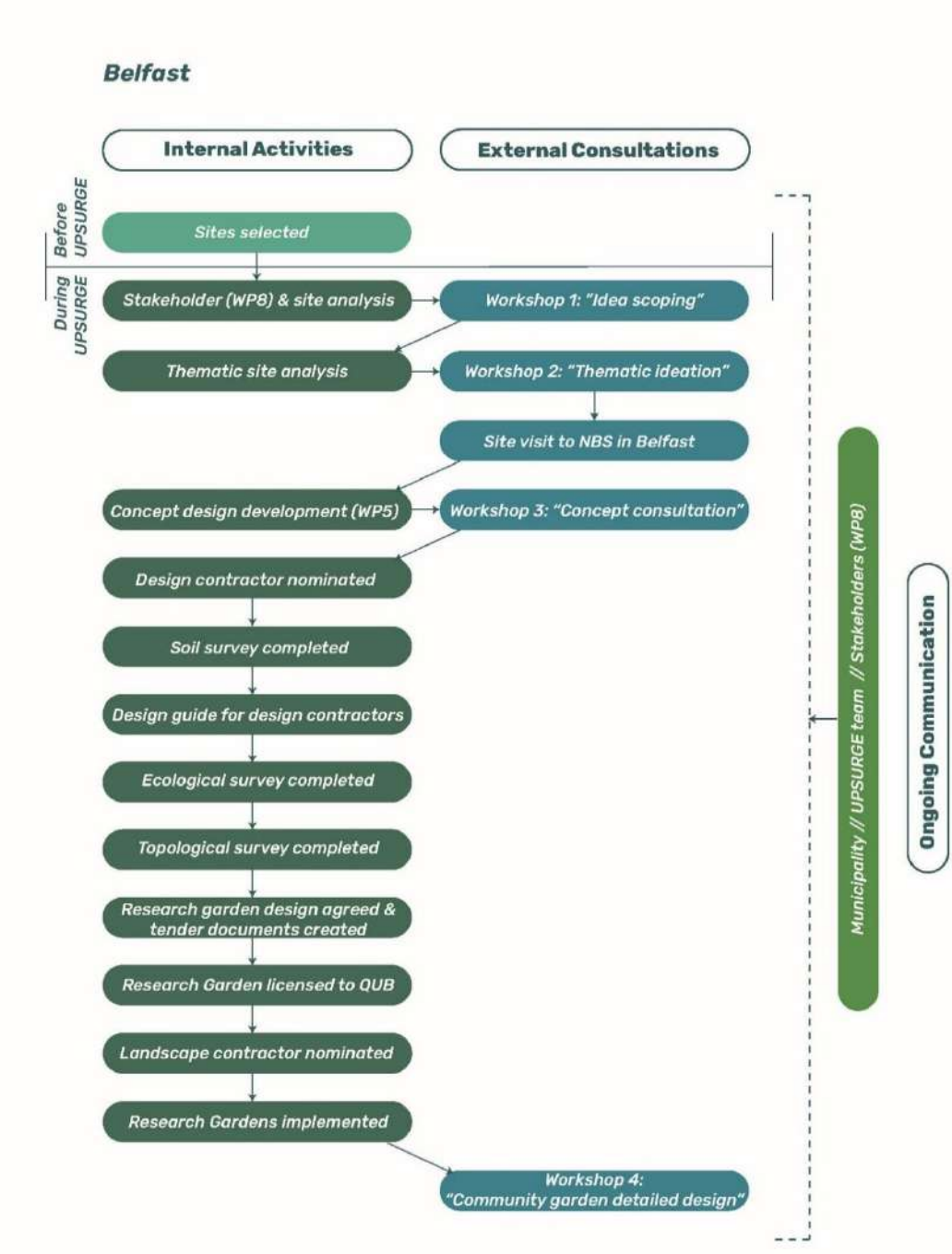

Figure 7.6.1: Process diagram depicting internal activities and external consultations to co-design Belfast's NBS demonstration site

7.6.1 PUBLIC CONSULTATION

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Initial ideas about the demonstration site and beyond (September 2021)

Belfast is a city that has undergone significant transformation in recent years, having emerged from a sectarian conflict that impacted relationships, investment, policy and the shape of the city. Many Belfast neighbourhoods remain disconnected, and several 'peace walls' which were erected to prevent violence between communities during the conflict continue to separate local areas – a stark reminder that much work is still needed to repair and reshape both relationships and the city itself. The peacebuilding programme of work is ongoing the UPSURGE project offers peacebuilding from a nature-led perspective, which will enable participants to look outwards to other city partners, and forwards, developing sustainable approaches to living.

Belfast has developed a strategic framework for the city known as 'The Belfast Agenda' that is delivered through city community planning structures and is coordinated by Belfast City Council, working closely with city partners. Within the community planning framework, the Belfast Resilience and Sustainability Board is responsible for creating the Belfast Resilience Strategy and the Belfast Climate Plan. The UPSURGE project directly links to these plans through the Belfast City Council Belfast Resilience Unit. Other city plans aligning with UPSURGE include the Smart Belfast Plan, the Green and Blue Infrastructure Plan, the Belfast Open Spaces Strategy and the Belfast Biodiversity Plan.

The UPSURGE demonstration site in Belfast was selected as an unused, derelict site within Belfast Botanic Gardens. The site is in close proximity to university facilities, local schools, a local theatre, and several local neighbourhoods including the Lower Ormeau area, Ballynafeigh area, the Holyland area and Stranmillis area. While Lower Ormeau is traditionally characterised as a 'nationalist' area with a mixture of students and ethnic minorities among local residents. Ballynafeigh is characterised as an area with a wide mix of citizens and was one of the few politically 'mixed' of Belfast throughout the conflict. The Holyland area is characterised as an area with a major student population, living alongside a small group of long-term residents and a range of ethnic minorities. Stranmillis is characterised as a more affluent area, again with a large student population. These local communities provide a rich and diverse mix for the Belfast team to engage with, alongside opportunities to build social cohesion, learning and neighbourhood approaches to sustainable urban agroecology. In addition to focusing on inter-community and intra-community relationships, the UPSURGE project spurs engagement specifically aimed at females, ethnic minorities and asylum seekers, groups traditionally underrepresented within such programmes.

The primary site at Lower Botanic is to act as a learning base and hub for coordination and activity, linking to several satellite sites across Belfast. These will also be underused and derelict sites with the potential for increased community involvement in their development, with a focus on generating multiple benefits including increased biodiversity, local sustainable food production, skills development, and rewilding. These satellite sites are integral to developing community and political support for a citywide approach, with the primary site at the core of the project.

Stakeholder Mapping (March 2022) - An initial stakeholder matrix was drawn up based on the specific expertise of organisations and individuals, relevant to the development, implementation and longer-term use of the overall site and project. Having extensive capital project delivery knowledge, BCC worked with QUB to define appropriate stakeholders, based on the separate elements of delivery on the site. The matrix then mapped the level of involvement required from each stakeholder over the life of the project, which in turn ensured that consistent information sharing, knowledge collection and sharing took place.

The matrix maps the actions for stakeholder involvement, frequency of communication, and as well as establishes the type of communication agreed e.g., email, face-to-face, on-site, etc. Please see the matrix categories below:

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Table 7.6.1: Matrix categories for stakeholder involvement (Source – D8.1 Report on Social Context of Place Labs)

Sector	Organisation	Contact	Role	When to involve	Level of interest	Level off involvement

'Ideas, Knowledge and Experiences' Workshop (April 2022)

The first co-design workshop was 2.5 hours long, hosted at Queen's University, Belfast (QUB) and email invitations were sent to prospective attendees two weeks in advance. The aim of this workshop was to enable different kinds of stakeholders to meet and share their initial reflections and ideas for the UPSURGE demonstration site. The organisers, QUB and BCC, were keen to enable people with a wide-ranging interest in the project to be involved. Reflecting this, the session was hosted on a Friday morning, close to the site, to appeal to professionals and local citizens as well as academics based nearby.

This consideration was also embedded in the structure and physical set-up of the workshop where three tables, set up for 10 people each, looked at the themes of city, neighbourhood, and site. There were at least two facilitators at each table, one to take notes and one to manage conversations. At the beginning of the workshop, attendees were invited to sit at the scale that most aligned with their interests. The organisers found that residents were more interested in sitting at the neighbourhood and site tables, while local government officials and environment groups preferred to sit at the city-scale table, since their expertise and interest suit the bigger scales. Giving this choice helped the organisers to better understand attendee motivations as well as support the building of new connections between attendees with common interests. It also set up opportunities for UPSURGE-enabled satellite sites to be explored too.

The workshop began with a 30-minute talk that explained the UPSURGE project, the cities involved and the roles and aims of the Belfast demonstrator. Keen to save time for active collaboration, the site was described through a presentation with maps, photos, and videos. The presentation also touched on co-design benefits, approaches, and examples. This was followed by an icebreaker which asked three exercises to be carried out:

1. Big Map Chat (Fig 7.6.2): Aimed at developing a baseline of qualitative observations at different scales, participants were asked to log their experiences, knowledge, and ideas on different coloured post-it notes and stick them directly onto large, printed maps on the tables.

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Figure 7.6.2: 'Big Map Chat' output for the Belfast site scale

2. Journey Mapping: Aimed at highlighting how the city is used and issues of friction in mobility infrastructures, particularly through green space, participants were asked to cut pieces of string and use white tack to log ways in which they move through their table's scale, such as how they move through the neighbourhood or city. This was a slower exercise than the first, fostering supplementary networking discussions.

3. Nature-based Solutions (Fig 7.6.3): This exercise was split into two tasks. The first was supported by picture cards of different NBS and asked participants to prioritise which type of NBS would be best suited at their scale. This served as an educational exercise that provided tangible examples of their application in cities. The second task asked each table to co-develop a time-based strategy for three different NBS at their scale and to consider the negative and positive implications of their implementation.

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The workshop ended with a discussion on the task outputs and participants were asked to write down who might be missing in these conversations and should be asked to future engagement activities.

Figure 7.6.3: 'Nature-based Solution' exercise, which NBS are suitable for the site

Table 7.6.2: Belfast Consultation on design

Consultation		Aim of the consultation	Feedback/ Output. How has this impacted design?
Date	29 April 2022	To provide information and request ideas for the site design.	The need and desire for more local people from different backgrounds to attend. Attendees saw value in looking at three scales: city, neighbourhood, and site.
Place	QUB		
Total Attendees	30		
Academia (%)	46.6		
Civil society (%)	6.6		
Industry/Business (%)	13.3		
Government (%)	10		
Social/Environmental Groups (%)	23.3		

Thematic Ideation Workshop (May 2022)

The second workshop was also held on the QUB campus. Existing stakeholders and new contacts gathered at the previous workshop were invited by email two weeks before. There was a concerted effort to involve more citizens, particularly from underrepresented backgrounds, for example, some new attendees represented local Somalian and Romanian populations.

Planning this workshop, a month after the first provided the team at QUB and BCC to assess the first workshop outputs as well as reflect and consider the next steps on stakeholder engagement. Clear themes emerged from this inter-workshop analysis; an interest in how people move through their city,

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relationships and management of water, and connections to nature (Fig. 7.6.4). The second workshop was developed to expand on these three themes: mobility, water and green (nature) Fig. 7.6.5).

Figure 7.6.4: Photomontage to prepare thematic ideation discussions

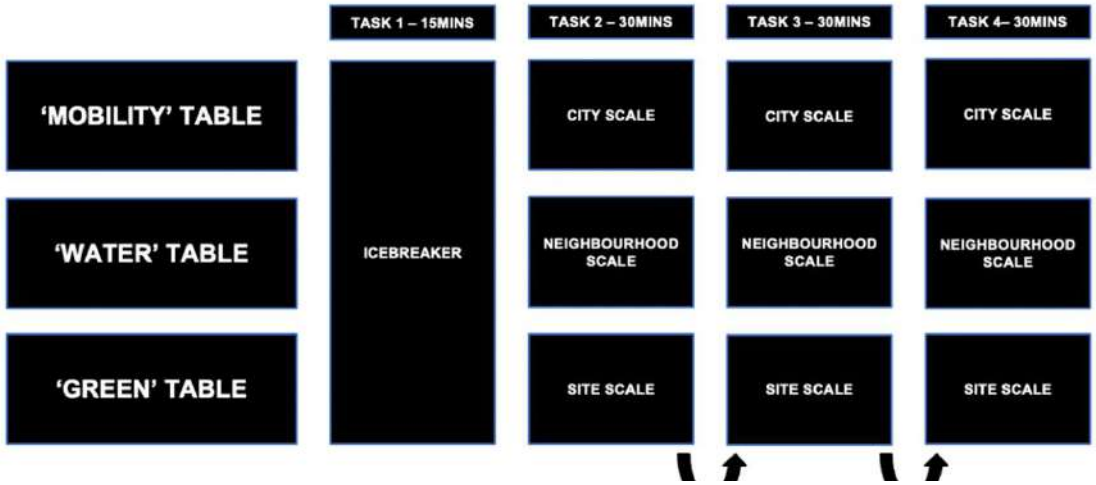

Figure 7.6.5: Diagram outlining the workshop structure spanning different scales and themes

With a similar number of attendees to workshop 1, this workshop was physically structured with three large tables for around ten people where each table addressed a different theme. While in the first workshop participants remained at the same table, focused on one scale, the second workshop asked participants to move tables after each task so that they engage with three themes and three scales (city, neighbourhood, and site). It's worth noting that facilitators remained at the same table throughout. After an icebreaker like the first workshop, there were three exercises of 30 minutes each. Each exercise remained the same and the only thing that changed was the scale of focus and the theme. Participants were asked to work collaboratively first at the city, then neighbourhood and then site scale to consider interventions inspired by their assigned theme, for example, developing solutions to embrace, manage or collect water at the neighbourhood scale. A table coordinator facilitated these discussions, using a large map and tracing paper to draw solutions in the plan (Fig.7.6.6). After each task, the coordinator presented the table's ideas. This ensured that all tables finished their tasks at the same time, and

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enabled cross-pollination of ideas, where the next group could critique or build on the previous group's ideas. Through this approach, 9 design scenarios across theme and scale were generated.

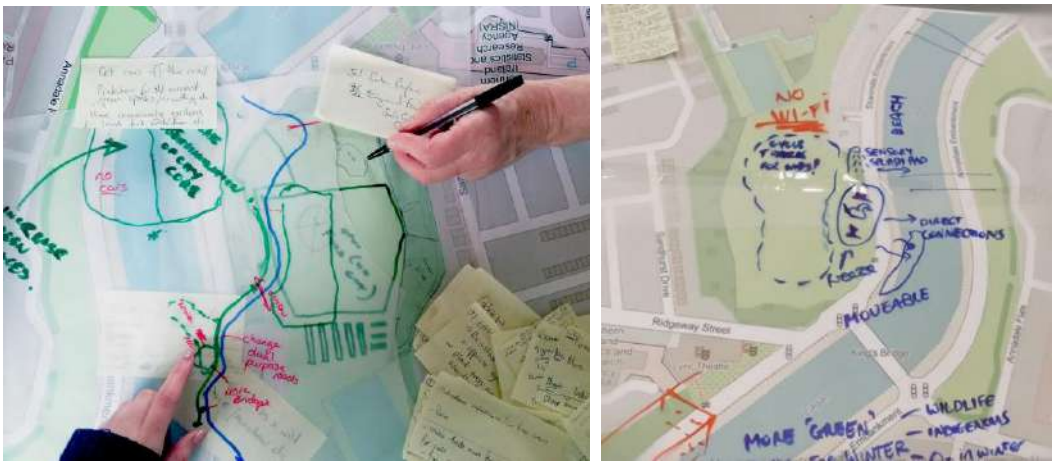

Figure 7.6.6: Ideas were explored collaboratively and translated by the table's coordinator

Table 7.6.3: Belfast Consultation 2 on design

Consultation 2		Aim of the consultation	Feedback/ Output. How has this impacted design?
Date	27th May 2022	To provide information and request ideas for the site design.	There was good cross-pollination of ideas in the workshop structure but the tasks took too long. The workshops significantly benefited from a mix of local citizens
Place	QUB		
Total Attendees	28		
Academia (%)	35.7		
Civil society (%)	25		
Industry/Business (%)	0		
Government (%)	25		
Social/Environmental Groups (%)	14.8		

Preparing the Conceptual Design (June - September 2022)

After the second Workshop, researchers collated thematic propositions across the three scales, and reflected on the requirements of the UPSURGE project, to develop agroecology gardens in the proposed site. Across this period, the UPSURGE team retained connections with key stakeholders, particularly those with an interest in implementing, managing, and maintaining the nature-based solution insertions. These were a mix of formal and informal interactions, from online meetings to casual encounters while on the site. Out of these activities, a concept design was developed in collaboration between Belfast City Council and Queen's University. Reflecting the different scales explored in Workshops 1 and 2, a proposal for the neighbourhood, connecting to wider city strategies was developed alongside a scheme for the site itself, explored further in 'Conceptual Design and Drawings'.

Conceptual Design Consultation Feedback (September 2022)

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Workshop 3 was designed to gather feedback from stakeholders on the concept design, which emerged from the first two co-design workshops as well as informal interactions. Given it aimed to gather another iteration of feedback on the co-designed concept design, this workshop was hosted by Belfast City Council in one of their publicly accessible buildings. Though existing stakeholders were invited to attend by email, the organisers made the event public allowing anyone to reserve a free ticket. As a structured and interactive event, ticket numbers were limited to ensure effective evidence-gathering and quality feedback. The concept design was developed based on dual-thematic strips on the demonstration site, **see Figure 7.6.7.** Aware ahead of time of who planned to attend, the organisers set up themed tables based on these strips. This made sure that attendees were located alongside those with shared interests providing feedback most aligned with those interests (Fig. 7.6.8).

Figure 7.6.7: Thematic strips in concept design were used to set up tables in the workshop

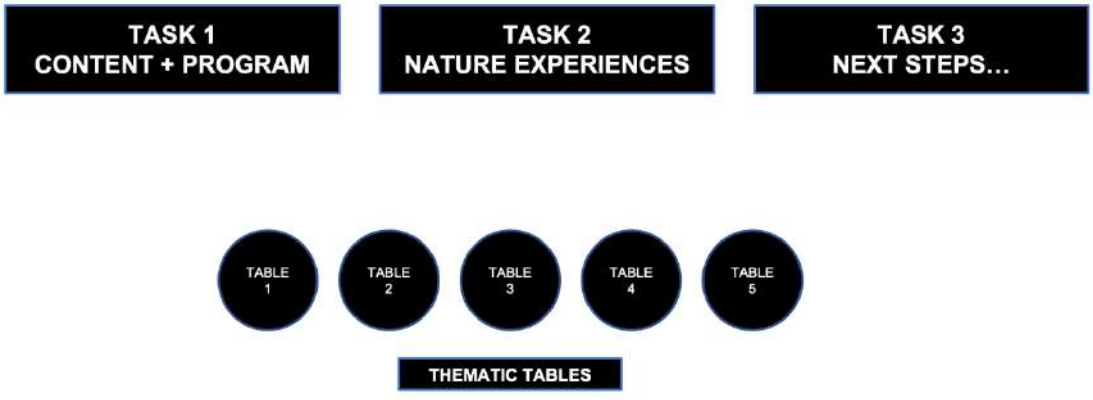

Figure 7.6.8: Table structure and exercises for workshop 3

The workshop was also divided into three tasks. The first two were used to explain how the concept design emerged and works while the third looked at ways to move into detailed design and implementation. As per the previous workshops, there was at least one facilitator at each table. All were briefed on the concept design and its overall aims and strategies before the workshop.

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1. Content and Program: This task asked each of the themed 'strip' tables to work together to craft a three-sentence manifesto describing the function and use of the strip and co-designing an A4 poster for their strip. This exercise combined verbal, visual and written communication styles to shape the strip's function based on shared interests at the table.
2. Nature Experiences: Each table was assigned a nature experience, a way of engaging with the site's activities (Fig.7.6.9).
    - Grow/Connect = Escapist experiences
    - Research/Learn = Educational experiences
    - Natural Systems = Natural experiences
    - Culture/Heritages = Aesthetic experiences
    - Water/Play = Entertaining experiences

    Briefing notes provided to facilitators were used to supplement discussions, with questions such as, 'What are the sights, sounds and smells on the site and how might they change? What is immersive, memorable, and new? How often would the place be inhabited, when and by whom?"

Figure 7.6.9: Photomontage to help participants imagine different kinds of nature experiences

3. Next Steps: The final task was future-focused and sought to tap into existing expertise to explore potential roadblocks and timeframes for detailed design, construction, and implementation. Conversations focused on funding priorities, future funding, the order of works, maintenance (how often and by whom), key stakeholders, ownership models and access. Participants were asked to create a five-point action plan, highlighting key priorities and from this developed a timeline for the next steps.

Table 7.6.4: Belfast Consultation 3 on Conceptual Design

Consultation UPSURGE		Aim of the consultation	Feedback/ Output. How has this impacted design?
Date	16th Sep 2022	To present the UPSURGE Concept Plan and seek input and feedback on how it could be taken forward.	Thematic tables outlining where people should sit for discussions were useful. Feedback on
Place	No2 Royal Avenue - BCC		
Total Attendees	33		

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Academia (%)	24.4		the concept design was very positive
Civil society (%)	24.2		
Industry/Business (%)	3		
Government (%)	21.2		
Social/Environmental Groups (%)	30.3		

7.6.2 CONCEPTUAL DESIGN AND DRAWINGS

The key characteristic of the concept design (Fig. 7.6.11) is the development of programmatic horizontal strips used to divide the demonstration site. These emerged as a reflection of the diversity of interests in the first and second workshops, from recreational and cultural activities, to research, education, growing and climate action. The workshop organisers had already used themes as devices to frame the site in Workshop 2 and therefore built this into the physical structuring of the proposed site plan. These strips are conceived as fields or test sites for a diversity of parallel activities to take place. The benefit of this approach is that collaboration can happen in a way that still serves different kinds of interests. These strips can also be implemented in a phased approach and due to their defined boundaries, allow partners to step up to maintain or take ownership of the space, addressing concerns about ways to manage urban green spaces. Finally, the strips also allow for phased implementation, are a smaller more defined mechanism to co-design content within them and open opportunities for future funding opportunities. As described briefly in the previous section, the site is divided into five horizontal strips with different kinds of content:

1. Grow/Connect – agroecology community garden, community and education space, informal marketplace.
2. Research/Learn – soil research plots, Royal Horticulture Society growing plots, climate resilient show garden, cycle shelter and educational sculpture park.
3. Water/Play – ponds, dipping pools, and a water garden.
4. Natural Systems – meadow, Miyawaki forest, forest clearing, climate arboretum.
5. Culture/Heritage – flax or sunflower field, outdoor theatre clearing, nature play zone.

The placement of strips on the site correlates to site conditions and adjacencies. For example, Grow/Connect is located close to parking and is the most overlooked making it more suitable for a community garden, while Culture/Heritage sits closest to the Lyric Theatre, creating opportunities for outdoor theatre events. The concept suggests that the first two strips would be implemented first since they align with the requirements of the UPSURGE project. Reflecting on UPSURGE's aims to catalyse further NBS implementation across cities, the third, fourth and fifth strips are conceived as the next steps for future work based on learnings from the first phase.

Aligned with the strips is the concept of different kinds of nature experiences, explored in the third co-design workshop. These experiences are based on Pine and Gilmore's seminal text, 'Welcome to the Experience Economy, which outlines four different forms of 'consumer' experiences; educational, entertainment, aesthetic and escapist, connected to four forms of engagement; passive and active participation, absorption, and immersion. This manifests in vertical site zones, which define the level of engagement within the space, from a city commuter to a community garden volunteer. These new nature experiences are facilitated by a new fast, slow and meander pathway through the site. Other

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moves include the decision to formalise a 'wild' zone behind an already fenced-off area hosting existing habitats and the insertion of a grid of semi-mature trees along the site strips to solidify a green future for the site.

Responding to discussions on mobility through and near the site, the concept design put forward a vision for how the site connects to wider routes through the city. A new green route network through the site was presented, indicating opportunities to improve walking, and cycling infrastructures in South Belfast as well as NBS satellite sites along these routes, expanding on existing community-led work to, for example, green alleyways and creating pocket parks in grey spaces (Fig. 7.6.10).

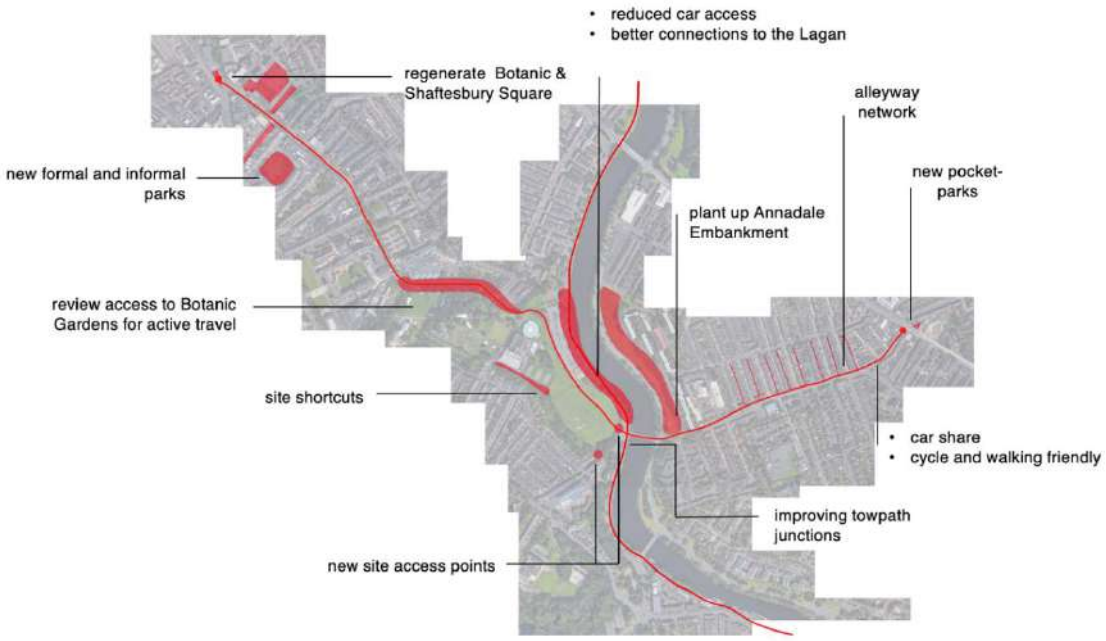

Figure 7.6.10: Concept design for a green route through the site

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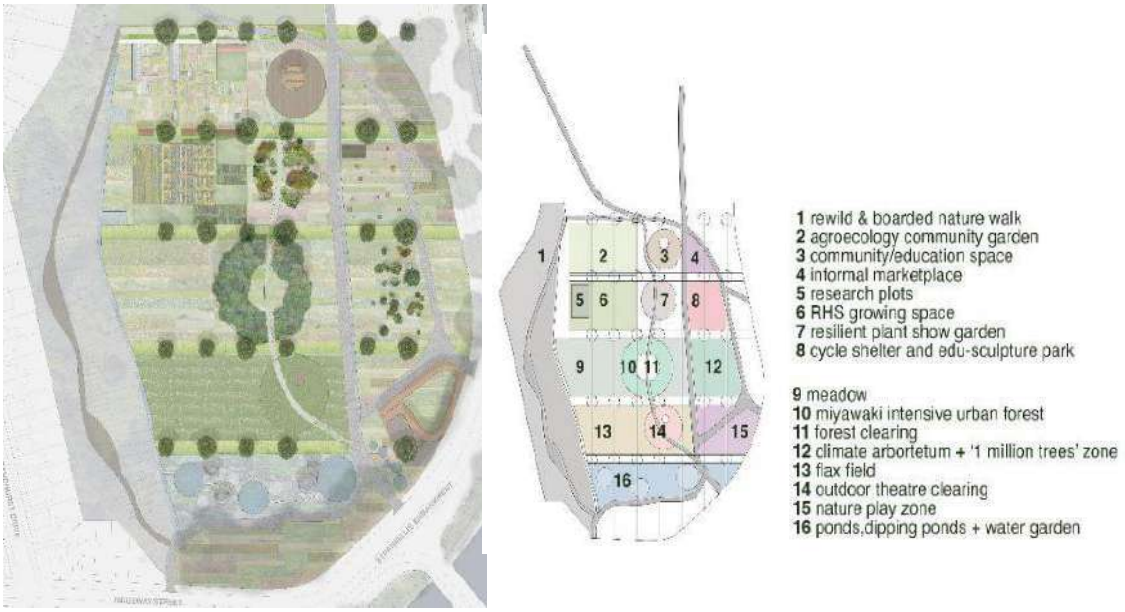
a)



b)

Figure 7.6.11: a) Conceptual Design of Belfast site and b) Phase 1 construction of the site

Stakeholder engagement since the workshops - The first three workshops outreached over 90 people, across 35 organisations and spanning multiple local communities touching on all aspects of the quintuple helix. Despite this, shifting consultations from the co-design format to navigate issues of on-site implementation have, at times, been particularly challenging. In hindsight, a more strategic, internal level of consultation may have been more appropriate before community interests were involved. This would have ensured that internal expectations were met, regarding potential resources, from within BCC, being needed, as well as planning for project resources after the UPSURGE project ended.

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We have engaged professional stakeholders, such as Ulster Farms and Gardens, ecologists, biodiversity experts, The Conservation Volunteers, and countless others to provide independent evidence concerning the current and future impact of the project, and in turn, these parties have also engaged with wider stakeholders to educate, build capacity, communicate potential project benefits.

Engagement with all stakeholders has been adapted to facilitate the successful delivery of the project, bearing in mind spending and outcome requirements. Since the workshops, engagement has been more focused on the interests of one or two specific interest groups who will be instrumental in the implementation and management of the future site. Involving stakeholders so closely in this stage of the decision-making process has been time-consuming, and has caused significant delays in, for example, implementing new infrastructures.

The political makeup of Belfast has also played a role in these challenges. Parties who were not fully engaged in the early consultation stages have since become more involved in the project, causing further delays and internal design changes to ensure flexibility with the future use of the site.

As it stands, internal and external stakeholder engagement is regular, with supportive meetings and communication occurring whenever required. We have also used third-party facilitation to consult on specific deliverables within the site, and utilised existing delivery partners, from other projects, to work with relevant stakeholders. This has been a very useful process, which, at times, has diluted potential conflict of an existing two-party dialogue i.e., BCC and stakeholder, functioning as a neutral third party.

Within BCC, a project board has been established with relevant staff and departments, to look at the future needs and benefits of the project, concerning its inclusion in the overall BCC estate and resource requirements.

7.6.3 Final Design

The development and implementation of a final design has been challenging due to the requirement to consult on the detailed design with stakeholders, which must be balanced with the needs of BCC and its commitment to ensuring certain statutory requirements, such as health & safety, accessibility, and legal permissions, as well as the concerns of individual political actors. QUB's Physical Projects Team has been involved in all relevant consultations with stakeholders and have offered technical support to problem-solving, within these consultations. External organisations, such as local government departments also influence the final technical and strategic elements of the project, such as ensuring connectivity across the city. These factors have all shaped the detailed design process, with notable changes between the concept and final design. Bearing in mind the considerations previously mentioned, a final design for the entire site is not yet complete. As mentioned in the previous section, internal political have led to the development of a phased approach, enabling more flexibility in the future development of the site.

Involvement in the stakeholder consultations has mostly been incredibly positive, and well supported by the project delivery team. In hindsight, the development of an internal concept design, which could have been then brought to stakeholders to engage with, might have reduced any current difficulties and managed expectations. Despite these challenges, the potential for utilising NBS across the greater BCC estate, to mitigate against climate change, as well as developing new land and resource requirements, has been noted as beneficial to the city's future development. Testing NBS on the demonstration site has challenged existing ways of work. Considerations concerning natural materials, existing contamination, public interaction, and future use, have played a significant role in shaping internal operations for future projects.

The a) Conceptual Design of the Belfast site and b) Phase 1 construction of the site is provided in Fig. 7.6.11, with the most recently agreed design for comparison shown in Fig. 7.6.12 and Fig.7. 6.13:

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Figure 7.6.12: Development of Final Design of the Belfast Demonstration Site

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Figure 7.6.13: Final Design of the Belfast Demonstration Site

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8 REFLECTIONS AND CONCLUSIONS

At the Project General Meeting (PGM) in Prato in October 2022, each of the UPSURGE cities presented a projected timeline for the design, construction, and implementation of NBS on demonstration sites. This was reiterated in the PGM in Maribor in March 2023. In all cases, cities anticipated a range of challenges that could impact the timeline of delivery. The next section summarises challenges affecting the timeline for the implementation of NBS on demonstration sites.

8.1 SUMMARY OF CHALLENGES AFFECTING THE TIMELINE

At the most recent PGMs, cities noted widespread issues with rising costs, not just for sensors but also for labour due to rapid rises in inflation. Cities noted difficulties in procurement processes, partly impacted by delays and shortages because of the COVID-19 pandemic. In Belfast, there were additional logistical issues and cost implications of procurement due to its position outside of the European Union.

Cities also anticipated hidden costs in the construction and implementation phase that will inevitably reduce the amount of money that can be spent on capital works on the demonstration site. These hidden costs include:

- Sensor installation, management, and maintenance including power connections and 4G network connection.
- Specialist surveys and consulting for the site design to understand, for example, the location of existing protected habitats or invasive species.
- Costs for demonstration site maintenance and management, including, for example, maintaining service connections, groundskeeping, and managing people focused NBS insertions such as community gardens.

As cities procure sensors and plant species as well as design and construction services, they must continue to consider the extent of work that can be done on their demonstration sites and scale back ambitions where appropriate. These challenges could not have been predicted at the project funding application stage. Nonetheless, cities have taken action to address these challenges by redressing the scope and timeline of work to address these challenges. For example, by reducing the number of demonstration sites or establishing a phased plan of work. It should be noted that amendments to NBS projects at the demonstration sites have been made to mitigate against risks. By recognising the challenges and taking action to redress their scope of work, cities have taken steps to mitigate against risks. Details of amendments from the original proposed NBS taken by each city are provided in Section 6.6 and Tables 6.6.1-6.6.5).

8.2 DEMONSTRATION CITY CHALLENGES

8.2.1 STAFF RECRUITMENT

Cities noted that recruitment processes were delayed due to the prolonged impact of Covid-19 and lower than normal staffing levels. This has led to further delays in getting appropriately equipped staff into posts to manage the UPSURGE project within municipalities.

8.2.2 SENSORS

Procuring sensors for the UPSURGE project has proved difficult. This is primarily due to the rapid rise in the cost of sensors requiring councils to re-evaluate the type and quantity of sensors they can purchase with the available budget. Cities have also struggled in terms of specifying the correct sensors to meet city and UPSURGE data collection requirements.

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At the PGM in Prato, some UPSURGE partners suggested that the cities could collectively procure the same sensors for each city. After some debate, cities agreed that it was best to procure sensors separately due to the administrative difficulties of collective procurement, particularly as Belfast sits outside the EU. Cities also expressed the need to connect sensors purchased for the UPSURGE project into existing city-wide sensor networks and therefore required sensors to meet certain city-led specifications. As a result, cities have found it difficult to specify suitable sensor networks, with the need to balance conflicting requirements from within the UPSURGE project and within municipalities. Not only do cities need to choose the correct sensors, but also the best digital services and supply companies to support both data collection and sensor maintenance.

In February 2023, OPERATE, BURST, and Open Content developed and supplied a document to the cities to support them in sensor procurement. The document outlined minimum specification requirements for cities to tender sensor equipment and suggested how many sensors each city should purchase based on the number and size of demonstration sites. It was suggested that some further money may be taken from the budget for site construction to cover the cost of sensors. There were also some additional suggestions to reduce the cost of sensors through the following approaches:

- Refer to the EU monitoring network baseline data or link to existing city sensor networks to gather reference data for the project rather than purchase additional reference sensors.
- Exclude the use of UAV data capture.
- Minimise maintenance costs for the sensors by transmitting sensor data directly to the UPSURGE platform which can flag to cities when sensors need to be fixed or replaced.

Further sensor-specific challenges are explored below:

Sensor installation and maintenance

Cities are recommended to install sensors at a height of three to four meters from ground level. This poses challenges for cities in terms of identifying either existing infrastructure to mount sensors onto and gaining permission to do so or installing new infrastructures to fix sensors that fit with the overall demonstration site design. Additionally, in cities such as Belfast where solar power is unreliable, sensors must link with a fixed power supply. In such cases, cities must identify nearby power supplies gain appropriate permissions and cover the cost of connecting to these. Delays in gaining appropriate permissions may also create knock-on effects on timelines.

Baseline data capture:

All cities noted additional challenges in relation to meeting the proposed timeline in terms of construction of the demonstration sites due to the requirement to record sensor data before implementation to identify baseline metrics. The UPSURGE project document suggests that construction begins in Spring 2023 and that sensors must capture data before this timeframe, particularly before planting occurs. Since in most cases planting must occur in the spring or autumn periods, this could delay planting to Autumn 2023 at the earliest. Additionally, cities will need to consider how and where to install sensors to capture pre-construction data in a way that sensors are protected and are also not an obstruction during construction. Where some baselines can be captured at once, others must be captured across a timeframe. Equally, some baselines can only be captured accurately at certain times of the day or year and require different levels of time and effort to capture. This adds to the complexity of the challenge of capturing adequate baseline data in the timeframe and within budget.

Cities with multiple demo sites

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Katowice and Budapest have identified multiple demonstration sites. These cities discussed the optimum quantity and quality of sensors, fixed and moveable, and the benefits and trade-offs of different approaches, mindful of the need to gather data that is comparable with the other demonstration cities with only one site. With multiple sites, cities must also consider the additional installation and maintenance costs during the project.

Wearable sensors

OPERATE, BURST and Open Content suggest that each city purchases 50 wearable sensors. Cities face challenges in identifying who might wear these sensors, when, and how often. They will need to explore the permissions required to capture data from wearable sensors as well as identify suitable candidates that regularly use the demonstration sites. Safe storage of these sensors during the data capture period will also need to be considered as well as establishing an effective communication strategy with nominated candidates.

Connecting Sensors to KPIs

All cities must capture air quality and climate data to meet general project Key Performance Indicators (KPIs). However, cities have also identified KPIs to address specific challenges, such as soil pollution and surface flooding. As a result, some cities must purchase and install additional sensors to target KPIs related to these challenges. Where this creates a challenge due to costs, cities must first prioritise general data collection for the project.

Managing sensor data:

OPERATE confirmed they would manage city-created sensor data but would allow access to cities to use. This opened conversations around GDPR and how cities could use this data outside the UPSURGE project as well as after it ends.

Site vs. city scale data

There is an ongoing discussion around the value of capturing sensor data that can help us understand the benefits of NBS insertions at the site scale and how data might be assessed against city-scale data.

8.2.3 PLANT SPECIES

Cities also noted there may be difficulties in procuring trees and plants for demonstration sites. This issue is most pronounced in Belfast as it is located outside the EU. As this situation is evolving, there are increased administrative burdens on municipal staff, as well as increased costs and delays.

At the PGM meeting in Prato, cities also noted that the demonstration site design could be delayed because they had to wait until Month 16 for a report on suitable plant species for enhanced NBS performance (Task 2.4, LEITAT), leaving a two-month window to assess and design in optimal plant species. Given the month 18 deadline is in February 2023, there are additional time pressures to source and plant in the spring window.

It is likely that due to the tight timeframe between the delivery of the NBS plant specifications and the demonstration site design, the former will become a reference for the UPSURGE satellite site designs or simply for future NBS projects beyond the UPSURGE project.

8.2.4 POLLEN MONITORING

There have been some challenges in relation to the preparation of bee pollen data capture, facilitated by Beeodiversity, on the demonstration sites. Municipalities must either identify an existing beehive close to the

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demonstration site or set up a beehive on the site. In the case of the latter, appropriate permissions and notifications are a requirement, and if installed near residential zones, local people must be informed. As beehives must be installed on sites at certain times of the year depending on the city's climate, this must be factored into the overall schedule of works. Finally, municipalities must identify suitably qualified beekeepers to manage the hives and must seek advice on the correct species for the locale.

8.2.5 Ensuring access to the demonstration site

The construction and implementation of NBS on the demonstration sites may be delayed due to issues of access for example from Spring to Summer 2023, works are scheduled on the river flowing through the demonstration site in Maribor. This creates unavoidable delays meaning site works for the NBS demonstration cannot begin until Autumn 2023.

To mitigate against delays due to access, the UPSURGE demonstration cities must continue to engage with key stakeholders such as government infrastructure departments and residents, who own, manage, or have a stake in the demonstration sites or land immediately adjacent to them.

8.2.6 Contractor Procurement

Some cities found it difficult to procure suitably qualified design contractors with knowledge of nature-based solutions. Katowice had difficulty awarding a tender contract to a suitably qualified design team which has led to delays. After a failed tender call for designers, Katowice decided to award a contract to a team already signed up on an existing framework with the municipality. Belfast has followed a similar route, awarding the design contract to a landscape architect on an existing framework. This has eliminated the time required to prepare and assess tender bids. In both instances, concept designs produced during the co-creation phase have been useful in communicating the core ideas developed by a mix of stakeholders.

8.2.7 Permits and consents

Cities have been proactive in mitigating delays caused by gaining consents and permits for the demonstration sites (see WP5 task 5.2). By becoming aware of, for example, planning constructionson the site, cities can avoid potential delays through careful site design and by keeping authorities aware of progress and timelines for delivery. It has also been useful to gather service connection maps to anticipate the types of permissions required ahead of construction. In Belfast, part of the demonstration site has been licensed to QUB to set up research gardens. This requirement was not anticipated at the beginning of the project and has caused additional administrative load causing some delays as a result. The legal or licensed transfer of land will be an ongoing concern in Belfast as it installs community gardens that may be managed externally. Budapest will likely have to navigate similar legal constraints when installing raingardens on private or semi-private land.

8.2.8 External Influence

At the PGM meeting in Prato in October 2022, both Belfast and Maribor cautioned that the project timeline may be delayed by local elections. Municipalities will need to ensure continued communication with decision-makers to mitigate delays of this nature. Since the demonstration sites will change the appearance, and in some cases, the use of urban spaces, it will also be vital to continually inform, engage, and involve a wide group of influential stakeholders. This topic is explored further in the next section of the report.

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8.3 REFLECTIONS ON THE PLANNING OF CO-DESIGN ACTIVITIES

Task 5.1 marks the end of the co-design phase of Work Package 5. The next section of this report, which links to the work of WP8 (UniPassau), reflects on the progress made by cities to involve citizens in the co-design of the demonstration sites.

8.3.1 INVOLVING PEOPLE

Co-creation requires intense, ongoing collaboration between a mix of stakeholders within the Quintuple Helix (Academia, industry, government, civil society, and environment groups). In the case of the UPSURGE project, co-design processes are used to create place-based solutions through nature-based solutions. It is important to involve people with different motivations to support collaborative designs of NBS and inspire action to implement NBS beyond the site, a key aim of the UPSURGE lighthouse.

Across the period of co-designing each demonstration site, one of the key questions in cities was around 'who to involve.' With support from colleagues in WP8 (UniPassau) and WP5 (QUB), each city took different approaches to involve citizens in co-creation activities, including targeted emails, door-knocking, social media posting, and tapping into existing interested parties. Approaches varied depending on the location of the demonstration site in relation to local neighbourhoods, businesses, or educational institutions. Tactics also varied depending on whether the demonstration site proposal evolved more prior to the UPSURGE project, such as in the case of Breda and Maribor.

Reflecting on the types of people involved in the UPSURGE project in each city, the list below captures who might be involved in the co-design of urban NBS across the Quintuple Helix.

- Residents located close to the demonstration site
- Resident organisations close to the site that represent distinct groups of people
- People who want to get directly involved in the NBS insertion e.g., community garden volunteers
- People who will manage, maintain or govern the demonstration site eg. municipal groundskeepers
- People who want similar changes in other parts of the city or region
- People who have experience in designing, constructing, implementing, or running a similar project
- People with design expertise or who will develop the detailed design of the site
- People who will be involved in the site's construction
- People with the expertise of the NBS to be implemented
- Environment groups that deal with region or city-wide policymaking as well as on the ground action
- Decision-makers and official community representatives
- Local businesses
- Local educational institutions and specific academics

8.3.2 PLANNING AND HOSTING CONSULTATIONS

Across the demonstration cities, the UPSURGE co-design process was centred around consultation events. These events functioned as key moments to support a mix of citizens to share knowledge, ideas, and experiences of the demonstration site to inform its design. From June to September 2023, the QUB team visited each demonstration city to gauge progress on the co-design phase of the demonstration sites. A summary of engagement activities by each city is provided below:

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In the case of Maribor and Breda, the UPSURGE demonstration site design and stakeholder network were better developed before UPSURGE. In these instances, more engagement activities took place before the UPSURGE project. These cities had more time to engage with stakeholders to build consensus for the demonstration sites. Despite this, Breda notes ongoing concerns around acceptance from citizens living close to the installation of NBS. While Breda carried out some engagement activities on the site during the project, all co-design activities for Maribor happened pre-UPSURGE. As a result, Breda and Maribor are much further advanced in the detailed design of the demonstration sites.

On the other hand, the demonstration sites in Belfast, Katowice, and Budapest were not well developed before the UPSURGE project. While the UPSURGE project provided these cities an opportunity to test out new ways to find and engage with citizens, they had to work harder and with more intensity to build consensus on the demonstration site design in a shorter timeframe. Furthermore, these cities are further behind in terms of delivering final site designs due to the levels of engagement required with newly identified stakeholders.

A general summary of reflections based on each demonstration city's engagement activities is provided below.

Planning tips:

- Consider splitting activities across several consultation events eg. if there are multiple demonstration sites, and consider when these could happen in relation to the overall timeline. Katowice took this approach by hosting two co-design workshops for each demonstration site, and ten workshops in total.
- When planning activities and sending out invites, consider looking at different scales beyond the demonstration site. This can help provide useful context to discussions, expand the type of stakeholders involved, and establish a lighthouse for satellite or spin-off projects. Belfast took this approach by planning workshop activities by scale to build capacity for future work during the demonstrator.
- Host consultation events at a time and location that might result in better attendance. The duration of events can also influence levels of engagement. Consider how to include under-represented groups in this process. Breda hosted several weekend markets at their site to gain feedback from a wide mix of local residents.

Hosting tips:

- Decide on the optimum number of people per event based on the type of engagement activities. Factor in how many coordinators may be required to support these activities and brief them appropriately.
- Consider whether it's worthwhile to plan where attendees might sit in engagement activities based on their area of interest or expertise to develop working groups with similar or mixed backgrounds. This consideration will depend on the level of engagement expected by attendees.
- Anticipate that some attendees will be more involved than others and plan ways to actively involve those who might find it more difficult to participate. Establishing rules for engagement at the beginning of engagement events can be helpful in this respect. Equally, engaging separately with certain groups of people may make it easier for them to open up and provide meaningful feedback.

Build in downtime with events to allow attendees to develop connections and expand networks. Provide attendees with the opportunity to suggest who is missing from conversations and who should be involved in future engagements.

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Consider how to introduce and talk about including, the project and its overall aims, the site and its surrounding context, particularly if engagement events take place off-site and the concept of nature-based solutions and their tangible impacts on the demonstration site.

8.4 KEY FINDINGS

8.4.1 BUILDING CONSENSUS

One of the benefits of co-designing NBS is that it helps to build consensus for on-the-ground action. During engagement activities such as design-focused workshops, organisers can employ various approaches to develop consensus over compromise, such as retaining positive, solution-focused conversations, instilling a culture of play, co-visioning medium and long-term futures, focusing on content (the brief) over form (the design), and exploring NBS implementations beyond the immediate site. As briefly mentioned in the previous section of this report, supporting time to pause can help build horizontal, bottom-up consensus.

8.4.2 SHIFTING HIERARCHIES

Co-design engagement is a relatively new approach in the production of municipal projects. Co-design for the UPSURGE demonstration sites gives councils a chance not only to test out how to reshape the city but also to reshape methods of engagement and internal decision-making processes. Co-design approaches break typical hierarchies. These approaches require a shift in power dynamics, where those who normally do not have control over the future of urban space can make a difference. This can be difficult to do because municipalities often own the land for these demonstration sites and have traditionally had the final say in what is done with these sites. As is the case with any form of public engagement, building trust through transparency and respectful communication is vital to relationship building across and beyond the project. It can be helpful to break boundaries through an increase in communication, both formal and informal, and to keep all stakeholders aware of the objectives and timelines of urban NBS projects. Extended breaks at workshop events and regular site visits are a wonderful opportunity to build these vertical relationships naturally. The same can be said for remaking new connections within municipalities to challenge existing ways of working to facilitate more rapid pathways to change in cities.

8.4.3 RAISING AND MANAGING EXPECTATIONS

Cities are often concerned about over-promising and under-delivering and how this may impact long-term community relations. In a project such as UPSURGE, stakeholders must be informed from the outset about what can be achieved with the resources available during the project's timeframe. However, the project gives an opportunity for a stakeholder to demand better for their city and spur decision-making bodies to rapidly change to address climate change. By communicating that the UPSURGE demonstration site is a testbed for NBS insertions, as well as models of engagement and governance, municipalities might be less afraid of making mistakes and more open to piloting new ways of working. In this respect, there is considerable value for municipalities to work with university partners to communicate that the UPSURGE demonstration site is distinctly separate from typical projects in the city.

8.5 KEY RECOMMENDATIONS

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- Co-design approaches must both be tailored to fit within existing processes in local authorities and challenge these processes to make decision-making more transparent and inclusive. These approaches need to be reflective of each city's culture to maximise engagement. Similarly, each city needs to tailor approaches to co-designing NBS considering different climate and social challenges.

- Each city took different approaches to involve people in the design of demonstration sites. Some projects were initiated by citizens while others invited citizens to co-design. Both are valuable approaches. The former requires consistent ongoing communication and feedback to ensure the vision is met. The latter requires cities to consistently engage with a wide mix of stakeholders to build capacity and interest. In either case, cities must find effective ways to create two-way communication channels with quintuple helix stakeholders across all 'plan of work' stages, from brief development to installation and use. These channels must be active, reflective, inclusive and long-term.

- Co-design processes work better with the same team across a whole project, particularly in terms of providing good communication between municipalities and other stakeholders. Despite this, designers are not normally nominated until the concept design stage, while sometimes, different designers complete the different design stages. This can be due to how finances are managed or how designers are valued across a project. Equally, this may be because some designers are more skilled than others in the design of NBS. These approaches can create friction across the project's timeframe, by, for example, making it difficult to co-design the brief of requirements. The shift between different designers and different co-design approaches can also cause the loss of traction, confusion, or interest from stakeholders. Design contractors must increase their general awareness of NBS and ways to co-design these for urban sites. Cities must see the value in involving designers in the pre-design stages to embed co-design processes in the early decision-making processes.

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