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PROTECTING URBAN AQUATIC ECOSYSTEMS TO PROMOTE ONE HEALTH

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D4.2 Report on Needs and Analysis of Contextual, Social and Cultural Determinants

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Executive Summary

This deliverable of the OneAquaHealth (OAH) project is the core output of task T4.2 which is aimed to investigate and report on citizens' experiences of urban aquatic environments. Thus, it provides a summary report of the contextual, social, and cultural determinants that influence citizens' experiences and interactions with urban aquatic environments.

The initial work reported concerns a review of the literature on the determinants influencing citizen interactions and experiences in urban blue spaces. In this deliverable, urban blue spaces, or urban aquatic spaces, include rivers, lakes, canals, and streams in urban and peri-urban areas. This is because most of the literature reviewed concerned rivers and canals. Only a handful of articles were found to include streams within their definitions and investigations of urban blue spaces. Additionally, an article on lakes has been included in this report, as the determinants in this article mirrored those found in articles on rivers and canals.

Based on the literature reviewed, citizens' interactions with the environment can be incidental or intentional. Incidental interactions refer to our everyday, taken-for-granted experiences with nature. Intentional interactions refer to the conscious decisions we take regarding where we spend our time. Intentional interactions also include nature-based volunteer activities such as citizen science initiatives. The report therefore divides these interactions into two groups: citizen science activities and habitual interactions. By doing so, the determinants influencing participation in nature-based citizen science activities are contrasted and compared with the determinants that influence citizens habitual experiences and interactions with urban aquatic environments.

Additionally, this report presents the findings from four focus groups of the five OAH sites regarding their specific experiences and attitudes towards their local urban aquatic areas. Contextual city reviews precede the summary presentation of the individual focus group findings. This is followed by a comparative city analysis. The report concludes by presenting the extracted health, ecological, and social determinants influencing citizens' interactions with urban aquatic spaces. It also provides a list of health and ecological indicators that will be deployed in the citizen app and support work taking place in T2.3, WP3 and ongoing work in WP4 of the OAH project.

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Acronyms & Abbreviations

Term	Description
ANB	Agentschap voor Natuur en Bos
CS	Citizen Science
GDPR	General Data Protection Regulation
INTP	University of Toulouse
MAPTAM	Modernisation of Territorial Public Action and the Affirmation of Metropolitan Areas
NCD	Non communicable disease
NGO	Non-Governmental Organisation
OAH	OneAquaHealth
ORF	Oslo River Forum
PNRR	National Recovery and Resilience Plan
PTA	Water Protection Plan
RBMPs	River Basin Management Plans
RSLR	Rapid Scoping Literature Review
SNOA	National Network System for the Protection of the Environment
SSH	Social Sciences and Humanities
UC	University of Coimbra
UG	University of Ghent
UGS	Urban Green Space
UK	United Kingdom
UN	United Nations
UNINA	University of Naple Federico
VMM	Flander's Environment Agency
WFD	Water Framework Directive
WHO	World Health Organisation
WP	Work Package
WWF	World Wildlife Fund

1 Introduction

1.1 Overview

It is well predicted that urban growth will bring an exponential increase in city populations in the forthcoming decades [3-6]. As urbanisation expands, the resilience of aquatic and riparian ecosystems is increasingly threatened. Consequently, competition for land will cause habitat fragmentation to increase, with spillover effects on freshwater quality in urban blue spaces [2]. As a result, conservation efforts are increasing, and citizen science efforts are on the rise. Thus, this report will address three questions:

1. What are the obstacles and motivating factors for engaging people in citizen science projects in aquatic environments?
2. What other factors influence citizens' interactions and experiences with urban aquatic ecosystems?
3. What impact do urban aquatic environments have on human health outcomes?

Literature focusing specifically on blue spaces is gradually increasing; however, definitions of what encompasses blue space in urban environments generally omit streams and smaller water bodies. Definitions mostly include large water bodies, such as lakes and rivers (see [3-4], for example). Thus, for the purposes of this overview, blue space or urban aquatic environments is defined as 'all surface aquatic habitats such as rivers, streams, ponds, lakes, canals, ditches, and drains in urban public spaces and encompasses surrounding green spaces'. This definition has been adapted from Thornhill et al. (2022) and is specifically used given the inclusion of streams, which are the focus of the OneAquaHealth (OAH) project. Additionally, it incorporates the tension in the literature concerning riparian spaces, which are inherently blue and green in character and, as several authors have highlighted, cannot be distinctly separated from each other, as land and water frequently come together in most riparian spaces [5-6].

Likewise, the number of citizen science projects taking place in European aquatic environments are increasing (see [7-11] as examples). While projects can entail bottom up or top-down approaches [8], the overall aim is to achieve mutual benefits for participants and professional researchers alike [9]. Thus, citizen science (CS) is defined as 'the collection and analysis of data relating to the natural world by members of the general public, typically as part of a collaborative project with professional scientists' [10].

This deliverable is produced in WP4, Task 4.2 whose objectives it is to map and understand the needs, problems and constraints that connotate citizens experiences, their relationship and interactions with the environment. Thus, this deliverable aims to map the existing citizen observations and perceptions of urban aquatic environments, including desired changes to support the development of the further development of the citizen science model. A list of citizen science indicators, health and ecological, will also be extracted and ultimately incorporated into the OAH App. The identified indicators will also be used to support work in WP2 and WP3.

1.2 Relation to other tasks and deliverables

The relationship between this deliverable and other OAH tasks and deliverables is outlined Table 1 and Table 2. This deliverable has received relevant inputs from the University of Coimbra (UC), the University of Toulouse (INTP), the University of Naples Federico (UNINA) and the University of Ghent (UG), mainly concerning the execution of the focus groups and summary reports of the focus group discussions.

Receives inputs from:

Table 1: D4.2 Input from other tasks and deliverables.

Deliverable	Due Date	Input for D4.2
D4.1	M18	The outputs of the focus groups and contextual analysis are helping to design the Citizen Science protocol as described in D4.1.
T4.1	Ongoing	The focus group designed for this deliverable D4.2 was conducted in each research site in the context of and supported by the Local Alliances as organized in T4.1.
D6.3	05/05/2023	Information from Pestle analysis for city contextual reviews
D3.1	Ongoing	The human health indicators identified in the initial scoping review (D3.1) and additional sources are helping understanding activities in UBG spaces and public health – human health opportunities.

Provides outputs to:

Table 2: D4.2 Output for other tasks and deliverables.

Deliverable	Due Date	Output from D4.2
D4.1	M18	The outputs of the focus groups and contextual analysis are helping to design the Citizen Science protocol as described in D4.1.
D5.3	M18	Digital app and back office
D4.3	M45	Citizen Science design, process and outcomes

1.3 Structure of the deliverable

The present deliverable is structured in six Sections arranged as follows:

Section 1 provides the reader with the scope and objectives of the deliverable and its connection with other tasks and deliverables. **Section 2** provides the methodological approach of the rapid scoping literature review and the focus group methodology. In this section, the desk-based search strategy is comprehensively explained and presented. The focus group methodology describes the activities and processes used to develop the various tools for the focus group research sites. **Section 3** provides a wider literature review on citizen experiences and interactions with the environment. It concludes with an analysis of how these experiences and interactions impact their health outcomes. **Section 4** provides the contextual city reviews for the five focus group sites. Summary findings from the focus

group sites are provided. **Section 5** opens with a comparative discussion on the main findings from the five focus group sites and city contextual reviews. It lists the human and environmental indicators highlighted by citizens in the participatory research activities and gives citizens priorities for the app based on focus group findings. **Section 6** provides the main findings supported by a table of the ecological and social determinants that influence citizens interaction with the environment.

2 Methodology

This report is based on both primary (fieldwork) and secondary (literature review) methodologies. More specifically, it employed:

- an adapted **scoping review methodology** performing a **desk search** on the main targets of the study (**1. Citizen Needs/Experiences with nature, 2. Contextual City Reviews in OAH**, see 1.1) via acquisition of scientific, institutional, and grey literature (section 2.1)
- a **focus group methodology** collecting information from citizen representatives and stakeholder organisations via the local alliances (section 2.2).

Acquisition of research data began through desk-based research extracting preliminary knowledge on the main subjects of the study. Background knowledge was necessary to develop the content contained within Chapters 2 and 3. Thus, it contributed to constructing a reference framework which included operational definitions and previous scientific debates, alongside reference material on the existing practices and evidence of citizens' experiences with urban blue ecosystems. Comparative assessment led to the identification of a list of socioeconomic, demographic, and cultural determinants necessary to understand societal needs which will considered in the development of the citizen science app within the OAH solution system.

For the second part of the research activities, the authors of this deliverable exploited background knowledge acquired through desk search. This information was used to develop the focus group protocol for the alliances of local stakeholders who acted as referents and representatives of citizens in the five research sites. The researchers developed a focus group manual which contained extracted information on citizens needs and experiences when interacting with urban aquatic ecosystems. Following this, the focus groups were planned to be conducted locally by the respective leaders of the research sites as instructed by the project workflow with the purpose to collect richer results and maximize inclusiveness by using local language. Thus, the research site leaders performed and recorded the five workshops (Coimbra, Toulouse, Oslo, Benevento and Ghent). They summarised and synthesised the reported findings in English. The research team entrusted with this current report received qualitative data from three research sites, and quantitative data from one research site (Benevento). This data was reviewed, cleaned and further synthesised to produce the analysis provided herein. It was further used to identify citizen needs in relation to the environment, health and engagement in citizen science activities. This part of the work was duly reported in Section 4 of this report. The task entrusted to the research team was thus the translation and connection of citizens' real experiences and needs with the desired functionalities to be provided by the OAH app. Comparative analysis and deductive extraction of results was applied for the development of Chapter 4. The following sub-section discusses in more detail the social science research methodology deployed to produce this report.

2.1 Rapid Scoping Literature Review (RSLR)

A **Rapid Scoping Literature Review** (RSLR) using a defined set of sources, keywords, and parameters for inclusion was selected method to acquire background information for the desk search process of this report (see Step 1 below). This method was chosen over other methodologies (e.g., systematic review) according to previous research experience when performing exploratory enquiries in Social

Sciences and Humanities (SSH) topics. As learned from previous projects, a search purely based on systematic formulas and limited by criteria constraints (e.g., selecting only the first 100 results of a query string, adhering strictly to given keywords) is less beneficial than a scoping exercise with multiple sources and intense snowballing (i.e., cross-reference search of authors, investigating quotations cited in an identified paper, in-depth investigation of grey literature). In addition, previous research experience shows that even small variations in keywords search can lead to improved results in each field. Thus, we have concluded that a certain degree of flexibility was necessary to enhance the overall result.

Next, we illustrate our adapted search strategy for the successful development of literature identification of the two core issues of the study: **1. Citizen Needs/Experiences with Nature, namely aquatic ecosystems, 2. Contextual City Reviews**.

2.1.1 Step 1: Definition of Sources, Keywords & Parameters for Inclusion

Firstly, this report has employed three categories of data sources to identify literature relevant to the topic: literature-specific databases, institutional repositories, and contributions from relevant stakeholder organisations and their websites (See Table 3 below).

Table 3: List of sources for data collection in the RSLR.

CATEGORY OF DATA SOURCES	DETAILS
Literature-specific Databases	▪ PubMed, Scopus, Google Scholar
Institutional Repositories	▪ **European Organizations and Stakeholder Websites** in the field of **Public Health** (e.g., WHO Europe) ▪ **European Organizations and Stakeholder Websites in the field of Environmental protection**, with a focus on Water Management and participatory experiences (e.g., European Environmental Agency) ▪ **European Institutional Repositories:** EU Publications' Office Website, European Commission Library Catalogue, European Parliament Website (e.g., think tank and committee documentation), Joint Research Centre ▪ **Results from EU-funded programmes, research projects and/or networks** ▪ **National and Local level reports** published on territorial authorities' websites
Others	▪ **Local Stakeholder Alliances contributions**: specific request to stakeholder alliances to provide local information pieces (e.g. cover stories, local reports, local media news, city council projects, others) ▪ Dedicated **Research Institutes** and **Research Group** Websites ▪ **Oher stakeholder organisations** from EU to local level (e.g. civil society, NGOs) ▪ **Initial review of studies** presented through OAH project proposal and based on Project Team expertise ▪ **Snowballing references** extracted from encountered and previously known literature

In addition, **the following parameters for inclusion of relevant literature were included in the overall search strategy**. See table 4 below.

Table 4: RSLR parameters for inclusion of sources.

CATEGORY OF PARAMETERS	DETAILS
Study Type	The study will include three typologies of contributions, notably: ▪ **Scientific Literature**: Peer-reviewed academic publications coming in the form of articles in journals in the field (e.g., *Sustainable Cities and Society, Ecological Indicators, Water, Health Promotion International, Biodiversity and Conservation*). ▪ **Institutional Literature**: Literature published by European, national or even regional/local institutions. This may include funded studies, sponsored research, other collections such as working papers or even public policy briefs and territorial strategies. ▪ **Grey Literature***:* Literature produced by a large variety of stakeholder organisations. It may include for instance position papers or non-scientific documentation examples (but clearly referenced), newsletters, reports, working papers, bulletins, surveys, and even online resources e.g., videos.
Publication Date	▪ The publication range for the SLR is officially set **between 2000 and 2024**. ▪ However, **higher priority is placed on the 2020-2024 range** due to the updated view on contemporary societal trends in an age of digitalisation and recent urbanisation processes.
Geographical Scope	The following approach is adopted in terms of geographical coverage: ▪ **General Framework Background: global scope**, as theorisation on the core issues of the report can be enriched by other contributions from other industrialised countries. ▪ **Case-studies of Citizen experiences: priority is given to European scope.** In case of systematic/meta reviews of the literature, the study must contain at least a few cases from Europe. In addition, solid examples from other countries may also be considered for inclusion. ▪ **Research Sites**: **European, national, regional, and even local scope**. Literature from all study types in relation to the five cities and their national context.
Language	▪ The **focus language of the RSLR has been English**. ▪ Notwithstanding, by virtue of the active collaboration with research sites coordinators and all task contributors, the research team can count upon **coverage of all pilot sites languages** (i.e., Portuguese, French, Italian, Flemish and Norwegian) as **well as Spanish and Catalan** if necessary (WISE Team Expertise).

When performing searches, the research team departed from the **original list of keywords (and their semantic groups) outlined in Table 5 below**. These were selected based on most relevant terminology connected to this reports' objectives. The list includes 3 semantic groups outlining the main subjects of the study relative to Citizen Needs, Experiences and Determinants (group 1. CNED) alongside the main area subject of the OAH project (Urban Environments and Urban Aquatic Environments, groups 2. UE and 3. AE). The searches were also enriched by the presence of further semantic families for zooming in on Environmental (4. ENVI) or Public Health (5. HEALTH) issues connected to both study and OAH ultimate finalities. The last thematic family was deemed necessary specifically to zooming on contextual reviews of the research sites any other comparative European studies. Further detailed combinations of keywords are outlined in table 5 below.

Table 5: Keywords for the literature review classified according to semantic/thematic families.

SEMANTIC GROUPS (KEYWORDS THEMATIC FAMILIES)	INDIVIDUAL TERMS
1. Citizens' Needs, Experiences and Determinants (CNED)	Citizens OR Need OR Experiences OR Participation OR Engagement OR Citizen Science OR Physiological OR Behavioural OR Opinions OR Feelings OR Fears OR Desires OR Expectations OR Determinants OR Social OR Cultural OR Norms OR Economic OR Socioeconomic
2. Urban Environment (UE)	Urban OR Urbanisation OR Metropolitan OR City OR Town OR Residential area OR Urban Ecosystems OR Outdoor
3. Aquatic Ecosystems (AE)	Streams OR Channels OR Rivers OR Aquatic OR Water OR Hydrological OR Hydro-morphological OR Freshwater OR Groundwater OR Outdoor Water Environment OR Aquatic Ecosystems
4. Environment (ENVI)	Environmental OR Nature OR Sustainability OR Climate change OR Ecological quality OR Biodiversity OR Public Environmental Competences
5. Public Health (HEALTH)	Green & Blue Areas OR Green Space OR Blue Space OR One Health OR One Digital Health OR Human health OR Wellbeing OR Healthy OR Physical OR Mental OR Public Health Competences
6. Contextual Markers (GEO Scope)	European OR EU OR Portugal OR Portuguese OR Coimbra OR France OR French OR Toulouse OR Italy OR Italian OR Benevento OR Belgium OR Belgian OR Gent OR Norway OR Norwegian OR Oslo

2.1.2 Step 2: Data identification, collection, and analysis

For **literature-specific databases** (i.e., PubMed, Scopus, Google Scholar), the technique employed in the research was based on the use of the combinations of keywords in table 5 above in the selected search engines. The baseline query formulas included free combinations of keywords generated by researchers while consulting the databases. Examples of explored combinations included:

- For the General Overview of Literature on the field: 1+2, 1+3, 1+2+3, 2+4, 2+5, 3+4, 3+5
- For Specific Overview of CNED on ENVI: 1+2+4, 1+3+4, 1+4
- For Specific Overview of CNED on HEALTH: 1+2+5, 1+3+5,
- For Zooming in on City Context Reviews: +6 to formulas (per individual country/city or EU context)

The researchers explored up to 5 pages of results for each query via title and abstract check but **only noted appropriate reference of publications deemed as relevant for study finalities**.

For **institutional repositories and grey literature**, the researchers **used a reduced set of basic keywords combinations** (e.g., Urban Aquatic, Streams, Green & Blue Areas, Citizens) in internal intranet search engines. **Otherwise, publications were manually explored from the relevant section of each website** to identify documents relevant to the study. This was coupled with a **holistic website exploration process of all potential webs of interest**, ranging from general topic to specific city context review (e.g. local administration websites, local NGOs, etc.).

To gather contributions from **local stakeholder alliances** in the various cities involved in the project, the research team sent **a specific request for documentation** via e-mail to the research site coordinators and the individual participants of the local alliances network. Using an assisted form with dedicated instructions (also including the keywords), the researchers requested the field actors to indicate, and where possible, provide references for possible studies including institutional documents, grey literature/press or media dealing with the two main study subjects. Project partners coordinators from the research sites were also asked to fill literature gaps by aiding the drafting of the study.

All compatible publications were stored in an Excel file. Publications were divided into a. General Framework or b. Specific City Context. At the preliminary level, the researchers took note of the **full reference** (e.g., authors, year, title, journal or editorial), **quick URL access** and copy/pasted **the abstract** into the file. A **quick-notes section** including keywords and/or comments helping them to acknowledge relevance and noteworthy aspects of publications at first glance was incorporated. In the case of doubt regarding certain elements (e.g., typology of aquatic intervention, European focus of the analysis), **the team quickly scanned relevant article sections** for further details.

The **researchers included up to 150 publications in the initial screening**, considering a balance in-between the typology of literature sources. The team also downloaded relevant publications in a folder on the shared cloud system for common access following a standard format for rapid consultation (Files title: Author1. _Year).

The second part of the review **screened 105 publications and classified the content according to geographic location and research topic according to the predefined semantic groups outlined in table 5 above**. This supported the researchers to refine the inclusion and exclusion criteria to determine eligibility for the next step. The researchers overviewed **the abstract, results and discussion** to ascertain the essential findings required for both the general and context-relevant reviews. Meanwhile, the team **classified the publication content** by filling a series of content analysis fields in the corresponding Excel Dataset. These are shown in Table 6 below.

Table 6: Control fields for literature review and classification in the excel dataset.

DATASET FIELDS	CONTENT
URL & REFERENCE	Full reference to the publication, including URL hyperlink for quick consultation
ABSTRACT	Copy/Paste of Abstract. Possible key sentences marked in bold
COUNTRY / CITY	Indicates country reference of the document for quick geographical classification
KEYWORDS OF REFERENCE	Any keywords of reference helping researchers to quickly link the source to specific aspects of the study (e.g. Blue & Green Areas)
THEMATIC FAMILY	Indicates towards which kind of thematic family the study is more focused towards: UE, AE, CNED, ENVI, HEALTH or a combination of them
NOTES	Preliminary notes/comments of the researchers on document content and possible use in the study
ADMITTED	Y/N. First screening stage for further analysis

METHODOLOGY	Indicates whether it's Theory-Based (e.g. Systematic Lit. Review), Case-study based, Report or any other.
STUDY EVIDENCE	Short notes for the identification of available evidence of CNED issues in the publications, or alternatively the main topics of relevance for the analysis (e.g. key aims in local territorial strategies)
SPECIFIC	Indicates whether the document identifies specific sociocultural or economic determinants of citizens in relation to the environment
NOTES 2	In-depth comments and notes from researchers, evaluating if and in which section the document could be used.
ADMITTED FOR STAGE 3?	Y/N. Final evaluation for considering in main study text

In the third step, **90 publications were screened according to publication date, semantic and geographic scope. Further analysis of these articles was conducted to determine whether the literature discussed blue spaces or urban aquatic environments as part of their definition of 'green space'.** Additionally, articles were analysed to identify whether they referenced citizen's needs in relation to the environment or citizen science projects. Moreover, articles were explored in dept to ascertain whether they incorporated an analysis of blue space, aquatic and urban aquatic environments. Following this analysis, articles published before 2020 were excluded from the RSLR. Additionally, articles that did not discuss blue space or aquatic environments were excluded. Articles published between 2020 – 2024, studying blue spaces, and green and blue spaces, citizen science projects with aquatic environments were included in the final selection. A total of 52 academic articles were identified for inclusion, incorporating case studies from across Europe, including countries outside the EEA, and global systematic meta-analyses which included studies in European countries.

2.2 Focus Group Methodology

Local Stakeholder Alliances are an integrating part of the OAH European project. They represent local clusters of representative territorial administrations and civil society's actors located in the urban areas of each of the five research sites. As the project already foretells consultation and co-creation processes in conjunction with these stakeholders (up to six workshops), their involvement through a qualitative methodology setting immediately appeared as an ideal fieldwork solution. In principle, it would allow easier access to local perspectives via participation of a small representation of participants from the local stakeholder alliances. It would thus allow in-depth reflection and discussion on the relationship between citizens of the research sites and the natural environment upon which OAH seeks to develop appropriate solutions for monitoring, management, and improvement.

Considering the requirement of a flexible method that would allow in-depth exploration of values and beliefs while maintaining a selected focus on small numbers of participants, the **Focus Group methodology** was considered as the most adequate solution for the development of the needs' analysis of the research sites. According to standard definition, a focus groups is understood as "a carefully planned discussion designed to obtain perceptions on a defined area of interest in a permissive, non-threatening environment" [11]. It is increasingly used as a data collection method in political and social sciences, and its aims are quite fitting for the development of results included in this deliverable. Focus groups allow researchers to collect the needs, desires, problem perceptions and concerns of stakeholder groups or general citizens. A protected and comfortable setting for discussion

allows participants to give shape to unarticulated ideas and concerns, while respecting a diversity of views, values, attitudes and beliefs. When properly applied, it thus becomes a window for understanding personal, historical and cultural context of the interviewed groups [12].

The needs analysis used for this deliverable is strongly based on previous European projects' practice of consolidated focus group methodologies and citizens' review panels (e.g. VOICES project [12]; RRI Leaders project [13]). The background knowledge acquired through a literature review at both general framework and city-specific level was thus translated in the development of new materials for the development of OAH targeted focus groups. The lead partner prepared a series of materials (e.g. OAH moderator manual, a list of requirements, templates and a session slide deck) which were distributed to the research site coordinators. Precise instructions on how to develop the fieldwork, including instructions on discussion/brainstorming/design activities for participants of the workshops were given. The manual also included specific instructions for submitting a summary report of the focus group (including all developed brainstorming materials) in English. However, slightly different approaches were adopted by the five research sites in conducting this activity as methods were adapted to the specific contexts and available resources. The summary reports were used to present the results exposed in Section 4 of this document. The comparative assessment and extraction of possible citizen indicators was part of a direct process of data elaboration performed by the research team. These results were also compared with state of work documentation produced by scientific partners on ideal environmental and public health indicators developed during innovative research in the OAH project.

3 An Introduction to Citizen's Experiences with the Environment

Freshwater systems are among the most diverse habitats in the world. However, these systems are increasingly threatened by human activities, particularly those in urban environments, as the expansion of urban landscapes continues. Water pollution, river diversions and flow regulation are just some of the contributing factors causing less diverse fish populations, less stable bird populations and lower riparian forest production [14]. Urban blue spaces are now experiencing high or extremely high water stress, with consequent effects on human health [14].

Urban aquatic areas provide urban populations with numerous health, social, and functional benefits and offer critical access to nature in high-density, built environments. However, throughout history, urban freshwater systems, including rivers and streams, have been perceived as unsafe and associated with flooding and disease [15]. As a result, many European cities buried or diverted their waterways, removing the cultural relationship between cities and rivers, and knowledge about their ecosystems and wildlife has been progressively lost [15]. Negative perceptions of rivers as dirty, threatening and unattractive environments are counterbalanced by the centrality of urban aquatic environments as pleasant areas for rest, recuperation and exercise. This tension typifies citizens' experiences and attitudes towards urban aquatic environments.

At first glance, the literature shows that blue space means different things to different people and appears to be largely dependent on visual cues, exposure to aquatic systems, and other demographic factors [16]. Regardless, various psychological and physical health benefits are associated with positive human health outcomes [17]. Recent literature currently suggests that waterscapes are more beneficial for psychological and mental health than green spaces [17]. Indeed, research from the UK shows that visiting canals and rivers is significantly associated with higher levels of wellbeing compared to visiting green spaces [3].

3.1 Citizen's interactions with Urban Blue Spaces

Rivers establish a wide variety of flow-human relationships, like transportation, recreation and wellbeing, identity and group cohesion, or even a sense of time and place [18]. Citizens interactions with blue spaces are intrinsically linked to the rhythms and rituals of their respective lifestyles. In the literature, citizen interactions are generally categorised as intentional, incidental (e.g., travelling through a canal or river area as part of a commute), direct, or indirect [4]. Overall, physical activity through independent exercise or sharing hobbies and activities, seeking social connections, socialising with family and friends, and using areas to escape and relax typify urban residents interactions with urban aquatic environments [1-3], [5], [7], [16],[17]. Activity type is associated with well-being outcomes, and social interactions are an important motive for blue space visits [3], [21]. Studies from Ireland, Germany, and the UK all found evidence that these environments are perfect locations for spending quality time with friends and family [21]. Cultural and contextual factors have also been found to influence people's perceptions, use and experiences of natural spaces [6].

Furthermore, citizen interactions with urban blue spaces may also be linked to conservation efforts such as citizen science activities (see [22] for example). Community participation in monitoring aquatic systems, whether via community-based water monitoring or citizen science (CS) projects, is generally

voluntary. In citizen science projects, citizen interactions with aquatic environments can encompass the collection and analysis of water samples for physical, chemical, and biological markers [8], [10]. Additionally, they may be involved in monitoring parameters associated with plastic pollution and riparian habitats [10] or in projects exploring the relationship between mental wellbeing and the surrounding environment [3]. They may also be involved in uploading surveys and images to interactive platforms [23].

With citizens' interactions with urban blue spaces becoming increasingly diverse, it must also be kept in mind that the way people relate to nature varies according to geography, demographics, and socio-economic variables. The following sections will focus on citizens' interactions and experiences with urban aquatic spaces within two contexts: factors influencing participation in CS projects and the wider structural, economic, and cultural factors influencing people's habitual interaction and use of urban blue spaces.

3.2 Citizen Science

At the policy level, the Rio Declaration states that 'environmental issues are best handled with the participation of all concerned citizens, at the relevant level' [24]. Additionally, the European Water Framework Directive (WFD) includes clear requirements for public participation, defined as the involvement of individuals (including the lay public), associations, organisations, or groups in European water policies [25]. Citizens can thus be involved in the preparation and planning of River Basin Management Plans (RBMPs) [25]. Thus, community participation in monitoring aquatic systems is significant for achieving good water status for human and aquatic ecosystem health. Furthermore, CS projects can make nature more relevant to a wider part of the population, increase citizen awareness of the quality of their local aquatic systems, and empower them to be more involved in local policy-making activities.

As capacity to measure water quality is limited, calls have also been issued for more citizen engagement in monitoring processes [10]. Correspondingly, CS has gained momentum in freshwater monitoring [10], [26]. Motivation to participate in citizen science volunteering activities can be intrinsic or extrinsic [27]. According to several articles on the topic, motivation to participate in nature-based citizen science projects is linked to desires to contribute to research and science, address environmental concerns, foster learning, professional growth, and development, and community engagement [22], [26 - 29]. Regarding water-based CS projects, motivation factors included developing knowledge about wildlife [28], place attachment [28], and desires to learn more about water quality [22]. Improving environmental conditions and responding to a specific problem were found in one study to be the highest motivational factors spurring participation in CS freshwater projects [10]. Learning about nature and water quality were also marked as significantly high motivating factors [10]. Additionally, an important motivating factor for families was the desire for children to learn about the environment [29]. Moreover, proximity to rivers, associated with place-attachment, may influence volunteering activity [30].

Figure 1: Motivations for engaging in nature-based citizen science activities.

Demotivating factors influencing participation included the level of commitment required [22], [24],[25], [27],[28], task complexity [24],]25],[31], interest [22], [27], perceived utility [24],[25] and understanding both the project and the term 'citizen science' itself [23], [28]. In one article, the term citizen science was found to affect buy-in, with participants reporting that the term felt alienating and discouraged participation [28]. As for perceived utility, despite growing awareness of the benefits of citizen science for policy-makers and researchers, challenges remain regarding the inclusion of results in environmental policies [31].

Involvement in citizen science and water monitoring activities can also be compromised by a range of policy, operational, and structural factors [30]. Digital literacy and comfort using data collection tools [27], the flexibility and capacity of teachers and educational curriculums to support CS projects [31], costs and funding [23], [31], access to site locations [23], intellectual ownership [23], and data privacy concerns [23] are additional factors influencing project participation and outcomes. While citizens are eager to learn more about nature and science, and involvement in nature-based projects has individual and societal benefits, significant barriers need to be overcome to assure their continuity and success.

3.3 Socio-economic determinants

People who take part in citizen science projects tend to be highly educated [22], [27], live locally [27], belong to middle and upper socioeconomic classes [10], [22] and have an established interest in the topic [22]. It is rare that citizens with less than a third-level education and from lower-economic groupings are involved in CS projects [10].

Socio-economic factors are also correlated with the use and access of blue spaces. People with lower incomes are less likely to visit blue spaces than those with higher incomes, regardless of proximity, while people with university degrees visit blue spaces more frequently [5]. It is suggested that high-income individuals may proactively migrate to areas with more green and blue space [21], thus their purchasing power permits them to 'buy' indirect and direct access to nature resources. Indeed, one

study shows that still waters may be a simple and effective indicator of socioeconomic wealth; statistically significant differences were identified in relation to the availability of still waters and lower levels of deprivation in the UK [2]. Meanwhile, in the European-funded project BlueHealth, tensions emerged in cities such as Plymouth (UK) and Tallinn (Estonia) regarding waterfront developments that risk changing the function of urban water environments and excluding sections of the population in favour of economic returns [20].

Furthermore, the unequal distribution of blue spaces more often means lower levels of environmental quality for residents in lower socioeconomic groups with local access to aquatic areas [5]. In Amsterdam, for example, areas prone to flooding are situated in more deprived neighbourhoods [32]. Indeed, as urbanisation increases, green space diminishes; thus, blue spaces have fewer complex habitats, are more likely to be malodorous, and receive urban discharges [5]. Additionally, the likelihood of insect-borne disease increases, as does the likelihood that some water bodies induce feelings of fear and anxiety due to perceptions of risk [5]. This impacts communities relationships with nature and lessens affinity, which is linked with less environmental participation, worsened environmental degradation and social inequalities [18].

3.4 Demographic factors

Attitudes, perceptions, interactions, and affinity with riverine areas have been shown to differ according to age, ethnicity, and gender for both CS projects and in the habitual use of blue spaces [5], [18], [21].

In one study, CS participants come from various age ranges but typically involve younger but also elderly and retired citizens [22]. Yet another study identified that projects mainly involved middle-aged people (31–50 years), and the participation of children (less than 16 years) and senior citizens (over 75 years) is uncommon. In terms of habitual use, studies from Portugal suggest that children and younger people living in cities have less contact with rivers and streams and less affinity with the ecological aspects and biodiversity values of riverine areas [18], [33]. Indeed, children's relationships with rivers tended to be associated with family activities such as picnicking [33]. Meanwhile, the functionality of these areas for younger people (e.g., adolescents) is more associated with waters sports than traditional activities such as fishing [18]. For children, on the other hand, fear may be associated with rivers and streams. Several children in Feio et al.'s study, for example, were afraid of water spaces, which may be associated with their level of exposure to such environments, which was considered poor by the researchers [33]. Indeed, despite these children's relative proximity to rivers and streams, their contact with these environments was sporadic.

Children's interaction with these areas is also linked to parental perceptions of risk. Thus, children's exposure depends on family culture, educational levels, and adult motivation to visit such spaces [6], [33]. The importance of family exposure is further highlighted in Vitale et al.'s analysis of childhood exposure to blue spaces. One study sample included in this study of 16,000 people in England who do not visit natural environments regularly showed that 22% of respondents were not interested and felt that nature was not for people like them [33]. While children and young people are increasingly aware of environmental threats and their impacts, they appear to be largely alienated from nature. For the most part, information on natural environments is acquired through educational programmes and the media rather than direct interaction and observation of changes taking place in their local areas [18],

[33]. Thus, there is a risk that the importance of rivers will be lost as children and younger people age, and the sense to belonging with nature will accordingly diminish.

Considering **gender**, women are more likely to engage in passive recreational experiences linked to aesthetic value, such as walking or collecting plants [18]. In contrast, men tend to engage in activities such as hunting, fishing, boating, and swimming and, as such, have a more dynamic interaction with and perceptions of water flow and quality [18]. Preferences in CS activities were also found to be divided amongst gender lines, with men showing a higher interest in data collection and women showing a stronger interest in data analysis [22]. Furthermore, men in two countries, England and Spain, are more likely than women to visit inland waterways [21]. This finding is believed to be linked to perceptions of safety, which also influences relationships with blue spaces. Thus, some parameters determining individual use include the time of day, location, flooding risk, drowning hazards, river bank conditions, disease transmission, and water pollution [5], [6], [18], [34]. Additionally, blue spaces can be perceived as dangerous depending on a range of factors by people with disabilities and by parents with children. Thus, contact with these environments may be reduced according to parental status, physical ability, and awareness levels.

As for **minority groups**, some US studies discovered that people belonging to ethnic minority backgrounds are less likely to spend time in urban blue spaces despite living closer to them [5]. Although this factor was not found to have any impact in a separate British study [3].

3.5 Other factors influencing blue space use

3.5.1 Accessibility and proximity

While blue spaces are generally free resources, proximity is not always associated with use, awareness, or accessibility even if it generates place attachment [5], [30]. Exposure and use of blue spaces are dependent on distance, which is also correlated with accessibility and equity in many instances [5], [3], [17]. Indeed, households or individuals living adjacent to riverine areas are more likely to spend time there and have greater indirect, intentional, and incidental exposure [21]. In fact, intentional exposure studies across eighteen countries, including England and Denmark, show that close proximity to blue spaces correlates with a higher visit frequency [21]. However, instances also exist where people have little or no accessibility to blue spaces despite proximity (see [35] for example). Moreover, living near blue spaces does not necessarily indicate use as daylight hours, and weather conditions vary across the European continent and themselves predictors of blue space visits. This is especially the case for the spring/summer and the autumn/winter seasons with evidence showing that visits are more frequent for the former period than the latter [36].

3.5.2 Infrastructure availability

Other features, such as the functional level of the landscape, defined as the availability of infrastructure and good facilities for walking and recreational activities, can also determine use levels. A recent study in Ile de France shows that users of urban lakes ranked the availability of leisure facilities as more important than the lake's natural appearance [7]. Additionally, the presence of facilities such as benches and toilets, especially for older people was considered an important aspect of blue space usage [21]. Likewise, man-made features such as bridges, footpath quality, seating availability, and the built environment around canals in Scotland were found to affect how people used such spaces

[5]. As the objective of many design interventions is to increase access to inland waters, building promenades, converting docks, and constructing seating and viewing platforms are important initiatives to promote use associated with relaxation and physical activity [21]. As such, many urban river restoration projects usually include objectives enhancing the leisure and recreational function of these environments, thus increasing usage as waterfronts open up [15].

3.5.3 River regulation

As most cities are located on or near rivers, which have historically been associated with flood risk, dikes and flood control dams have led to the complete deforestation of riparian flood plains in cities [15]. River regulation reduces use and leisure activities in regulated waters compared to free-flowing systems [18]. Furthermore, research shows that visit frequency declines following river damming due to the damaging impact such interventions have on rivers' ecosystems [18]. Positively, river restoration projects are exploring the reintroduction of riverine landscapes as natural barriers and protection against floods [15].

3.5.4 Ecological integrity and ecosystem quality

Ecological integrity and ecosystem quality are dependent on individual perceptions, which vary from one person to another. Heavily dependent on sensory perception, qualities associated with blue spaces include water quality, water odour, presence of wildlife, urbanisation, landscape or naturalness, and vegetation [3], [7]. Aesthetic value and public perception are considered key issues in the field of urban water for the sustainable management of urban water environments, including rivers and wetlands [7]. Additionally, landscape preferences and nature connectedness are other factors that influence visits to natural spaces [6].

Research demonstrates that perceptions are influenced by a number of factors, including sensory inputs, envisaged use, and location, although what people enjoy may not be inherently connected to ecological quality [7], [18]. For example, a French study shows that the intensity of **urbanisation** affects blue space function, use, and user appreciation [18]. In urban areas, landscape function (20% of urban residents' vs. 5% of peri-urban residents') and cleanliness are deemed more important than ecological function (24% vs 15%) and natural appearance compared to less urbanised spaces [7]. Sensory perceptions in particular shape people's opinions on whether spaces are physically healthy, whether a space is cared for, and thus influence feelings of wellbeing and security [7], [20]. For example, peri-urban environments tend to use green and blue perceptions as criterions to assess lake quality, and seen as a guarantee of biodiversity [7]. Subjective perceptions may also reflect objective measures, although no conclusive studies exist demonstrating the interconnection between both [7]. Thus, aesthetic and visual preferences are deemed to be important issues for conservation purposes, as when people perceive ecosystems as attractive, they are more likely to have long-term sustainable behaviours towards them [7].

Water features, sounds, colour, and clarity are important sensory perceptions of waterscapes that people attach importance to. For users, water quality is associated with appearances such as the presence of algae blooms, litter, and pollution residue [16]. Transparent water is also associated with cleanliness and healthy environments. Indeed, the return of untreated wastewater triggers perceptions of rivers as dirty, unattractive environments that are sources of bad odours and disease [8]. Additionally, the presence of cyanobacteria also leads to water odour problems and large fish kills

[19]. Perceived negative aspects of water features, whether lakes, rivers, or canals, adversely influence use regardless of actual quality [2] [17]. However, attitudes have been demonstrated to change when spaces are revitalised and restored [5], [15].

Wildlife (fauna), the natural environment, and biodiversity levels are also considered positive features influencing users' perceptions and use of blue spaces. The presence of charismatic species (e.g., kingfishers, dragonflies, beavers) is positively interpreted by people [37]. Watching changing habitats and seeing birds, such as swans, grow in riverine spaces connects people with biodiversity in a tangible way [5]. In one Scottish study, canal visits increased in the summer months, which appeared to be correlated with watching birdlife evolve during this period [5]. High wildlife presence is correlated with greater visit satisfaction, and smaller water bodies have slightly stronger associations between wildlife presence and visit satisfaction [3]. In some cases, the presence of birds is also associated with positive environmental criteria, as was the case in one lake studied in Ile de France [7]. Indeed, people are more likely to visit waterscapes if there is wildlife to see [17]. Flora also influences people's enjoyment of water bodies [5],[7]. In a Portuguese study, affinity for nature is linked firstly to river ecology components such as the presence of insects, plants and mosses in the margins [18].

3.6 Health outcomes

3.6.1 Mental health and psychological wellbeing

The perceived quality of interacting with blue spaces on psychological benefits was recognised by the World Health Organisation (WHO) in 1980 [17]. Indeed, most of the articles reviewed investigated the link between blue spaces and their impact on mental health. General findings showed that psychological benefits can be broken into two groups: cognitive and psycho-emotional outcomes and prescribing practices for mental health illnesses (e.g., anxiety and depression). From this research, psychological outcomes are related to a range of factors, including exposure to and proximity to blue spaces, the presence of wildlife, and perceptions about the quality of water and the surrounding environment.

Cognitive outcomes associated with still and moving water included feelings of peace, contemplation, enthusiasm, energy, excitement, and relaxation [7], [15], [16], [20]. Studies also refer to the benefits blue spaces, that is, rivers, lakes, and canals, have on stress reduction, concentration levels, awareness, attention, psychological distress, increased self-esteem, and decreased use of mental health services [16], [20], [35]. Indeed, physical activity in green spaces, including those bordering blue spaces, improves cognitive and emotional outcomes, such as reducing feelings of anger, tension, and confusion [1]. Studies show that cortisol levels are lower among people who regularly use vegetated trails along canals [16]. Furthermore, as little as 15 minutes of exposure to natural environments is associated with lowered stress responses measurable by blood pressure, pulse rate, and cortisol levels. The greatest effects are found among those who are the most stressed [9].

Research shows that water quality perceptions have the strongest relationship with mental wellbeing, and even the sound of running water can positively impact mental health [3], [17]. In one study, excellent water quality was associated with significantly greater visit happiness, worthwhileness, and significantly lower visit anxiety, while poor water quality was linked with significantly low levels of visit satisfaction [3]. The presence of wildlife, facilities and the absence of litter are also associated with better subjective mental well-being [3]. Although the presence of wildlife can be unpleasant and

provoke feelings of anxiety for some [3]. Indeed, feelings of safety in these environments are also positively correlated with feelings of happiness, worthwhileness, and satisfaction levels [3]. On the other hand, conservation activities were found to be associated with lower levels of visit happiness and higher levels of visit anxiety but had no effect on visit satisfaction or worthwhileness [3].

Furthermore, a UK study shows that better mental well-being is associated with places described as beautiful, historic, peaceful, and inspiring [3]. On the other hand, descriptors such as ugly, uninspiring, dirty, and dull are associated with worse wellbeing [3]. Indeed, findings from Portugal are consistent with this insight, as depression, sadness, loss of motivation, and insecurity regarding the future were found to be promoted by issues linked to environmental degradation [18].

Moreover, living near blue spaces reduces the need for anti-depressant medications, according to three reviewed papers [1], [4], [36]. Meanwhile, a Scottish study found that living near blue space modifies the risk of mental health disorders linked to socio-economic deprivation by 6% [34]. Additionally, proximity to natural environments is associated with lower stress, has been found to moderate the impact of socio-economic deprivation, speed up recovery from psychological events, mood improvement, and increase self-esteem as well as self-perceived general health and happiness [16], [24]. Moreover, mounting evidence now shows that proximity to blue spaces creates feelings of place attachment [30].

Furthermore, population research in the UK and Spain found that exposure to nature during the COVID-19 pandemic was associated with better sleep quality and mental health outcomes and fewer experiences of mental and physical health symptoms [4]. However, the relationship between blue space accessibility and mental health (e.g., generalised anxiety, depression, chronic mental health disorders) is unclear and warrants further investigation [9], [36].

3.6.2 Physical health outcomes

Physical health benefits are also associated with blue spaces that have green features such as trees and plants. These include reductions in the incidences of cardiovascular and Alzheimer's disease, reduced respiratory symptoms, and positive impacts on immune function, pregnancy outcomes, stroke, obesity, and mortality rates for urban dwellers [9], [16], [34], [35]. Indeed, bird and fish watching can lower pulse rate and muscle tone and increase skin temperature [17]. It should be noted that degraded environments, such as those that occur with river regulation, can negatively affect health outcomes and contribute to stroke, hypertension, and cancer. To date, however, the relationship between riverine environments and public health outcomes is not yet fully understood [18].

At the same time, one overview found that the greatest rate of decline in mortality rates was observed in areas closest to blue spaces [34]. Although a follow-up study suggests that this benefit is largely observed in those from the most socio-economically deprived areas [35]. However, in Poland, large proportions of blue and green space were attributed to lower COVID-19 cases and deaths, suggesting that evidence on this outcome remains inconclusive.

Furthermore, engaging in physical activities alongside canal and river banks contributes to regular exercise, improved fitness, and enhanced energy, according to survey respondents in an Irish study [20]. A bibliometric review shows that proximity is again an important factor that is related to higher

physical activity, and age, accessibility, and the built environment all influence physical activity levels [38].

Physical and mental health can also be negatively impacted by the objective quality of aquatic ecosystems. While the participant research reviewed here did not identify perceptions of increased health risk with freshwater sources, nevertheless, it appears that at a subconscious level, the cleanliness of these environments is correlated with perceptions of risk.

Polluted waters, for example, from human and animal sewage, are one of the chief threats to human health that can trigger gastrointestinal illnesses and pose infectious disease risks [21], [32]. Indeed, it appears awareness of the risk from sewage in canals, at least in Amsterdam, is not widely known, as many residents are unaware of the risks associated with urban blue spaces for bathing [32]. Given Amsterdam's ethnic diversity, a specific challenge exists in ensuring sufficient outreach and culturally appropriate communication to all residents regarding the interconnection between ecological and human health.

Research underscores that climate change will increase toxic cyanobacteria in freshwater sources, posing serious health risks [37]. Indeed, projections suggest that the number of water-related diseases will increase, and freshwater warming, causing bacteria growth will cause primary amoebic meningoencephalitis (PAM) disease in humans [37]. Mental health will also be adversely affected by weather related disasters, such as floods and droughts. Such events will equally affect sanitation, water supply and water quality [37]. Despite these challenges, the benefits of blue spaces are now being widely recognised by health services as the use of blue prescriptions increases and becomes part of social prescribing[1] plans (see Juster-Horsfield & Bell, 2022, [14] and Alejandre et al., 2023, [4] for example). Furthermore, the inclusion of CS, which are intrinsically linked with holistic health benefits, in social prescribing programmes is advocated for [9].

3.6.3 Sociological benefits

Finally, literature also points to the sociological benefits associated with blue space exposure, include pro-environmental behaviours [38], better social connectedness, and enhanced physical and mental health that can emerge from citizens' engaging in environmental volunteering [28]. Arguments are also put forward about the benefits of citizen science on overall health outcomes such as loneliness, physical activity, and affinity with biodiversity [27]. Intergenerational connections can be improved via nature-based citizen science projects in schools that facilitate reciprocal and reverse peer learning [9]. Furthermore, knowledge gained in school settings spills over into families and communities, raising awareness of environmental challenges [8].

Thus, citizen science projects can be considered important tools for holistic health outcomes as they foster public participation, ecosystem responsibility, strengthen social capital, collective intelligence, and scientific capacity [27]. In fact, stakeholder engagement has been found to lower mortality, improve mental health, and increase health-related help-seeking behaviour when needed. Moreover, citizen inclusion in planning processes and ecosystem stewardship increases feelings of agency, connectedness to the environment, and community belonging [1], [15], [27]. This underscores the underlining importance of facilitating interconnections between citizens and public policy-making as

1 Social prescribing is defined as 'a formal means of enabling primary care services to refer patients with social, emotional or practical needs to a range of local non-clinical services and provides a framework for developing alternative responses to meet need' (Brandling and House 2007, 3)" (Juster-Horsfield and Bell, 2022, p. 138)

when citizens feel excluded, frustration, anger, and sadness may arise [1]. Furthermore, the large datasets citizen scientists are capable of generating can be powerful for decision making, a fact recognised by the Scottish government which has helped some CS projects with training and tools to improve data collection [31].

Additionally, access to blue spaces is suggested to be positively associated with **social connectivity**, as demonstrated by a Spanish study showing that social support is higher amongst those who have access to blue spaces [21]. A UK study showed participants were more likely to feel socially included when visiting canals and rivers compared to other spaces [3]. Furthermore, blue spaces can alleviate flooding, mitigate climate change through carbon sequestration, and mitigate the effects associated with urban heat islands [2]. Despite these benefits, concerns are also raised in the literature about the impact of nature detachment on environmental sustainability and public health, as the ongoing alienation from nature may cause nature-deficit disorders to emerge [17].

4 OneAquaHealth Research Sites: Contextual Reviews

The following section illustrates the results of the five city contextual reviews conducted in the OAH research sites. Citizens were recruited using a variety of outreach methods e.g., via local media announcements, mobilisation of local associations, etc. Three out of the five research sites followed a strictly qualitative format using the focus group manual and materials provided and here attached in the Annexes. All sites were also provided with a prepared slide deck to support facilitation. Following this, each site was requested to translate their results into a pro-forma focus group reporting template, translating and summarising their results in English.

The fourth group, the Benevento research site, adopted a different method distributing a multiple-choice questionnaire amongst the group and collating responses in quantitative format. Despite the limitations that this approach poses to the comparability of the results with the other sites that implemented the qualitative approach as planned, the quantitative method adopted exposed some interesting results between groups, presented below. In some groups, the opportunity was also used by facilitators to educate participants about the importance of streams and the concept of 'naturalness' in their local environment. It is unclear whether this approach changed the dynamic of the group or influenced their responses. Finally, Oslo, the fifth site, first had an informal group interview with three members of Oslo River Forum (ORF) targeting the topics from the focus group manual. Thereafter, to obtain more in-depth information, they conducted a key informant interview with a city planner person who, besides being a member of the ORF, has participated in the process of reopening of Oslo's rivers and streams. In addition, the key informant has been actively involved in work conducted in Oslo to transform the city into a greener and environmentally friendly city. As additional participatory research activities are ongoing in Oslo, the final results will be eventually included in a joint publication that the consortium is considering producing with the combined results of the citizen consultations under T4.2.

The following sub-sections present the results of each city's activities combining the results from the desk-based city contextual reviews and the key findings obtained in each site via the participatory research work undertaken, thus providing an insightful overview of citizens' sustainability experiences in their respective urban environments. It further summarises citizens attitudes towards their local urban aquatic areas and their willingness and motivation to engage in CS activities. Generally, like the literature reviewed in the earlier section, residents linked their interactions with the urban aquatic environment with subjective health outcomes and largely ascribed emotions to their experiences with nature and urban aquatic areas.

4.1 Coimbra (PT)

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The city of Coimbra, with around 92,000 inhabitants, is located in west-central Portugal and crossed by the Mondego River [33], [39]. The Mondego is the largest of exclusively Portuguese rivers. It has several tributaries that cross the city, draining into the Mondego from both the left and right margins of the Mondego's hills and valleys [40] (Pestle analysis, D6.6, T6.3). The river hydrology changed as the city urbanised, consequently many streams are channelised and altered in the historical area, while others are open and semi-natural [41]. Therefore, the urban streams have various levels of preservation and ecological diversity. Generally the city's urban streams have relatively low levels of biodiversity of macroinvertebrates and higher richness compared to non-urban streams in the same region [33], [42]. The city has a Temperate-Mediterranean climate, typified by dry, hot summers and mild winters with short, intense precipitations [33], [39], [42]. Agriculture (grains, olives, rice, and fruits) and fishing are the main occupations of the surrounding area, and the university and its medical sector are its main economic agents [40], [43].

The city is experiencing urban shrinkage, defined as population ageing and decline, compared to other regions in the area [43]. This dynamic is partly explained by high property values, and a local policy emphasises the needs of tourists and short-term residents rather than urban regeneration [43]. Recent research appears to reinforce this finding, as the city lacks wide coverage of green space, especially in the historical city centre and in other multifunctional areas [32]. While investments in greening the city has increased in the past two decades, and the city has a goal of being an "Ecocity/greencity" centred around the Mondego river [44], it is argued that the city needs to increase urban green space (UGS) design [45].

Efforts to increase greening initiatives can been seen in municipality information campaigns, such as its campaign, on the importance of meadows in the urban environment in June 2023 [41]. The campaign, based on a project for the protection of green spaces, involves placing explanatory plaques explaining why some meadows are not being cut or watered in eight green spaces around the municipality. Thematic areas include water conservation, environmental responsibility and climate change [42] (Pestle analysis, D6.6, T6.3). Furthermore, the commitment to environmental sustainability is underscored by a national fund, Fundo Ambiental, for climate change. The fund was estimated to have €2.2 billion available in 2022 dedicated towards nature conservation and environmental awareness efforts amongst other green topics [43]. Plans are underway with project partners (UC) to restore the riparian vegetation of a small urban stream in the next few months and a municipality afforestation plan exists [46].

Since 2019, health management has been decentralised from the national government to the local municipality [40]. Consequently, the municipality has developed an evidence-based health strategy that guides activities and investments for health environments and populations to reduce health inequities. In a public consultation, citizens considered contact with nature as one of their top health priorities. Consequently, one of the sixteen objectives of the municipality's health plan is to provide sustainable mobility and public spaces. Furthermore, a key objective of the plan is to reduce the

prevalence of non-communicable diseases (NCD) such as depression, anxiety, respiratory conditions, diabetes, and cerebrovascular disease, among others, by promoting exercise and conditions for healthy lifestyles, along with an action to provide accessible, clean, and safe public spaces [40]. Additionally, another strategic objective is to ensure collaborative and intersectoral leadership reflecting a health-in-all policies approach. Thus, to enhance public participation, one strategic objective concerns promoting citizen engagement and community development [40]. The city's health plan appears to have contributed to the expanding development of its cycleways network which will provide some access to urban green spaces [45].

Despite these efforts, recent research suggests that social wellbeing is low on the local authority's agenda and a perception exists that the local authority is reluctant to communicate with the city's residents and a clear vision for the city is lacking [43]. This perception is reinforced by wider research stating that the city does not have a tradition of public participation in UGS design [45]. Furthermore, political and structural challenges, such as municipal organisation, real estate and housing pressures, and urban densification appears to be restricting UGS implementation in the city [45].

4.1.1 Focus Group Overview

Fourteen, ten adults and four children, people aged between 10 – 59 years participated in the Coimbra focus group with an equal balance of men and women. Participants were motivated to contribute by their concerns for rivers and streams near their homes. Overall, participants were more acquainted with rivers and larger streams in Coimbra in the urban and peri-urban environments than smaller streams which they tended to overlook. The recreational function of aquatic environments was noted by a handful of participants. Interaction with rivers and streams was mostly associated with walking, hiking and other physical activities and infrastructure dependent (e.g., availability of paths, roads, etc). Only one participant said they had experienced an inaccessible, isolated, stream. Further discussion by the group revealed that participants would like to interact more with rivers and streams, although the pace and pressures of modern life can cause them to overlook important aspects and changes occurring in these areas.

4.1.2 Citizens' Sustainability Experiences

According to three focus group participants, aquatic areas have changed significantly over time. On the one hand, enhanced physical infrastructure has improved access, margin use has improved, and banks and aquatic plants have been cleaned. For four others, no changes have occurred, and poor conservation of these areas was highlighted. For the six remaining participants, the environment has been noted to have degraded largely due to human alterations of streams and rivers and the expansion of intensive agriculture. Participants noted that, compared to the past, highly urbanised streams and peri-urban streams now have limited vegetation, are more polluted, and habitat loss has increased. This was evidenced by the presence of invasive species, such as Acacia trees, and decreased numbers of fish and birds.

> *"I've known these streams since I was little, they used to be places where we could find fish, birds, were always places full of life… the waters now smell awful and are oily, which I assume is a result of the side fields' intense cultivation."*

Concerns were also expressed about 'overcutting' vegetation and the corresponding impact on biodiversity levels and wildlife habitats. Such changes were also linked to the altered use of these areas by humans. In some cases, banks become dumping grounds, and one child shared that they have seen household appliances dumped in the banks of waters close to their home.

Correspondingly, water quality was linked to cleanliness. Sight, smell, and sound were key indicators for assessment, with the presence of rubbish, intense odours, and unpleasant noises noted. Consequently, concerns arose about maintenance and the accountability of responsible local authorities. Political will in urban authorities was perceived to be lacking, with participants providing examples of inaction at the organisational level:

> *"Last year I took photos of large garbage, for example tires and household appliances placed in a stream, I spoke to some local authorities, but nothing happened…"*

4.1.3 Citizens' Attitudes towards Urban and Aquatic Ecosystems

People mostly linked their experiences of urban rivers and streams with recreational functions and services, and most participants linked positive emotions with the use of urban and aquatic ecosystems. The inherent value of these areas was recognised as something to be treasured. However, some people expressed concern about how compromised access will discourage recreational use.

Feelings of stillness and relaxation were linked to the landscape, the sound of running water, and the presence of wildlife. Stream's aesthetic value was underlined; however, it was recognised that what is considered nice for humans may not be in the best interest of nature. A desire for spaces to be better maintained and protected from invasive species was also expressed. Equally, participants expressed a desire for a harmonised, balanced urban development approach.

> *".. I wish for more areas to enjoy the nature of city's streams, and a greater harmonisation of urban buildings with the stream".*

The regulatory function of streams on air quality, temperature, and flood control was recognised by over half of the group. While it was noted that streams are dry during summer periods, higher, faster water flows are equally observed during the winter season. Concerns were also expressed about rainwater run-off entering aquatic environments and the impact this has on water quality and pollution levels.

The impact of man-made interventions (urbanisation, river construction) on these habitats was noted, as was their influence on environmental degradation. Most people expressed worry and indignation about the perceived poor quality of the water, believing that these ecosystems are in danger. Equally, it was believed that these ecosystems are undervalued by the wider population, are generally degraded and polluted, and their impact on human health is ignored. Participants argued that awareness must be increased about the importance of urban streams and that something needs to be done to protect them, as people largely appear indifferent to the negative changes taking place.

> *"...if one of the oldest battles (placing garbage in the appropriate containers) has not yet been won... What hope can we have in people becoming aware that we are part of a whole with nature, if the environment is sick, we will be too?"*

4.1.4 Willingness and motivation to participate in citizen science activities

Participants motivation to participate in science activities for the citizen science app is firstly associated with an intrinsic motivation, which is a desire to protect and improve the environment (8 participants), followed by an extrinsic factor, namely the belief that it is a civic duty (5 participants). The desire to improve their neighbourhood (4 participants) was of higher concern to participants than anxieties about health and wellbeing, climate change, and food risk. Participants were unlikely to be motivated by the need to protect the environment for future generations or to want to share and create knowledge networks in the community. Demotivating factors were largely associated with time constraints (7 participants), data protection concerns and task complexity (4 participants). The group also shared that discouragement would also arise if they didn't understand the goals of the app and if what they shared was not translated into changes or actions they wished to see. The latter part may relate to the perceived worthwhileness of the project in the eyes of local citizens and the long-term, tangible outcomes their efforts can result in.

According to the group, the app should include features such as the ability to take short videos and photos, provide a quick form to select observations (for 11 participants), and share a text-based message with local authorities. Nine people suggested geolocation use and agreed to install or carry sensors. Overall, the group was unenthusiastic about sharing information on social media platforms or engaging in other communication-related activities. Younger people were more likely to give this feedback. The group also suggested that an incentive system should be built into the app, which should also include features providing the ecological status of the monitored stream along with providing educational resources for users. It was also recommended that the app make clear the impact of participation. Finally, despite high participation levels in the group, five out of fourteen participants expressed an interest in becoming early adopters of the tool.

4.2 Toulouse (FR)

Le lit de la Garonne à un niveau très bas, à Toulouse, le 25 août 2022. VALENTINE CHAPUIS/AFP

With a growing population of over 500,000 inhabitants, Toulouse is France's fourth largest city, located in the south-west of the country [47], [48]. The capital of the Haute-Garonne department in the Occitane region [49], 55% of Toulouse's population is aged between 15-44 years [47]. Toulouse is situated at the junction of the Canal Latéral á la Garonne and the Midi Canal, where the Garonne River, France's third largest, curves northwest from the Pyrenean foothills [49]. The urban area of Toulouse is situated at the confluence of the Garonne and Ariège rivers, and the Garonne's largest tributary downstream of Toulouse is the Tarn River [50].

The Midi Canal connects Toulouse to the Mediterranean and was designated a UNESCO World Heritage Site in 1996 [49]. As such, the canal is important for leisure and is now the most heavily used canal in France [49]. Five kilometres of the Garonne flows through Toulouse [51] which serves wildlife, the local

population (provides potable water), and the city's economy (energy generation, agriculture, and industry) [52]. The Garonne River is a shallow river (generally 2 m) and has a high flow velocity, even in its lower reaches [50]. Studies show that the hydromorphological dynamics in parts of its reach have degraded in the past fifty years due to bedload removal, localised channel bedrock incision, reduction of lateral channel adjustments, and riparian wetland disconnection [53]. Landscape change and ecological issues in the region have arisen from active belt narrowing prior to the 1960s, which is associated with human activities. Furthermore, due to the high population density, the river is experiencing high anthropogenic pressure due to agricultural influxes, urbanisation, industrial development, and tourist activities. High nutrient pollution, plastic pollution, and urban pollution, together with increasing flood frequencies, have altered the ecosystem [54]. Many studies have been carried out in the system regarding pollution, but assessments of ecosystem health and health risks for freshwater communities and the urban population are scarce (Pestle analysis, D6.6, T6.3).

Toulouse's climate is defined as a transitional Mediterranean with mild winters and warm, sunny summers [55]. In recent years, Toulouse has experienced extreme weather events that led to summer temperatures exceeding 35 degrees, causing drought and water shortages in the region [48], [56]. In July 2022, 9.7 millimetres of rain fell across France, a deficit of about 84% compared to normal for the period 1991-2020 [57]. In contrast, the city also experiences dramatic flooding and surging waters, which have led to evacuations, road and public transport closures after the equivalent of one month of rainfall fell in 48 hours in January 2022 [58]. At one point, the Garonne River was 4m 31cm above normal level, something the city hadn't experienced in two decades [58].

On the policy side, in 2019, the city received the European Cit'Ergie label for its climate, air, and energy policy, which aims to double cycle paths and create new public transport networks [59]. In the same year, Toulouse was awarded the "Territory Committed to Nature" label by committing to restoring ecological corridors, setting up a biodiversity monitoring system and identifying and promoting metropolitan biodiversity discovery routes. Additionally, the Toulouse +Fresh plan proposes transforming the city, particularly via new tree plantations and rewilding of other areas and removing bitumen to support rainwater infiltration and refill water tables in an effort to mitigate the worst effects of climate change for its inhabitants [56], [60]. The municipality has also been acknowledged as a territory committed to nature in the Occitanic region for its active steps to preserve biodiversity in its territory. Evidence of this commitment can be seen in the Grand Parc Garonne urban project, which began in 2015 and incorporates seven municipalities covering 3,000 hectares [61], (Pestle analysis, D6.6, T6.3). The aim of the project is to rehabilitate and develop 32 kilometres of the Garonne River banks, including riparian areas. This includes creating cycle and pedestrian paths, allowing the practice of water sports, creating new spaces for cultural events, and enriching the region's natural heritage by restoring and rewilding some areas. The municipality is also the coordinating beneficiary of the Green Hearth LIFE project [62]. The project's objective is to reduce the impact of the Urban Health Island effect by reducing temperatures by 3 degrees during heatwaves. To achieve this objective, a new green 'lung' involving 10 hectares of green space will be planted, including 2,500 trees. Additionally, biodiversity will be restored by consolidating ecological corridors (including blue corridors) [63].

Furthermore, following the adoption of the Modernisation of Territorial Public Action and the Affirmation of Metropolitan Areas (MAPTAM Law) in 2014, Toulouse has exclusive and compulsory responsibility for the management of aquatic environments. This competency covers 400 km of

Toulousian watercourses and 18.5% of the territory with exposure to flood risk [64], [65] (Pestle analysis, D6.6, T6.3). A "smart city" strategy has also been put in place to make the city more fluid, user-friendly, innovative, dynamic and sustainable. Various projects have been developed around 5 objectives: simple and fluid mobility, an adaptable and breathable living environment, a place of well-being for all generations, guaranteed cleanliness and safety, and a city that is both international and rooted in its authenticity [66].

Citizen interest in Toulouse's environment and aquatic ecosystem is found in several associations around the city. One key player in the protection of the city's natural heritage is Nature en Occitanie, which coordinates several programmes to maintain, restore, and preserve green and blue infrastructure [67]. Likewise, a smaller volunteer association, NORDENVIE, brings together concerned residents to preserve and improve the environment (Pestle analysis, D6.6, T6.3).

4.2.1 Focus Group Overview

Seven adults, aged between sixty and seventy years, participated in the Toulouse focus group. Over half of the group were retirees, with only two still in employment. The group was overrepresented by men, as only two female participants were present. One woman participated in the first part of the exercise. Awareness amongst the group on the topic was high, as all had a job in the field or belonged to a topic-related association. Despite an extensive media campaign advertising the event, non-experts did not participate in the group.

Experiences with urban streams were largely associated with proximity and exercise. Half of the participants shared that their interactions with streams were due to walking, biking, or running. It is during these activities that observations are made of the waters and surrounding environment.

4.2.2 Citizen's Sustainability Experiences

In Toulouse, many streams have been buried, although plans are in place to reopen them, participants reported. Regarding streams, superficial comments were made about streams being dry in summer, difficult to see and access, and some having insufficient vegetation coverage. Consequently, the capacity of these areas to regulate temperature is compromised. An observation was shared that larger watercourses are better maintained than smaller streams. Although unspoiled, undeveloped areas were noted to have higher levels of wildlife, with photos available of animals including foxes, deer, and badgers.

Generally, human interference in aquatic systems, whether for economic or water management reasons, was viewed unfavourably and as having increased over time. Activities impacting water levels, riparian forests, and aquatic life included damming and waterbed and bank incision.

For one person, flood control efforts have been negated by the construction of non-porous concrete banks that prevent the natural role of nature from absorbing excess water. In some cases, documentary evidence has highlighted the fact that these efforts have not protected the city from flooding. For another, flood threats have been effectively managed by the deepening of riverbeds. Another person brought up the contribution of riparian forests for flood control, although this benefit does not appear to be recognised by local authorities, who cut riparian forests during key amphibian

reproductive seasons each year. Additionally, the question of using meadow areas as an alternative to artificial banks for flood control emerged.

While the importance of aquatic areas for recreational purposes was recognised, it was noted that blue spaces appear to be exploited for tourism and water sport activities by local planners. The impact of urbanisation on the environment was also linked to the 'domestication' of nature. While plans are underway to further develop parks centred on aquatic areas, a balanced approach needs to be obtained between natural and 'artificial' environments, as it is essential for all aspects of life in urban environments participants advocated

At a household level, it appears that critical reflection on the effect of daily activities on water quality is not common. Two participants linked water quality to the presence of foam in the rivers and streams and believe this could be linked to pool drainage and car washing activities. More knowledge on water quality was underscored by two participants. For them, it was unclear what is considered as natural water quality and what type of water should be considered an issue for concern. In one case, it was assumed that the water was polluted due to low levels in the stream. Similarly, the accumulation of waste along riverbanks, such as the Garonne, was underscored.

4.2.3 Citizens' Attitudes towards Urban and Aquatic Ecosystems

Overall, participants attitude towards urban and aquatic ecosystems were mixed with pleasure and concern. The importance of these areas during the COVID-19 pandemic was greatly appreciated by one focus group member. Urban aquatic ecosystems are seen as soothing and important spaces, allowing residents to escape built-up, oppressive urban environments. At these sites, people can rest, relax, recuperate, engage in physical activity, and in nature-based volunteering. They are exposed to flora and the sounds of various fauna, including birds and amphibians. Public infrastructure facilitating access to aquatic areas is appreciated and plans to further develop pedestrian areas are underway and generally welcomed.

Risks associated with aquatic spaces for human health included water-borne diseases, drowning, and insect vectors, namely the presence of mosquitoes. For several summers now, some areas have been closed to the public due to the presence of bacteria.

Indignation was largely associated with the practices of local municipalities, which are cutting riparian areas during prohibited seasons, cleaning riverbeds, and allowing the accumulation of waste alongside banks. Despite this, participants want to understand the rationale behind the public management of these spaces. Desires were also expressed for the preservation of bank vegetation and wetlands, as it was perceived that they have an important role in regulating water quality.

4.2.4 Willingness and motivation to participate in citizen science activities

Motivating factors for engaging in citizen science activities and using the app included participating in environmental observation, environmental protection, facilitating the feedback of information, contributing to alerts, raising collective awareness of environmental degradation concerns about the impact of water quality on human health, and as a civic and collective act. The sole concern that emerged was related to data protection issues. On the other hand, six people agreed to use geolocation, highlighting a potential disagreement in the group on this topic. Additionally, the group highlighted that not everyone may want to use an app, so a web-based feature should be considered. Information they would like to receive via the app includes environmental status reports and warnings,

public health alerts, and information on policymaking related to urban aquatic environments. The group recommended that the app should have the facility to take photos and short videos and provide a quick form whereby users can select their observations. The group was less inclined to agree to sending written reports to local authorities, installing and carrying sensors, and engaging in virtual discussions nor other communications activities. They, however, suggested that the ability to share information on social media platforms may be relevant for younger users. The group recommended that the app link the information collected to the responsible service; an annual summary of the metropolitan areas would be welcome; and the news feeds could be replaced with a map containing the observations made. Thematic contests were suggested for a younger audience rather than an older one. Finally, three out of seven participants expressed an interest in becoming early adopters of the app.

4.3 Benevento (IT)

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Benevento is an inner province of the Campania region, situated 50km northeast of Naples [68] in southern Europe. The city of Benevento is located in the south-central portion of the province at the convergence of the Sabato and Calore Irpino rivers. The Sabato and Calore Irpino rivers flow from the Picentini mountains, into Benevento, and then into the river Volturno [69]. The city comprises segments of the Calore, Ufita, Tammaro and Sabato rivers flood plains [70]. Benevento's population is around 60,000 people, with a median age of 40 years. The city population is largely stable, with no significant changes noted in official databases [71]. Agriculture and food are the main areas of economic activity for Benevento residents [69].

With a Mediterranean climate, the mean annual rainfall is approximately 990 mm [72], however the area is undergoing a decreasing trend in water availability explained by increasing temperatures in the region [70]. While the area has been repeatedly affected by floods, the most recent occurring in 2015, causing landslides, soil erosion and damage to the city and the surrounding rural areas [73], [70], [72], flood scenarios are estimated to decrease by up to 30% by 2050 [70]. Thus the area will require new flood guidelines as the hazard level decreases [70]. Additionally, water pollution appears to be a minor concern, with reports that local water supplies were temporarily banned due to human use due to excessive amounts of tetrachloroethylene in 2022 [74].

The National Network System for the Protection of the Environment (SNPA) comprised of 21 environmental agencies is responsible for the protection, supervision and management of the environment including aquatic ecosystems (Pestle analysis, D6.6, T6.3). Additionally, the Campania region has established a six-year water protection plan (PTA) due to expire in 2026. This plan is the regional instrument to achieve water quality objectives in surface and underground water bodies, as well as the protection and enhancement of water resources [75]. An investment plan is in place for the refurbishment of Benevento's water networks [76].

Additionally, the Regional Council of Campania approved an important package of interventions in the water sector for the city of Benevento in November 2022. Interventions are funded and defined within the regional structural funds and the infrastructure fund of the 'Acqua Campania' concessionaire and were included in the national recovery and resilience plan (PNRR) investment and reforms programme for water infrastructure (Mission 2: Ecological Transition [77], [78]). Measures are divided into three operational plans:

i. an extensive investigation campaign aimed at monitoring the quality of groundwater drawn from the wells used to supply the municipal aqueduct;
ii. the construction of a filtration plant to protect the water resources of the Pezzapiana power station for hydro potable use;
iii. the design and construction of a hydraulic connection between the wells in the Solopaca locality and a new pipeline in connection with the Benevento aqueduct.

The city of Benevento has embarked on a journey to raise public awareness of the need to evolve towards an ecological transition and the defence of biodiversity as also called for in the United Nations (UN) 2030 Agenda. In cooperation with the municipal waste management company (ASIA), since 2021 the municipality has been organising the Environmental Festival, an event aimed at students of all levels to raise awareness of environmental issues. Benevento's civil society participates in the conservation of natural environments through the activities of some environmental associations (Lipu, World Wildlife Fund (WWF), Legambiente). The activities of these organisations include educational initiatives on environmental conservation, habitat restoration and conservation. The Benevento sections of Lega Ambiente and WWF have several ongoing projects to safeguard urban rivers and streams. These resources are considered important for the city's economy and citizens' well-being (Pestle analysis, D6.6, T6.3).

4.3.1 Focus Group Overview

Following an extensive media campaign, 26 individuals participated in the Benevento focus group. The group consisted of fourteen males and twelve females, ranging in age from below fifteen years to older than sixty-three years. The largest age group was 47–62, comprising 13 individuals, followed by 9 people in the 31–46 age group. Benevento used a multiple-choice questionnaire with participants to gather their views and perceptions.

Most participants, especially older people, had good knowledge of the main rivers in Benevento. Over half of the participants (61%) knew all three rivers in Benevento (Calore, Sabato, and Tammaro), and the remaining participants were aware of at least one of the three rivers. Knowledge of the smaller streams was significantly lower, and none of the participants knew about all 17 streams in the OAH project. One person from the middle-aged cohort (47–62) knew 11 out of the 17 OAH streams. Overall, only a few participants knew more than a couple of streams.

Benevento's aquatic areas serve multiple purposes and appear to be an integral part of daily routines in urban life. Residents frequently interact with urban aquatic areas while walking, whether this is for work, school, or pleasure (with friends or pets), but are less likely to relax or have a picnic beside an

urban aquatic space. Benevento residents (69%) generally considered rivers to be ideal places for physical and recreational activities that provide benefits for residents of urban aquatic areas. However, 25% (n = 5) of the 47–62 age group disagreed with this perspective.

4.3.2 Citizens' Sustainability Experiences

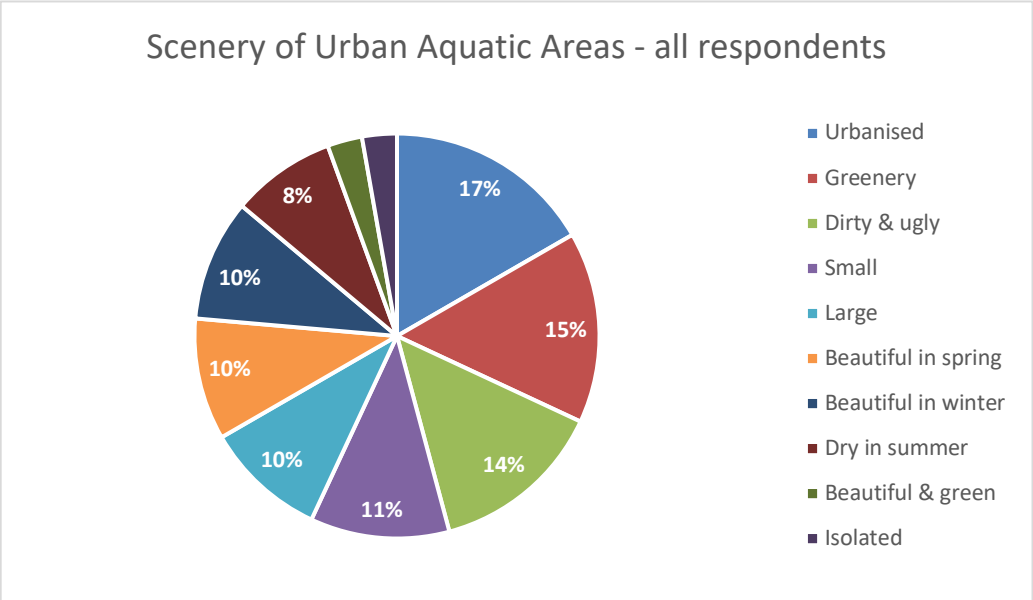


Figure 2: Benevento: Scenery of Urban Aquatic Areas – all respondents.

With reference to Figure 2, most respondents (17%) perceived the scenery around aquatic areas to be urbanised; this was particularly the case for respondents in the 47–62 age group. Men were more likely than women to perceive areas as green and urbanised. In contrast, women were more likely to describe areas as small, dirty, and ugly. Overall, only 15% of respondents described areas as 'green', and a similar number described areas as dirty and ugly. Older people were more likely to describe areas as such. 8% of participants highlighted that these areas are dry in the summertime.

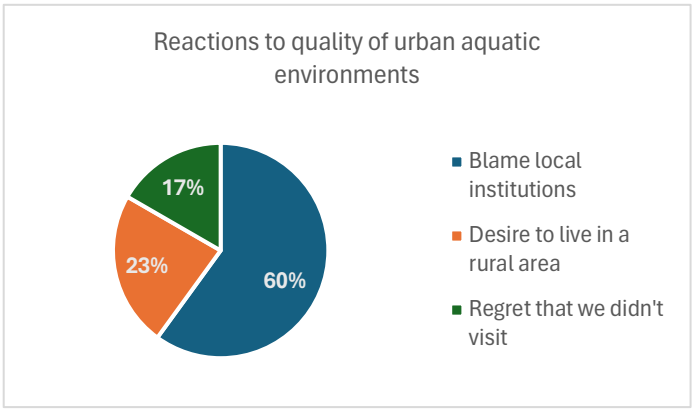


Figure 3: Benevento: Scenery of Urban Aquatic Areas – all respondents.

With reference to Figure 3, people were most likely to blame local institutions. Both men and women, especially in the 31-46 (28%) and 47-62 (61%) age groups (recognising the responsibilities of territorial management bodies for the incorrect management of urban water in the city of Benevento). Further, women (57%) were more likely than men (43%) to have a desire to live in a rural area and this wish was equally spread amongst the 31-46 and 47-62 age groups. Eventually, respondents regret that they did not visit the site more often before the quality of the environment degraded. This is particularly related to the 31-46 age group (60%).

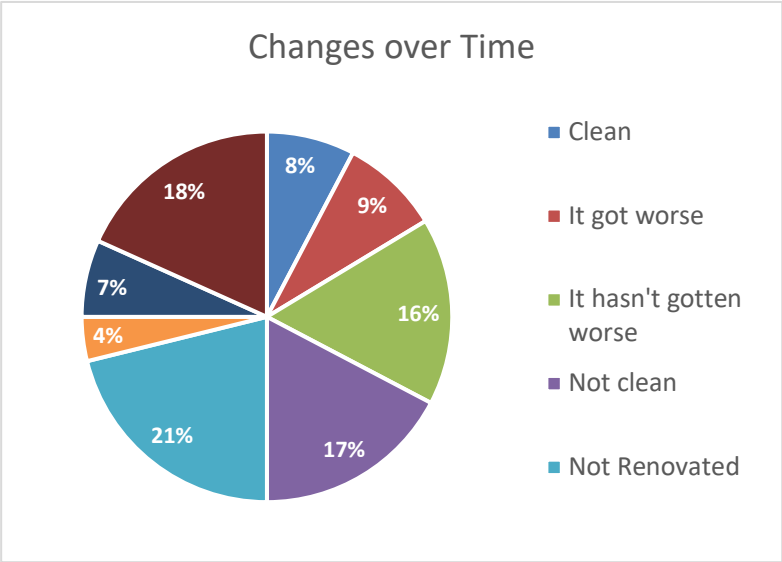


Figure 4: Benevento: Perceptions of how the environment changed.

Overall (Figure 4), it was shared that the spaces had not been renovated or cleaned nor were they modified into equipped areas (adding e.g., fountains, benches, seesaws, etc.) and this has not changed over time. However, despite these perceptions, a large number (16%) felt that the condition of the aquatic environment had not worsened over time. Gender differences were minimal, although 10% more men (55%) than women (45%) felt that the area had not been renovated.

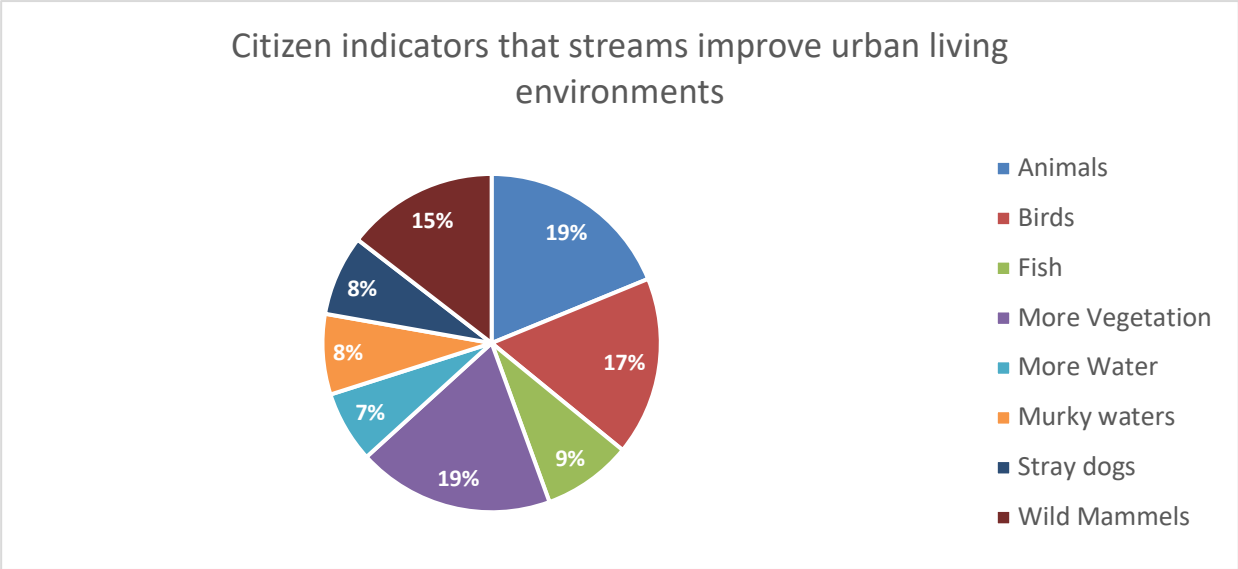


Figure 5: Benevento: Citizen indicators that streams improve urban living environments.

People gave multiple responses, providing insight into their perceptions that the diversity of urban aquatic environments was improving or degrading. Vegetation was mentioned by 22 respondents (84.6%), with a higher concentration in the 31–46 age group. Generally, people perceive more vegetation as an indicator that aquatic areas are improving. The presence of animals was also associated with positive water quality, as was the presence of birds (17%), wild mammals (15%), and fish (9%). Degraded waters emerged as a significant indicator that urban aquatic environments were worsening. Participants highlighted water quality, either degraded waters or less water (28%), the presence of mosquitoes (25%), and abnormal colours (15%) as indicators suggesting water is degrading.

4.3.3 Citizens' Attitudes towards Urban and Aquatic Ecosystems

People's feelings associated with their perceptions of the aquatic and surrounding environment ranged from positive to negative. A near-equal spread was found between feelings of contemplation and indignation, although older people (54%) were more likely to feel outraged than their younger colleagues. Women were more likely to report feelings of indifference than men, and no man recorded this feeling in reaction. Feelings of relaxation were also induced by people's reactions to these environments.

Positive perceptions outweighed negative perceptions, with high levels of appreciation associated with vegetation and animals. Negative aspects focused on water degradation, malodours, and mosquitoes. Negative perceptions, especially concern for degraded waters and a bad smell, were more prevalent in the 31–46 and 47–62 age groups. It appeared that people were more likely to blame institutions for these situations, and no suggestion were recorded about individual responsibility impacting the status and quality of aquatic environments.

4.3.4 Willingness and motivation to participate in citizen science activities

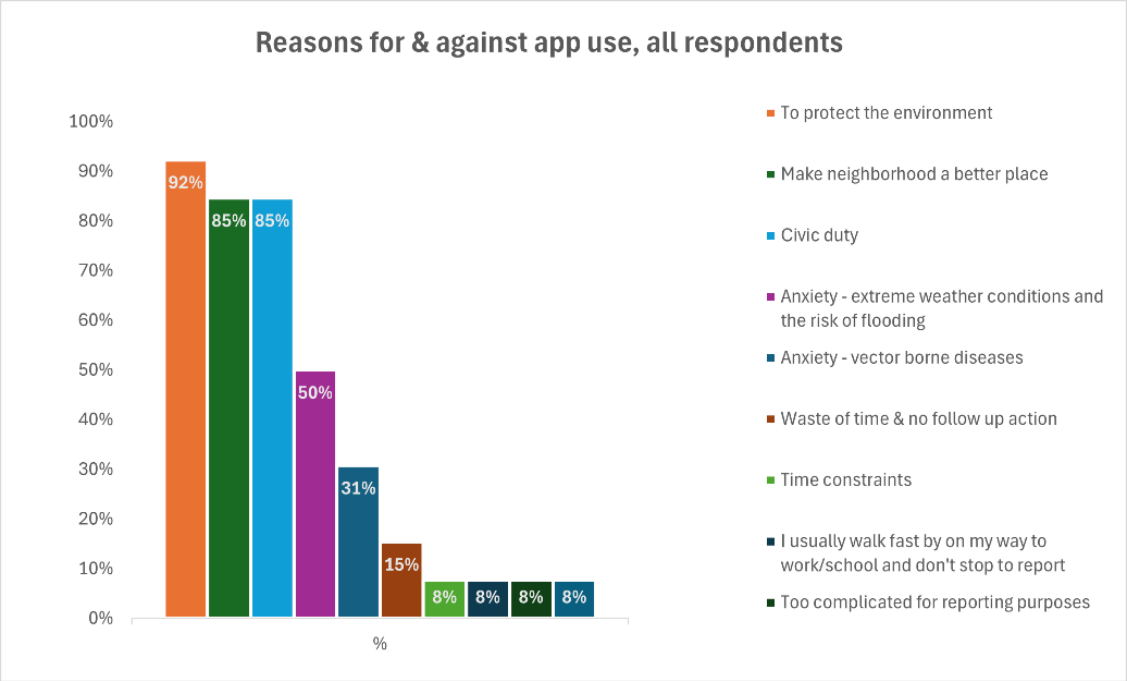


Figure 6: Benevento: Motivation for using citizen science app.

Findings show that motivation to engage in citizen science activities and app use outweighs limitations. Motivating factors were largely intrinsic in nature, such as protecting the environment and making the neighbourhood a better place. Extrinsic motivation was also high and linked to feelings of civic duty. Significantly low numbers were concerned about demotivating factors. However, the biggest demotivating factor was recorded to be the perception that using the app could be a waste of time with no follow-up action.

Significant agreement was found within the group concerning what information the app should include. All participants wanted reports on the environmental status of local aquatic areas, and over three-quarters (77%) wanted updates on policy decisions affecting the local aquatic environment.

Despite general consensus, noticeable differences regarding what information should be included emerged. For example, men were more likely to want policy updates and information on leisure and cultural activities compared to women, who preferred that the app provide more alerts and warnings about health and the environment. Additionally, up to one-third of younger people wanted alerts but did not favour features such as social media sharing or newsfeeds.

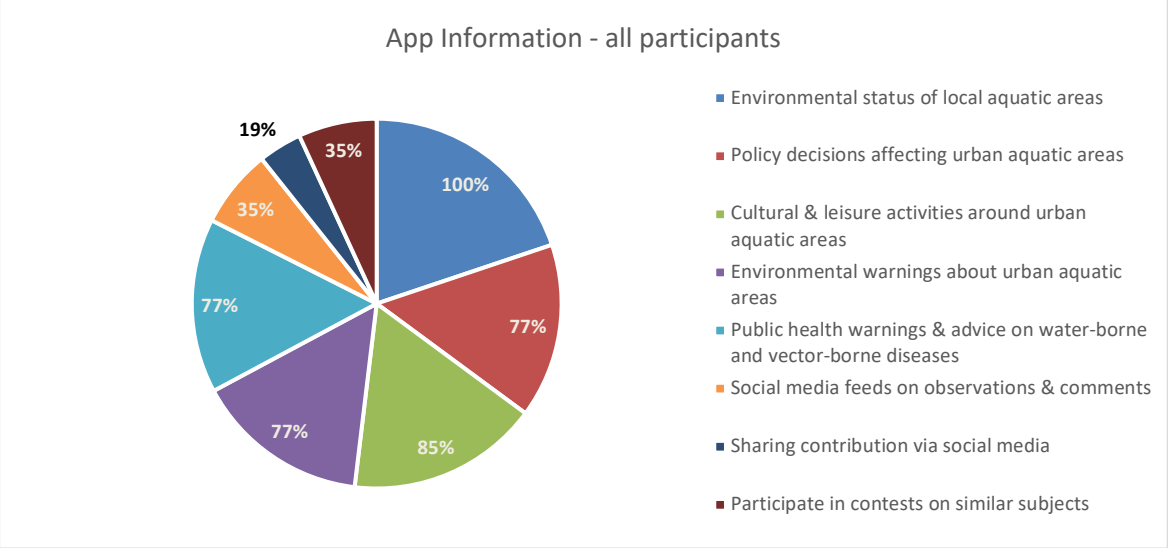


Figure 7: Benevento: Information citizens would like app to contain.

People were eventually asked about what features they would expect a dedicated app to have. The most preferred features to be included in the app would be taking pictures or videos, the ability to report via an integrated system and having some specific functionalities to record observations. Half of the group liked the idea of automatically sharing their location coordinates, and 11 participants (42%) preferred to use a quick form rather than writing their observations. Only 10 participants were willing to carry a digital sensor and were in favour of sending text-based messages to local authorities. Finally, 3 out of 26 participants expressed an interest in becoming early adopters of the app.

4.4 Ghent (BE)

Constructed on the confluence of the Lys and the Scheldt rivers, Ghent is a growing, medium-sized city with approximately 250,000 inhabitants located in the Flanders region of northwestern Belgium [79], [80]. Significant economic activities for the city include oil refining, banking, chemical and paper manufacturing, and tourism [80]. The latter is particularly important for the local economy and somewhat dependent on Ghent's rivers and canal network [80], [81]. Ghent is partially surrounded by marshlands or water meadows along the Lys and Scheldt rivers [82]. As urbanisation has progressed in Ghent, the hydrography has gradually been obscured by the raising of grounds, digging of canals, and dumping meanders [82]. The visibility, accessibility, quality, and importance of Ghent's water networks have ebbed and flowed in line with urbanisation, industrialisation, and modernisation (e.g., the advent of motor traffic). In the

latter part of the 20th century, Ghent's water quality significantly improved following investments in sewage and water purification systems [82]. The Flander's Environment Agency (VMM) enforces policies concerning sewage systems and wastewater treatment to ensure high-quality surface water. International collaborations are a key part of VMM's work as they engage in consultation and planning activities within international river commissions, specifically focusing on river basin districts to ensure effective water management. Complementing VMM's work, the Agentschap voor Natuur en Bos (ANB), located in Zottegem, Ghent, is responsible for the management and conservation of nature reserves, forests, and green spaces in Flanders (Pestle analysis, D6.6, T6.3).

Ghent's climate is classified as a mild maritime climate. The city has an average minimum temperature of 0.4 °C in January, and a maximum average temperature of 23.0 °C in July [83]. Average annual precipitation amounts to 859 mm [83]. The city is increasingly affected by flooding, caused by cloudburst, and heatwaves with temperatures reaching up to 39 degrees [84], [85], [86], [87]. Heatwaves are causing Ghent's soils to dry out as groundwater and river levels decrease with impacts Ghent's natural environment [87].

Consequently, political consensus in late 2018 led to the creation of a 2020-2025 multi-annual strategic plan (Pestle analysis, D6.6, T6.3). This plan reflects the coalition's desire to lead in various policy areas including environmental planning and sustainability. Additionally, a specific climate plan has been adapted [87]. Actions in this plan include a biodiversity vulnerability analysis (including the water system), implementing the vision statement 'Water in the City' which includes reopening former waterways, and the setting up of Green Climate Axes encompassing water areas is envisaged [87]. Additionally, plans and proposals for a climate smart Ghent recognise the right of water to exist in the city. Other initiatives within these comprehensive plans include promoting green-blue infrastructure, and maximising the water buffering capacity of the city [82].

Ghent's inhabitants are characterised by their levels of public participation, commitment to counteracting climate change and have strong attitudes to experimenting with innovative solutions [88]. Citizens are the heart of the city's development. As such, public participation is conceived as a social contract in Ghent. Citizen involvement via digital platforms has led to various initiatives such as urban farming, edible streets, and the creation of living labs which will focus on developing green spaces and reusing processed water amongst other activities [89]. However, despite the abundance of small-scale projects, many struggle to develop into successful ventures due to limited financing mechanisms. To address this issue, Ghent has launched a crowdfunding platform that enables citizens to propose innovative ideas for the city and seek funds to realize them (Pestle analysis, D6.6, T6.3).

In Ghent social innovation is connected with efforts to become a smart, digital, city [89]. Thus, data is seen as a strategic asset for the city, and the use of digital platforms by various not-for-profit bodies, including universities, underlines the importance of digital tools for coordinating public participation [88], [89]. Therefore, the provision of anonymised big data, provided by some residents, informs urban systems, and contributes to urban planning and management [88], [89]. As such, implementing citizen initiatives can motivate people to take part in public participatory activities whether by digital or non-digital means. In Certoma's paper, Ghent participants underlined that the reception and upscale of digital social innovations depends on attentiveness to cooperative dialogue between citizens and institutions, rather than technological readiness as off-line participation is still preferred large parts of the population [88]. Therefore, common good from these tools, in Ghent's experience, relies on not

just providing people with access to digital technologies, but ensure that people have a reason to use such technology [88].

In addition to these initiatives, an active voluntary association, Natuurpunt, counting 9,000 members aims to protect Ghent's natural environment (Pestle analysis, D6.6, T6.3).

4.4.1 Focus Group overview

Ghent's focus group comprised 10 individuals, five of whom were male and four were female. One person did not wish to disclose their gender. Six participants were aged between 11 and 30, and the remaining four were retired.

Ghent's residents' interactions with their urban aquatic environments relate to hiking, cycling, and family activities. The centrality of aquatic environments for Ghent residents was a consistent theme in responses, with some sharing that their decision on which area to use was determined by water quality and ecological integrity. It was also noted that blue spaces appear to benefit residents, as many people are seen sitting near the river enjoying the landscape. The availability of public infrastructure, such as bike paths and pedestrian ways, is a particular benefit, although it was noted that the concrete environment negatively impacts people's feelings that they are in nature.

4.4.2 Citizen's Sustainability Experiences

Ghent participants used the terms stream, river, and canal interchangeably. Depending on the location of the water site, areas were described as green, dirty, pleasant, or enjoyable. Generally, the water was perceived as clean, although some members highlighted their concern about the current situation—possibly a reference to the current climate event being experienced. Overall, participants in Ghent's focus group have noticed significant improvements in blue spaces over time and shared that a lot of efforts are being made. These improvements include regular analysis of water quality, the reduction or even elimination of malodours from water spaces, stream and canal cleaning, as littering from tourists is unremarkable. In some cases, these changes have increased fish populations in some spaces, according to one person.

The restoration of canals such as Doornzele-Noord and the establishment of a nature reserve in the same area were welcomed by two participants. Such restoration was associated with increased levels of engagement and interaction. While updated or renovated infrastructure motivated the use of water areas, it was also noted that the presence of urban spaces (e.g., concrete, streets, and car parks) reduced the feeling that one was in nature. Despite this, improvements to blue space environments appeared to be positively linked to the use of these spaces for rest and opportunities for exercise and recreation. Although, for one person, the presence of insects and dense forests discouraged the use of certain areas.

Public efforts to make neighbourhoods greener and the creation of more nature reserves were welcomed. It was felt that vegetation is good, and increased awareness about concepts of cleanliness and tidiness in nature appears to be having a positive impact on the environment. However, for others, certain places warrant improvement. One person, who used to be a bird watcher, remarked that the water quality of streams is poor. Consequently, it seems that some bird species may have declined, if not disappeared, due to declining water quality. Concerns were also expressed about the discharge of household wastewater into canals and whether any controls existed to prevent this from occurring. While wastewater is being split up, it is not happening everywhere, according to one person. The impact of ash and malodour from residential fireplaces was perceived to impact the quality of the local environment by another person. Concerns were also expressed about the impact agriculture has on smaller canals, which appear neglected, although this same person remarked that water extraction from canals has improved significantly over the years. For another participant, the most notable changes occur during the summer period when more green is present, a bad smell is evident, and fewer macrophytes are observed.

The emphasis on collective responsibility was a recurring theme, as it was noted that private individuals should take responsibility for keeping their surroundings and the city clean. For one person, it is important that efforts are made to improve aquatic ecosystems for the wildlife that inhabits them.

4.4.3 Citizens' Attitudes towards Urban and Aquatic Ecosystems

Positive attitudes towards urban and aquatic ecosystems were noted. Their importance for flood control, biodiversity, and recreational use was mentioned, and their interconnection with human health was underlined. Equally, the role of canals in regulating water pressure was underscored, as was their contribution to promoting business within the local economy through tourism and food production (e.g., fish).

Observing birds, wild animals, the habitat of local wildlife, and the landscape of these areas were described as pleasant and enjoyable, inducing feelings of calm and relaxation. No problem was perceived with the presence of mosquitoes or other insect vectors. Indeed, health threats arising from local streams were not evident, as one person commented that the availability of aquatic sources was a benefit rather than a risk.

Water quality was associated with colour, although consensus on what determined good or bad quality was not evident. For some people, safe water is clean, for others safe water needs to be clear or blue. This same person acknowledge that dark water can also be clean, but it appeared they were more likely to treat such water bodies with caution:

> *"I don't like the colour of the water, because I learnt that safe water needs to be blue or clear. I know it's not always like that, darker-coloured water can be safe but it's a thought that I have."*

For other people, water that is green in colour could be hazardous. However, for one person, this was unclear, as green was not associated with being 'ugly', but possibly dirty. Regardless, for one person at least, the quality of the water determined their interaction with the environment, as water quality and recreation are interconnected. In such cases, water bodies perceived as poor were less likely to be interacted with.

The most frustrating scenario for participants was the presence of trash at aquatic areas. The sight of rubbish was associated with feelings of disappointment and frustration, causing people to perceive that people do not care about the waters and rivers. At least two people mentioned that untreated sewage and animal waste are being dumped into the water. Surprisingly, despite the presence of sewage, one person admitted to swimming in these waters, while another also observed that these areas are used as swimming and fishing sites during the summer period.

> *"I live a 2-3 minutes' walk from a stream. I find it quite pleasant, there is enough green there and the water is mostly clean. However, untreated sewage waste and animal waste are being dumped into the water. During summer I go swimming there not so much in winter. I think they should stop the sewage dumping though…."*

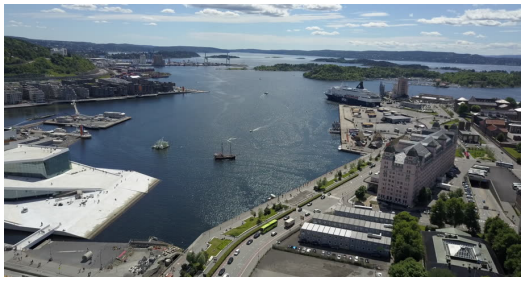
This underlines that more public awareness needs to take place about the impact of swimming in waters where sewage may have been dumped. In conclusion, participants suggested that awareness, especially in relation to littering, needs to be conducted at the community level to preserve and protect Ghent's waterways.

4.4.4 Willingness and motivation to participate in citizen science activities

The largest reason for engaging in citizen science activities and using the app was cited as protecting nature for future generations (4 participants). Two participants were motivated by a desire to protect the environment and human health. Low numbers of participants shared that they would engage in CS activities to help science, identify solutions, support tourism, and from a sense of civic duty. Demotivating factors include time commitment, effort, concerns about privacy and security, and the spread of misinformation. The app's usability was also raised as a potential barrier, and the question of what incentive existed to use the app also arose.

Educational information supporting awareness-raising and policy updates were the preferred types of information the app should provide. The group would also like to know how the information is being used and what changes have occurred because of the shared data. The group recommended that the app should include gamification features, especially for family use with children. It should also include health alerts so users can decide whether to interact with sites. Finally, one out of ten participants expressed an interest to become an early adopter of the tool.

4.5 Oslo (NO)



Oslo, the capital and largest city in Norway, lies at the head of the Oslo Fjord in the southeastern part of the country [90]. Oslo's ten main waterways equate to 354 km of rivers and streams, which have continually shaped the development of the city [91]. Two of these waterways, the Akerselva and Alna rivers, cut the city into two parts, with the Akerselva flowing from Lake Maridalsvannet in north of Oslo [92]. Oslo's population is registered at over 650,000 and is anticipated to reach almost 1,000,000 by 2030 [93]. Economic activity in the city is diverse. Its status as Norway's capital makes it the centre for trade, banking, shipping, and industry, while the city's leading economic areas are the production of consumer goods, electrotechnical and graphic industries [90].

The city's climate is characterised as warm summer continental, typified by warm summers and cold winters [91], [92]. Rainfall is modest, with the summer and autumn seasons traditionally the wettest, while the driest seasons are spring and winter [92]. Snow coverage is experienced up to 30 days per year, and annual precipitation is 763 millimetres [92].

Like the rest of Europe, Oslo is affected by climate change. Already, the city has experienced extreme weather events, including flooding, massive snowfalls, and drought [94], [95], [96], [97], {Citation}. Meanwhile, at other times, minor snowfalls have caused reductions in snowmelts and dry springs that feed rivers flowing into the city, reducing overall freshwater volumes [98], [99].

Meanwhile, climate model predictions expect floods from heavy, short-duration rainfalls to increase as Norway's temperatures increase to 4.5 °C by the end of this century. With the temperatures in the city expected to increase by up to 6°C until 2100 [100], urban planning is well underway to strengthen its capacity to manage extreme weather events and move Oslo towards becoming a climate-friendly city. The most obvious example of such efforts is evident in plans reopening the city's rivers and streams.

Bjerkedalen Park, Oslo

The city's waterways were closed in the early 1900s due to high levels of pollution, causing them to pose health risks and emit foul odours. Over time, it became evident that this approach had a negative impact on biodiversity, the overall ecosystem, flood control, and storm water management. The process of reopening and restoring waterways commenced with a total of 2,810 metres of waterways [101]. This restoration project proved to be a significant milestone for Oslo and, combined with other measures, contributed to the city being named the "European Green Capital" in 2019 by the European Commission [101]. Thirty additional waterways will be reopened in the next 10 years, as the plan is a fundamental element of Oslo's climate adaptation strategy [91].

In addition to reopening waterways, two-thirds of the city's green and blue spaces are protected areas. Extensive efforts, associated with the Municipal Master Plan (2015) and the Climate Change Adaptation Strategy, are underway to maintain blue-green infrastructure by promoting native vegetation to attract insects, birds, and other wildlife [100], [102]. Such projects have had a positive impact on recovering migration paths for fish, which has enabled population growth and breeding of migratory fish in the region [91]. Reopened waterways and associated park areas have seen the construction of several kilometres of hiking trails and the rehabilitation of old paths, creating a network of green areas [100]. A balanced restoration approach has been applied, as areas showcase a harmonious blend of natural surroundings with the built environment, while others remain untouched natural habitats.

Efforts are also underway to improve freshwater quality in Oslo, which is currently classified as 'not good enough' [103]. Oslo's waterways are polluted with tobacco-related products, substance abuse-related items, plastic packaging, wastewater run-off, and emergency discharges [100]. Actions to improve the city's waterways include benthic quality surveys, the monitoring of invasive species,

working with local stakeholders to reduce plastic consumption, and green accounting, which informs part of the city's climate budget[2] [101], [102].

In Norway, the public has a legal right to 'a say' in planning, and the municipality is obliged to organise public hearings under the Planning and Building Act so citizens have a voice in planning processes. [104]. Digital solutions allow citizens in Oslo to present petitions to the Municipal Council, provide direct feedback on service delivery, and citizen's representing interest organisations are formally entitled to present their views in various ways [105].

Grassroots citizen organisations, such as the Oslo River Forum (ORF), are well-respected by both civil society and the City of Oslo. Established in 2000, ORF members are devoted to local rivers and streams, and 10 smaller river and stream groups are each dedicated to a specific waterway in Oslo to ensure that waterways are clean, healthy, and accessible to all citizens. The organisation excels at communicating the importance of having healthy rivers and streams in the city. For example, ORF focuses on promoting the reopening, restoration, and rehabilitation of urban waterways, and part of their activities includes education and awareness of the city's waterways. This is achieved via a tour guide to Oslo's rivers and streams, through offerings of river walks and historical tours, which are popular among the elderly, and as educational "outside classroom" activities.

4.5.1 Overview of informal group interview and key informant interview

ORF and selected members of local stream groups were contacted and informed about the OAH project at the start of the project period. Given ORF's scope, the organisation was eager to participate. As described in D4.1, ORF is an important collaborating partner and information channel for the planned fieldwork. Researchers at UiO therefore chose to hold an informal focus group interview and a key informant interview with some members of ORF, given their extensive experience with the topics in the focus group interview guide. The reason for having an additional key informant interview was because the researchers at UiO noticed that one person had extensive knowledge and experiences about relevant topics that there was not sufficiently time to elaborate on during the 1,5-hour informal focus group interview.

Three people participated in Oslo's informal focus group interview. The interview lasted for 1,5-hours. All participants were female, above the age of 60 and active in ORF. In addition, one person, from this focus group, consented to have a 2-hour key informant interview to provide additional in-depth knowledge about the relevant topics that there was not sufficiently time to elaborate on in the informal focus group interview. The findings from both data collections will be presented together as the data complement each other.

Awareness among the participants about the topic of interest was high, and they told several stories of how not only themselves but their observations of how Oslo's citizens interacted with urban and aquatic ecosystems. In addition, they told stories about how ORF had contributed to reopening Oslo's streams transforming the city into a greener and more environmentally friendly city of which rivers and stream are a natural part. Consequently, residents and visitors alike can now engage in various recreational activities such as fishing, walking, biking, running, and simply enjoying moments of

2 Oslo was the first city in the world to create its own climate budget which aims to reduce greenhouse gas emissions from 2009 levels by 2030. The process entails accurate measuring of how different city policies are reducing greenhouse gas emissions. The impacts of these interventions are regularly quantified and monitored. Recent modelling suggests that the city's emissions will be reduced by 72% by 2030 see [102] for further information.

relaxation in these revitalised spaces. Additionally, cafes have been established in some restored areas, providing a pleasant venue for people to gather and appreciate the rejuvenated fresh waterways of Oslo. Furthermore, they elaborated on how ORF collaborated with the city council and schools to engage children to develop green skills at an early age, so they are aware of the importance of sustainability to make sure that Oslo is a green and environmentally friendly city.

4.5.2 Citizens Sustainability Experiences

The participants gave a rich description of how ORF had engaged with both civil society and the City of Oslo Agency over time to reopen the rivers and streams that were enclosed in underground pipes in the early 1900s. The participants communicated that, in addition to being members of ORF, they personally engaged in the reopening, restoration, and rehabilitation of urban waterways in Oslo. They expressed that ORF had, among others, communicated to not only the City of Oslo Agency but also to Oslo citizens that the lack of natural rivers and streams had a negative impact on biodiversity and the overall ecosystem. The impact of these activities is not fully known, but they perceive that ORF contributed to politicians and citizens increased awareness and focus on environmental protection and a greater understanding of the importance of preserving natural habitats. Thereby, they contributed to the process of reopening and restoring the waterways that commenced.

One of the participants gave in-depth descriptions of how she had worked as a city planner to reopen and restore the waterways. Furthermore, she expressed that the City of Oslo Agency had provided funding to areas in Oslo that were considered areas with large social inequalities and where the local environment was seen as unappealing and run-down due to a lack of maintenance.

> *"The person I worked with was very enthusiastic, the whole agency was enthusiastic, and they wanted to try to reopen the stream, so we go additional money to test this"*

The participants expressed that they worked to ensure that the city's waterways are clean, healthy, and accessible to all citizens. However, they were worried that this was not a common goal for every citizen of Oslo and that not everyone used urban and aquatic ecosystems. The participants expressed that ORF has recently produced a tour guide to Oslo's rivers and streams, as they believed this could help the citizens of Oslo be informed about the importance of urban and aquatic ecosystems. They also expressed that they are organising river walks and historical tours that are especially popular among older adults, but that citizens of all ages participated in these tours. In addition, they talked about green skills and that ORF had engaged with primary schools and kindergartens. The schools had established educational "classroom outside" programmes and this is now part of the standard education curriculum in several schools.

4.5.3 Citizens' Attitudes towards Urban and Aquatic Ecosystems

Overall, the participants attitude towards urban and aquatic ecosystems were positive. The active use of the blue-green spaces supports hypotheses of appreciation of the areas around the streams and attitudes towards preservation and engagement. Strategic choices to use these areas as "instruments" for inclusion and access for all are supported, as seen in individual choices to use the space until the city council's overall decision and subsequently the suburb's follow up activities to protect and keep the spaces available. Attitudes of appreciation and "taken for granted" were also noted. They expressed the importance of urban and aquatic ecosystems for people's health, and they have seen that older people are "happy" when they sit at the bench by the river or streams.

Frognerelva, Oslo

Benches were described as important because older adults "don't see" when they are walking with their cane or walker. They needed a bench to sit down on to be able to "lift" their gaze to see the environment. However, they expressed also a concern that there is little funding for outdoor areas, as they thought that this was the reason why there were often no toilets available. The participants expressed that they want toilets and cafés near rivers and streams.

> *"The citizens wanted a café (…) a toilet (…) the café should be a place where citizens could borrow ice-skates"*

The participants described how they themselves had taken pictures and walked along the streams and seen how it affected their senses, smell, sight, etc. Furthermore, they talked about universal design and how important it was to have the feeling of being safe. In addition, they expressed the importance of the newly opened rivers and streams being attractive and accessible. Furthermore, the participants said that there had to be strategies developed to get more people than just older adults interested in the several developed "meeting places" near the rivers and streams.

It became clear during the data collection that the participants were interested in what "lived" in urban and aquatic ecosystems. For example, they said that the Norwegian Environmental Agency surveys fish and birds in all rivers and streams and that they have found that there are trout in all rivers in Oslo.

4.5.4 Willingness and motivation to participate in citizen science activities

According to the participants, all rivers have measuring stations for pollution and a website where citizens can submit to the Water and Sewerage Agency if something is "wrong". This indicates that the willingness and motivation to participate in citizen science activities might be high in Oslo, as this is not a new activity for the citizens. However, the participants expressed that they wanted the ability to submit "what is wrong" through a QR code, as there were previous experiences in engaging different groups to contribute with their observations or perspectives:

> *"We put up posters, contacted organisations (…) libraries, schools and kindergartens"*

The need for educational material was also expressed. It was suggested to place QR codes and posters with information about the rivers and streams at the riverbanks where people walk. There was also a suggestion to use photovoice[3] as a technique, so citizens could submit pictures about what makes them visit urban and aquatic ecosystems through a QR code.

The participants expressed that ORF can be an important collaborating partner and information channel for the fieldwork that is planned. They have already communicated information about OAH to their members and the citizens of Oslo through social media and posters alongside Oslo's rivers and streams. In addition, ORF is willing to have a significant role in the recruitment of citizens of Oslo to participate in the upcoming CS activities that will take place in the context of T4.4.

3 Photovoice combines photos and accompanying words generated by participants allowing individuals to share and document their lived experiences through visual representation [106]

5 Discussion

5.1 Comparative City Overview

Citizens in the five focus groups were based in diverse locations across Europe. The population of urban areas ranged from 60,000 to over 700,000 residents. A total of fifty-three people participated in the focus groups. Demographics tended to favour middle- and older-aged people, with just five children involved in discussions. The gender balance varied between the groups. Most participants were lay people, except for Toulouse and Oslo, whose groups consisted of 'experts' as some people had a job in the area or belonged to a topic-related association.

Watercourses, that is, rivers, streams, and canals, dominate these cities landscapes. The centrality of these waterways is evident given that all the sites are built either around riverbanks or on the convergence of them. However, **familiarity with rivers and streams in each site was diverse**, with participants more likely to know rivers and canals than streams. This may be connected to the observation made in the Toulouse group that streams are difficult to see and access. Hence, discussions in each of the groups appeared to focus on the waterways the participants were most familiar with. Indeed, among the Ghent group participants, the terms river, stream, and canal were used interchangeably, while in the remaining three other sites, people were more familiar with rivers than streams, which they tended to overlook.

Climates in the five regions include Mediterranean (Toulouse and Benevento), mild Atlantic (Coimbra), mild maritime (Ghent) and warm summer continental climates (Oslo). Despite the specificity of each climate type, **each city is experiencing hotter, dryer summers due to climate change**. As such, focus groups on Coimbra, Toulouse, and Benevento remarked that streams are dry during the summer while others contain low volumes of water. Meanwhile, in Ghent, the most notable changes to water occur during the summer period when aquatic water bodies are green, emit bad smells, and less macrophytes are observed. Climate change is also increasing the risk of flooding, although some cities are more affected than others (i.e., Ghent and Toulouse). Benevento has also been affected by floods and landslides, and according to flood scenarios, precipitation is estimated to decrease by 2050 [70]. Current efforts to control intense precipitation by the Toulouse municipality were derided by the Toulouse group, which suggested that more effort should be focused on the benefits riparian forests could bring for better flood control.

Based on focus group findings, **citizen interaction with urban blue spaces** can be classified into two groups: intentional and incidental. The centrality of these areas was noted in all cities, although a 'taken-for-granted' attitude could be observed in almost all groups. Use was more likely to be incidental in the Coimbra and Benevento groups and intentional in the Toulouse, Oslo and Ghent groups. Riverine areas are used for exercise, community building and volunteer activity (Oslo only), photography, resting, walking to and from school, or work, hiking and biking. While people considered rivers to be peaceful and calm, there was an overall tendency to not use these areas for relaxation or social activities. Area use was also dependent on infrastructure availability (e.g., foot, cycle paths and benches), a fact underlined by participants from Coimbra and Oslo. They expressed concern about how compromised access and limited infrastructure (e.g., toilets and benches) would discourage recreational use and lead to access inequities. Additionally, the Toulouse, Oslo, and Ghent groups appreciated municipality efforts to restore rivers, streams, and canals and improve public

infrastructure. These investments have increased access, usability, and, hence, engagement levels. Oslo's efforts to improve access based on social inequality was praised by the Oslo group.

The literature indicates that **urbanisation, human activity, and climate change have significantly altered rivers at all sites**. By default, we can assume that changes in larger water channels, i.e., rivers, have led to changes in smaller water channels, i.e., streams. Changes to rivers and canals in Ghent and Toulouse include hydromorphological dynamics, bedrock incisions, bedload removal, ground raising, canal digging, dumping reduction of lateral channels, and riparian wetland disconnection [50] [82]. The changes have led to ecological issues in Toulouse, and agriculture activity, industrialisation, urbanisation, and tourism are causing the river to experience high anthropogenic pressure and high levels of pollution [53], [54]. Indeed, the Toulouse group viewed human interference in aquatic systems unfavourably, including the impact of agriculture on aquatic environments. The latter factor was also raised by the Ghent and Coimbra focus groups. Additionally, for Toulouse residents, human interferences were associated with poor flood control efforts that have not protected the city from flooding. In Coimbra, the focus group linked river and stream alterations, with banks becoming dumping grounds for litter and household appliances. In fact, almost half of the focus group participants, in Coimbra, noted that the environment has degraded due to human alterations to streams and rivers. Additionally, more women than men in Benevento were likely to perceive the scenery around aquatic areas as small, dirty, and ugly indicating gender differences in perception. Furthermore, the issue of littering and its association with urbanisation and tourism was a consistent theme in all cities. In contrast, Oslo has undertaken an extensive river and stream rehabilitation and restoration programme whereby hundreds of kilometres of waterways have been reopened. This initiative has been warmly welcomed by the Oslo group, European institutions, and international bodies (e.g., c40Knowledge Hub[4]).

In Benevento, focus group participants described aquatic areas as urbanised, a perception that reduces feelings of being in nature, according to the Ghent focus group. Concerns about **water and habitat pollution** arising from urbanisation were also raised. In Coimbra, highly urbanised streams and peri-urban streams have limited vegetation, are more polluted, and habitat loss has increased. As a result, invasive vegetation has increased, and fish and bird populations have reduced. A former birdwatcher in Ghent also questioned the water quality of some areas, noting that bird species have declined, which they associated with water quality. In Benevento, people associate higher levels of vegetation, fish, birds, and the presence of wildlife as indicators of positive water quality. Meanwhile, in Toulouse, undeveloped aquatic areas are perceived to have higher wildlife populations. Additionally, citizens in Toulouse and Coimbra shared concerns about the impact of urban policy on riparian forests, amphibian reproduction and the aquatic ecosystem. Concern was related to the early and overcutting of vegetation in these areas. Again, perceptions in Oslo differed from the other sites, as the water restoration effort has increased fish populations with participants pointing out that all rivers contain trout. On the other hand, the Oslo group also expressed a desire for restored areas to be attractive, in contrast to the views of some participants in the Toulouse and Ghent groups who underscored that what is considered pleasing by humans may not be in the best interest of nature. As such, these

4 The C40 Knowledge Hub is a resource for cities wanting to act on climate change. It equips city practitioners and policymakers with the practical information and tools they need to drive climate action locally. They identify and share tried-and-tested approaches, practical guidance, and insights and experience from cities working on climate issues. See https://www.c40knowledgehub.org/ for further information.

participants groups recommended that further development should balance population needs with nature's requirements.

For most participants**, degraded waters were associated with colour** (e.g., transparency, green, and dark), odour, and the presence of foam in rivers and streams linked to wastewater discharge associated with household activities (e.g., washing cars and pools). The Ghent and Coimbra groups also linked water quality with cleanliness, i.e., the absence of litter and sewage. Indeed, water pollution appears to be a concern in Benevento, according to local media, although limited information was found on the topic [74]. Meanwhile, findings from the focus group on this issue was unclear. Moreover, the decision on which area to use, or access, was determined by water quality and ecological integrity by two Ghent residents. Thus, it is suggested that water bodies perceived as poor appear are less likely to be interacted with.

In Ghent and Toulouse, publicly available information focuses on the **importance of canals for economic activity**. For example, in Ghent, the canals attract tourists, an important income source for many businesses in the city, according to focus group participants. Equally, Canal Latéral á la Garonne is the most heavily used canal in France and important for leisure activities [49]. Furthermore, the exploitation of rivers and canals for tourism was noted by the Toulouse group. Indeed, municipal efforts appear to largely target this purpose, according to the city's residents. Publicly available information on the role of rivers in Coimbra and Benevento was limited; however, given that the Mondego River crosses Coimbra and Benevento is surrounded by flood plains, it is inferred that these waters are of equal importance to both cities' economies. In contrast to the other sites, Oslo's urban policy focuses on the ecological importance of natural waterways making a clear connection with the positive impacts they have on environmental sustainability, storm management, flood control and public health. Oslo's waterways are also critical areas and spaces to achieve the objectives within its climate adaptation strategy and climate budget [91], [101].

Environmental planning and urban planning for climate change varies substantially across cities. Differences in urban and environmental policies between cities may be related to resource availability, environmental awareness, policy priorities, and finally, political ideologies. Based on grey and institutional literature, it appears that Toulouse, Oslo, and Ghent are making significant investments and efforts to mitigate climate change and become climate-smart cities. Two of these three cities have been recognised as leaders in the combat against climate change either at national (i.e., Toulouse), European and international level (i.e., Oslo). These three cities are making significant efforts to reopen waterways, restore or create new ecological corridors, including those in blue areas, and maximising the buffering capacity of water. Awareness of these plans was higher among the Toulouse and Oslo groups, likely due to their expert knowledge, but emerged in discussions in all three research sites.

In contrast, while recognition at the municipal level about the importance of nature is increasing in Coimbra, it appears that policy actions are limited as local policy emphasises the needs of tourists and short-term residents rather than urban regeneration [43]. Indeed, participants in Coimbra's focus group perceived local politics as lacking in the desire expressed for spaces to be better maintained, conserved, and protected from invasive species. However, some people noted that physical infrastructure and margin use have improved, and banks and aquatic plants have been cleaned. These changes may relate to the municipality's health plan. The plan includes an objective concerning an accessible, clean, and safe public based on citizen consultation, which revealed nature was considered

a top health priority. Commitment to achieving this objective appears to be growing given the development of cycle paths to some green spaces, along with plans to restore riparian vegetation along a small stream in the city [45]. The differing perspectives in the Coimbra group may be explained by different knowledge and exposure levels to the various aquatic areas in Coimbra. It may also be explained by the municipality's focus and attention on specific areas, given that the Toulouse and Ghent groups also noticed that some areas are better maintained than others.

Actions in Benevento appear to be limited to refurbishment plans for the city's water networks, but many in this city's focus group felt that the condition of the aquatic environment had not worsened over time, even if areas had not been renovated. Despite this view, at regional level water plan includes quality objectives encompassing surface and ground water bodies, as well as the protection and enhancement of water resources.

5.2 Potential health outcomes relative to Urban Aquatic Environments

As one Ghent participant remarked, the health of urban aquatic environments impacts human health outcomes. In Toulouse, another person remarked that the impact of ecosystems on human health is ignored and generally overlooked by the wider population. While only two people out of fifty-three made this explicit connection, multiple inferences can be drawn from the overall findings of the focus groups about people's perceptions of the impact that urban aquatic environments have on public health outcomes. These outcomes can be classified into three categories: physical, emotional, and psychological health.

Firstly, participants in all sites reported positive emotions in relation to the urban aquatic areas. However, this was dependent on the area's aesthetics. Feelings of pleasure, stillness and relaxation, were linked to the landscape, the sound of running water and presence of wildlife. Opportunities for restoration (described as contemplation by participants) presented themselves as these spaces allow residents to escape the built-up, oppressive, environments of urban settings. Moreover, high levels of appreciation and enjoyment was associated with the presence of vegetation and the observation of birds and animals.

People shared that urban aquatic areas also allow them to recuperate and engage in physical activity. The impact on physical health was openly discussed by the Toulouse group. The risks that blue spaces posed to health outcomes included water safety (i.e., drowning), and the presence of insect vectors (e.g., mosquitoes). The Toulouse group demonstrated concerns regarding water-borne diseases. This seems to be associated with the closure of some urban aquatic areas, during several summers now, due to the presence of bacterium. Interestingly, in Ghent, two participants highlighted concerns about the presence of animal and human sewage in the water. Despite risks associated with this, they reported that they observed people bathing in these waters. In Coimbra, participants also valued the regulatory function streams had on temperature and air quality. Additionally, the importance of these environments for flood control was identified in Ghent and Coimbra.

Equally, risks to emotional health emerged due to the conditions of urban aquatic sights especially where ecosystems are degraded and polluted. Indicators that ecosystem quality is poor include the presence of rubbish and bad smells, mosquitoes, poor fish, bird and wildlife populations according to the focus groups. Equally, the presence of invasive species was a sign that ecosystems were declining. The most frequent emotional response to these sights were cited as frustration, indignation and

outrage. Feelings of anxiety (cited as worry and concern) were also triggered by the poor quality of the water and the surrounding environment. In Benevento, older people were more likely to feel outraged than their younger counterparts. This could be because they can recall when areas were more intact and less affected by human activity, including litter on river margins and pollution residue in freshwaters. Indeed, the presence of litter was the most frustrating scenario for all focus groups. In Toulouse and Coimbra, people also felt annoyed at the destruction of riparian areas by public authorities.

While these emotional responses are fleeting, it is probable that long-term exposure to degraded environments will influence access to and use of blue spaces, ultimately impacting health outcomes. As such, environmental indicators can also serve as a proxy measure of health outcomes, given the interconnection between perceptions of environmental health and subjective well-being. For example, the wider literature has found that wildlife presence influences subjective well-being by inducing positive emotional states. Similarly, the presence of wildlife in the environment indicates the quality and biodiversity level of the surrounding environment.

Based upon the findings of the participatory research activities conducted to date, it is possible to extrapolate and highlight a series of areas for potential measurement that have been indicated by citizens as key issues of interest and/or concerns to them. This can in turn provide important insights for the work being carried out in WP2 and 3 for the identification and prioritisation of health and environmental indicators. These areas could be potentially eligible as variables for the citizen science experiment (WP4) and for inclusion in WP5, the Citizen App design, and the data collection protocol.

The areas are presented in Table 7 below and categorised into two fields: health and environmental indicators. The indicators recorded here use lay people's language, rather than scientific language which would likely pose a barrier to the uptake, and scalability, of the OAH CS app.

Table 7. Human health and environmental indicators highlighted by citizens in the participatory research activities

Health Indicators	Environmental Indicators
`Salutogenic` (health-promoting) sensory experience connected to water quality – pleasant smells and colourfulness vs presence of sewage and litter.	Water quality – presence of sewage and litter, bacterium, algae blooms and pollution residue
Levels and type of physical activity in urban aquatic areas	Biodiversity levels – birds, fish, and insect populations, presence of invasive and native vegetation
Quality and accessibility of built infrastructure (e.g., foot and cycle paths)	Weather conditions (e.g., drought, flooding)
Presence of insects – disease vectors (e.g., mosquitoes)	Quality of riparian areas
Subjective emotional wellbeing (e.g., feelings of happiness, frustration, indignation)	Water levels
	Naturalness – wild or maintained river/stream banks

	Presence of industrial production and intensive agriculture

5.3 Citizen priorities for the OneAquaHealth App

According to findings from the research sites, citizen's priorities for the OAH app are linked to a desire to protect and improvement the environment, feelings of civic duty, a wish to improve their neighbourhood and to protect nature for future generations.

People would like to receive environmental status reports, public health alerts, and local policymaking related information for their local urban aquatic environment. Health alerts should also include information concerning site warnings. In this way, users can make an informed decision about interacting with specific sites when undertaking CS activities.

The focus groups in all sites, underscored the importance of knowing how the information they collect is used and the associated changes that have occurred or are underway because of their activities. Indeed, regular feedback on how the information is used was strongly encouraged, as participants are likely to become demotivated and cease using the app if they cannot see how the data is translated into tangible actions and results. Furthermore, the app should also provide knowledge and education features, to improve awareness of the issues the app aims to address.

The app should include feature such as options to take photos and short videos. Incorporating photovoice techniques, which uses visual and verbal data collection, was suggested by the Oslo research site. The app should provide users with a short form to record their observations and information recorded in the app should be shared with local responsible authorities and services. QR codes could be used facilitate reporting from specific sites to responsible bodies in local municipalities. Location dependent features were also suggested such as annual summaries of the metropolitan area (Toulouse). Overall, the provision of a news feed in the app was not favoured. It was suggested by one group to replace this with an interactive map containing information on the various sites being monitored. Geolocation sharing should be optional and the facility to upload data should be available without the need to share exact geo-coordinates. For families, gamification features would be welcome to engage children in activities.

Development of the app should also consider data protection concerns. With regarding to project activities, time and task complexity should be considered. The app should also make its objective clear and be accessible for all language users.

6 Conclusions

Regardless of the climate and location of the urban aquatic area, citizen experiences of urban aquatic environments are intrinsically linked to their social, economic and cultural conditions. These conditions can act as enablers or disablers influencing access and use of urban aquatic environments. Weather, seasons, education, gender, income level and proximity to urban aquatic spaces influence individual and social use of urban aquatic environments. Other factors influencing citizens experiences and interactions with aquatic environments include feelings of safety, cleanliness, and the availability of infrastructure such as toilets, cycle paths and walkways. Considering citizen science similar determinants were found to influence the willingness and ability to participate in CS projects. However, unlike factors influencing the habitual use of urban blue spaces, education and demographic variables (e.g., retired, university educated) are more significant factors influencing the recruitment and engagement of individuals in CS activities. Additionally, the term 'citizen science' could influence initial buy-in to CS projects, while perceived inaction associated with data collection and volunteers' efforts influences the value of the activity and may eventually contribute to drop out rates.

Interaction with aquatic environments is largely determined by ecological and social factors. These factors are themselves determinants and proxies of human health outcomes. These determinants also influence individual engagement with nature-based CS projects, the use and individual subjective experience of urban aquatic environments, which in turn impacts the integrity of urban aquatic ecosystems. Taking water quality as one example, pollution levels indicate the impact of urbanisation on freshwater resources and riparian areas. Water quality can be positively and negatively influenced by human activities such as CS projects, public water monitoring, household activities and litter disposal. As such, a loop can be observed between the respective determinants which in some cases also influences human health outcomes. Indeed, findings from the overarching literature and the focus groups indicate that the colour, smell and sound of water impact subjective feelings of health and emotional wellbeing. Thus, the following ecological and social determinants influence citizens interactions with the environment have been extracted from findings in Section 3 and Section 4 for further use in the OAH project in table 8 below.

Table 8: Ecological and Social Determinants influencing citizens interaction with the environment.

Ecological Determinants	Social Determinants
Algae blooms	Education & income levels
Weather seasons & general weather conditions	Geographical proximity
Water quality – colour, odour, volume, sound, presence of sewage, pollution residue	Public participation
Biodiversity levels - birds, fish, and insects	Accessibility & distribution of blue space
Extreme weather events (e.g., drought, flooding)	Gender
Habitat – presence of vegetation (trees, plants)	Landscape aesthetics – littering, poor maintenance, etc.

Cleanliness – plastic & sewage pollution	Feelings of attachment
Presence of insect vectors	Built infrastructure including sanitation & rest facilities
	Pro-environmental behaviours
	Social interaction including community building
	River regulation – damming, artificialisation of beds, margins, etc
	Population/user density

In addition, the general literature review found that environmental CS activities can positively influence health outcomes. Likewise, interacting with urban aquatic areas can reduces medication intake for mental health problems such as anxiety and depression, and reduce the symptoms of anxiety measured by pulse rate, blood pressure and cortisol levels. Furthermore, frequent interaction with urban aquatic environments can reduce morbidity and mortality from cardiovascular and respiratory illnesses.

Lastly, the literature review and focus groups' findings suggested a series of indicators (related to both environmental/biological and health influencing factors) that are perceived by citizens as relevant for shaping their experience of freshwater ecosystems and impact their wellbeing. These results, discussed in section 4, represent a valuable contribution to the work conducted in parallel as a part of the ecological (WP2) and health (WP3) indicators definition. In this frame, the insightful directions provided in the present report are complemented by the efforts of partner HIT that is developing an AI-based tool based on LLMs (Large Languages Models) to search the literature for publications related to the different dimensions of fresh urban streams (ecological and human health mainly). This will allow progressive screening and retention of the most relevant literature to extract potentially relevant indicators and to suggest new ones (not appearing in said literature).

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Annexes

Annex A: Focus Group Manual

OneAquaHealth

PROTECTING URBAN AQUATIC ECOSYSTEMS TO PROMOTE ONE HEALTH

Grant Agreement: 101086521

T4.2 Report on Needs and Analysis of Contextual, Social and Cultural Determinants

FOCUS GROUP MANUAL

Developed by WISE ANGLE

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7 Introduction

7.1 Purpose of the manual

This manual provides **indications on understanding and executing a focus group session with citizens from the research sites** of the OneAquaHealth project (OAH). This is envisioned as a data collection activity required for the development of T4.2, whose scope and aims are described in the next sub-section below (1.2). The target audience of this manual are the five research site coordinators and their research teams in the project (Coimbra, Benevento, Toulouse, Ghent and Oslo). The document shows them what is a focus group and how they should operate as moderators (Chapter 2), gives hints on how to perform the recruitment of research sites' citizens (Chapter 3) illustrates the exact script to be followed and materials needed throughout the activities (Chapter 4), provides instructions for reporting results of the fieldwork (Chapter 5) and includes all the templates used during execution of the activities (descriptions in Chapter 5 and Annexes).

The materials developed for this manual are strongly based on previous European projects' practice of consolidated focus group methodologies and citizens' review panels (e.g. VOICES project, see Broerse et al., 2013; RRI Leaders project, see Bidstrup et al., 2022[5]). However, the activities and content have been fully adapted to the purposes and scope of OneAquaHealth.

7.2 Why and how does this fit in Deliverable 4.1: "Needs and Analysis of Contextual, Social and Cultural Determinants"?

The development of the Focus Group is a data collection activity which is required by the instructions of Task 4.2 ("*Preliminary assessment of citizens' experience of urban environments: contextual, social and cultural determinants*"). As foreseen in the Grant Agreement (GA), the task requires involved partners to describe several research elements as a baseline analysis of citizens' needs in the research sites areas. These are:

1. Identification of needs, problems, and constraints of citizens in their relation and interaction with the environments, particularly concerning green & blue areas included in urban aquatic ecosystems.
2. Provision of city contextual reviews of sustainability challenges, opportunities, and ongoing interventions in urban aquatic ecosystems of the 5 research sites.
3. Identification of structural, motivational, sociocultural, and socioeconomic determinants to be considered when developing tech tools supporting citizens' observations.
4. Based on the research results, discussion on how these may inform or complement (if possible) the selection of indicators in WP2 & 3.

To secure results, the task is described to employ a mixed methodology. A first part is based on desk-based review and can assist in the development of city contextual reviews (items 2, and partially 4, in the list above). WISE has already been working on a scoping literature review that will be later submitted to task partners for evaluation.

[5] See VOICES Focus Group Approach | Ecsite and RRI-Leaders | Leveraging Leadership for Responsible Research and Innovation in Territories .

However, the GA also specifies **the requirement to use either webinars or workshops in order to engage each city**. The task description references the Local Alliances, which might be used to reach the target of this particular analysis: citizens, resident in the research sites. Therefore, to secure valuable results for research associated to 1 and 3 in the previous list (i.e. needs, problems, constraints, determinants), the final solution agreed at the second Virtual Consortium Meeting of the OAH project (17/11/23) has been to employ a Focus Group methodology.

In line with GA provisions, the workflow for T4.2 execution is:

1. Planning of the data collection activity is entrusted to the task leader (WISE), who has responded through the consolidation of this manual with all necessary instructions for performing the activity.
2. The manual is sent to research sites, who need to perform recruitment of participants and to execute the activity during the planned time (by the end of March 2024).
3. At the end of the data collection experience, the results of the Focus Group need to be translated in English and summarised in a Focus Group report that must be sent back to WISE, together with any filled templates for participants (by the end of April 2024).
4. WISE will be entrusted with analysis of results for integration in D4.1 (deliverable completed by end of June 2024)

Detailed instructions and materials for all stages of the workflow are available in the various sections of the manual. While the research sites proceed to make use of this manual and conducting the activity, WISE will consolidate a first draft of the deliverable, which will be later enriched by the results of the fieldwork.

7.3 Key features of the Focus Group

Number of Participants: a minimum of 10 citizens from the research site area (see section 3)

Timing: 3 hours

Modality: face-to-face

General Objectives:

1. To better understand needs, problems, and constraints of citizens in their relation and interaction with the surrounding environment, particularly in relation to opportunities and barriers around urban freshwater aquatic ecosystems.
2. To identify a series of structural, motivational, socio-cultural, and economic determinants to be considered when understanding reasons for engaging in environmental observations of and public health opportunities around urban freshwater aquatic ecosystems.

Specific Objectives:

a. To provide daily life experiences, perceptions and reflections on the role or urban stream areas for participants of the workshop (Exercise 1).
b. To understand use of blue-green urban spaces and identify determinants of engagement in possible citizen's observation, both in terms of what and how they would communicate and the information they would like to receive (Exercise 2).

Deadline for execution of Focus Group: end of March 2024

Deadline for submission of Focus Group Report and Materials: end of April 2024

7.4 If you need any help

Please be reminded that WISE (as T4.2 leader) and SHINE (WP4 Coordinator) will be available to assist you with any doubts over the instructions of this manual or the execution of the activity.

You can send your enquiries to the joint team (all in 'cc):

WISE:
Francesco Camonita (fcamonita@wiseangle.es)
Valentina Tageo (vtageo@wiseangle.es)

SHINE:
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8 What is a Focus Group and how does it work?

8.1 Introduction on Focus Group Methodology

According to standard definition, a focus groups is understood as "a carefully planned discussion designed to obtain perceptions on a defined area of interest in a permissive, non-threatening environment" (Krueger, 1994)[6].

It is increasingly used as a data collection method in political and social sciences, and its aims are quite fitting for the development of results included in deliverable 4.1 of the OAH project.

Focus groups allow to collect needs, desires, problem perceptions and concerns of particular stakeholder groups or citizens. A protected and comfortable setting for discussion allows participants to give shape to unarticulated ideas and concerns, while respecting diversity of views, values, attitudes, and beliefs. When properly applied, it thus becomes a window for understanding personal, historical, and cultural context of the interviewed groups (Broerse et al., 2013).

A Focus Group brings together a small group of participants, make them feel at ease and ask them a series of questions and the execution of creative activities, which slowly become more critical. It thus allows to acquire rich information about human experience and culture. The analysis of this information allows to unravel intangible factors constituting social interpretations.

Objectives a Focus Group:

- Collecting needs and desires, problem perceptions and concerns.
- Involving end-users in generation of new ideas and hypotheses.
- Help articulating values and beliefs, but also investigating views and attitudes.
- Optionally exploring future visions or imagining new worlds.

Setting of a Focus Group:

- Ideally, in-between 10-12 participants together in the same room for around 2-3 hours.
- Guided by a moderator, they alternate between open discussion and structured exercises.
- The physical environment must be noise-free, stimulating creativity and with enough space to relax, walk and talk (e.g., a meeting/small conference room).
- The social environment must hold a non-threatening atmosphere. People need to feel free to express ideas through a pro-active and positive attitude.
- People should feel free and willing to contribute and showed appreciation for their time dedication.
- Respect and diversity are an indispensable perspective, all ideas can potentially contribute to the group discussion.
- The conversation about values and beliefs is highly complex, and their meaning is not fixed in the heads of people. Rather, it is actively shaped and constructed. Focus groups are therefore sites of social interaction, where meaning and understanding are actively negotiated and constructed.

[6] See the full reference here: Krueger, R. A. (1994). Focus group. A practical guide for applied research (2nd ed.). London: Sage.

General outline of Focus Groups:

- Presence of a global set of questions and exercises.
- A defined structure nesting the discussion.
- An alternation of thinking and doing/communicating.
- Going from broad to specific in concepts and ideas.

The logic of group interaction in Focus Groups:

- You start from individual's experiences, acquiring citizens perceptions on a given subject.
- You visualize intermediate results (e.g., flip charts, post-its, diagrams) and support participants in inspiring each other and building on each other's idea.
- You alternate individual thought and group discussion, possibly realizing competitive and complementary interactions.

8.2 Your role as a moderator

A focus group moderator is like the conductor of an orchestra. You need to obtain your research objectives while getting the best out of every participant.

Key-tasks of the Moderator:

- **Put participants at ease:** establish rapport and a friendly atmosphere; provide clear explanations of the objectives and exercises.
- **Guide, stimulate and facilitate discussion:** promote debate and interaction among participants. Facilitation style depends on research objectives and group needs.
- **Maintain the group's focus:** keep the discussion on track; ensure the key themes are covered while managing the group dynamics.

Seven important things to do and show as a Moderator:

- You help establishing a safe environment for communication.
- You respond in a positive and acceptive way.
- You model a neutral attitude.
- You listen with a true intention to understand.
- You summarise and clarify content brought up.
- You challenge and ask for more details when necessary.
- You lead the entire process.

The Moderator acts according to the LSC model (Listen, Summarize, Clarify):

1) **Listen (L)** carefully to what a participant has to say. It is important just to focus on what is said, postponing judgement or critique. Use curiosity, approach every idea as a potential contribution to the session output. All ideas are valuable. Be in the moment. Add to what is there.

2) **Summarize (S)** what has been said to check whether you have got it. Always let the participants decide what a statement means and how it should be put down in final words. Check your interpretations of the participant's story. Show the participant you take them seriously.

Tip: you can repeat what is said / integrate in your own words, for example: "if I understand it right…", "I hear that you sound really…", "I get from you the idea that…."

3) **Clarify (C)** with questions to gain an in-depth understanding of a participant's view. Ask "get-questions" ("what do you mean?") and "why-questions" ("why do you think that?"). The purpose of clarification is to explore underlying levels of beliefs, values, and concerns. It is about acquiring relevant arguments, purposes, completeness, examples, evaluation. Tip: you can use some key questions like "Tell me more about…", "What makes you think that…?", "What is it that you find important in this…?", "Please explain to me how…", "If you compare this to…?", "What do you mean by…?".

Advice on how to deal with resistance/obstacles during a Focus Group:

- If they ask you extra questions **about the nature and background of the project**:
  - Out of curiosity: postpone until after the session.
  - Out of distrust: deal with it clear and short, but immediately.

- If they ask you **extra questions that concern the session itself**: resolve issues directly, clearly and to the entire group.

- If they ask you **questions that seek your opinion**: explain that it is not about what you think, but that you're interested in what they think.

- If they ask you **questions reflecting the participant's desire to do it right**: explain that there is no right or wrong. All ideas are valuable.

- There are usually **two types of resistant behaviour**: *passivity* (a participant drops out of the discussion, sits back, unfocused and drifts away) or *dominance* (a participant dominates the conversation, lectures the other participants, and obstructs the flow of ideas).

- **Examples of useful interventions from moderators dealing with resistance**:
  - *Acknowledge & Zap*: acknowledge the participant's input (people want to be heard), but then move on directly to another participant.
  - *Summarize & Zap*: acknowledge even more by summarizing (making sure that you got it), but then move to another participant.
  - *Explain procedures*: explain that you want to collect the ideas of every participant in the group. Explain that this is why you want everybody to have a say.
  - *Address behaviour directly*: describe what you observe. Explain how this interferes with the group process. Kindly ask the participant to adjust behaviour.

- **If there is too much discussion and you are going overtime**: **do not skip any part of the Focus Group**, since data from all exercises are needed for comparability. It is suggested to kindly keep a strict time and to cut discussions short to cover all activities.

9 How to recruit for the Focus Group

9.1 Typology of participants

An ideal focus group should hold a minimum of 10 participants. To obtain a representative sample whose contribution can be meaningful for the OAH project and for the needs' analysis of T4.2 (D4.1), the following criteria should be observed:

Essential criteria: These are essential requirements for the selection of citizens participating in the workshop.

- A citizen residing in one of the five research sites.
- With experience living near or crossing through urban stream areas in daily life.

Representativeness criteria among participants: They should be taken into consideration to generate a representative sample of the population in the research site. If possible, try to keep balanced:

- *Gender:* Male and female attendants. Be respectful and inclusive of other preferences.
- *Age:* Young, adult, and older attendants.
- *Professional background:* Students, workers, and retired persons.
- *Level of digital literacy:* the group must be ideally formed by individuals having a varied level of digital literacy (from basic knowledge to good dominance of information and communication technologies, such as smartphones).

9.2 Recruitment strategy

There are several options that research sites can explore when seeking to recruit citizens for participation in the Focus Group.

9.2.1 Engage your Local Alliance

One possible solution would be to request the assistance of your Local Alliance (LA) of stakeholders involved in the OAH project. You can either consider a quick 30-minutes meeting (you can use previously produced slides for presenting the Focus Group by WISE, write to us for requests) or even sending them a written request for assistance in recruiting a minim of 10 citizens willing to participate.

Some considerations for recruitment:

- *Stakeholders with direct access to citizens* (e.g., education institutions such as schools or universities, NGOs): can help you seek out volunteers for the activity, particularly among their members.
- *Stakeholders with no direct access to citizens* (e.g., public administrations or agencies): they can still provide contacts and/or further reach out to other possible organizations for advertising participations (e.g. using their social media channels).

9.2.2 Advertise participation through your own channels

A second possibility involves the mobilisation of your own network (e.g., university channels for research sites' coordinators) to sponsor participation into the Focus Group.

9.2.3 Personal contacts

The possibility to involve direct personal contacts that fulfil the essential requirements was discussed and approved during the second virtual consortium meeting of the project (17/11/23). If you personally know or encountered individuals that have experienced life alongside urban aquatic ecosystems in your city, you can also proceed to direct engagement of individuals to request willingness to participate.

9.3 Recruitment materials

In the Annex section of the Manual, we have prepared two forms that constitute the "**Informed Consent Package**" (Annex 1) that you should send to each interested participant that responds to the different options of the recruitment strategy.

These include:

1. **Info sheet about the project and the activity:** this will contain a simple and accessible description of the project and of the Focus Group activity in which the participants are requested to contribute.
2. **Consent Form:** this form is **MANDATORY** and of extreme importance for the development of the Focus Group. It will provide all necessary information on privacy and confidentiality, alongside carefully informing citizens about what they will be required to authorise the data analysis. These forms must be collected either in advance (have them sent back via printed form or e-mail including the checkmark on the last page), and if they did not do so, make sure you have them sign these on the day of the activity.

9.4 Practical Suggestions

We also include a few suggestions that research sites should keep in mind when performing recruitment:

- ***Be aware of deadlines:*** **D4.1 is foreseen for M18 of the project (June 2024)**. Meanwhile, the **internal deadline that we set up in the project for execution of focus groups is set for the end of March 2024**. Remember that people's agenda may start to fill up quickly at the beginning of the year. Send out invitations as soon as possible.
- ***Keep track of your participants:*** Use a simple matrix/table on Word/Excel to list down your Focus Group participants and classify them according to criteria for representativeness (e.g., age, level of digital literacy). Graphical visualization can help you keep track of your sample and see where you need to fill the gaps. We will need this information for reporting as well (see Chapter 5).
- ***Keep track of registrations (and consent forms!***): You should consider complementing the Word/Excel list with an option indicating if the participants have sent back the consent form. Send reminders if required. Most importantly, consider printing out a few blank copies that missing participants can fill on the day of the activity, if necessary.

10 The Script of the Focus Group

This section begins by illustrating preparation tasks and then heads towards the full script of the activity. **The script is to be studied in detail and in close relation to the slide deck provided and the template form (see Annexes)**. It tells you when to say what, when to present a new slide to the participants, when to click for an animation in the slides and every other action on your behalf which may be necessary to properly moderate the focus group.

10.1 What you need and what to do before the meeting

This section briefly outlines the materials that you are going to require, how to prepare the room and what to do right to the moment before the start of the session.

10.1.1List of Necessities

Note: some of these may have to be adjusted according to the final number of participants.

- 1 Audio/video recorder (digital)
- 1 Beamer
- 1 Laptop/PC station linked to beamer
- Slide Deck of OAH Focus Group (don't forget to edit your name and the proper email address in first and last slides)
- Script in your own language or extended script
- *Optional:* 1 Blackboard or Flip chart for writing down concepts
- 10+ pens of blue/black color
- 10+ pens of red color (in case someone wants to remark concepts)
- 10+ White A4 paper if people want to take extra notes (don't forget to collect!)
- 10+ White A4 paper for people to write down their names and fold them on the table for everyone to read.
- 10+ copies of Template 1
- 10+ copies of Template 2
- 10+ copies of Template 3
- 10+ copies of Template 4
- Refreshment and Snacks for the participants (minimum requirements: water for hydration; may also include coffee, fruit juice and snacks such as biscuits)
- Printed Informed Consent Forms (for participants that did not send them beforehand)

10.1.2How to prepare the room

Note: Remember that the room setup can impact the dynamics, interaction, engagement, and comfort of the audience.

- Tables are arranged so that the moderator and note taker can see everybody and reach everybody easily when walking around.
- Tables should be arranged so that the participants can see the PowerPoint presentation and the flip chart/blackboard on the wall with relative ease (if you are going to use it).
- Tables should have enough space for participants to write down and take notes.

- For every person, a set of two pens and white paper available.
- Beamer is turned on, connected to a computer and PowerPoint slide 1 is put on.
- Have your name clearly written on a folded A4/ name plate at the place where you will sit.
- It is also necessary to ensure that the room is accessible to all participants if we have people with limited mobility (accessibility).

10.1.3Before you start

- Be on time! You will need to arrange the room. This should be done before the participants can come in.
- When people enter the room, welcome them, tell them where they can put their coat and offer them something to drink. Try to establish a friendly and open environment.
- Ask the people to find a place to sit and to write their names on the paper/name plate .
- Consider taking pictures. Even better if the notetaker or any other assistant can do this for you during the activities) Make sure to check that participants have agreed to this in the Informed Consent forms first.

10.2 Summary of the Focus Groups

- **Introduction of the Focus Group (Approx. 20 min)**
  - Welcome
  - Practicalities
  - Icebreaker and presentations
  - Explain: What is the activity?

- **Exercise 1: What is your perception of Urban Streams in your city? (Approx. 1h 10min)**
  - Define Context and Objective
  - Activity 1.1: Daily life experiences with urban streams
  - Activity 1.2: Communicate your perceptions
  - Activity 1.3: Discuss the function of urban streams

- **Break (Approx. 15 min)**

- **Exercise 2: How and why would you actively contribute to environmental observations? (Approx 60 min)**
  - Define Context and Objective
  - Activity 2.1: How would you like to report these issues?
  - Activity 2.2: Why would you choose to do this?
  - Activity 2.3: What would you like to know in return?

- **Conclusion (Approx. 10 min)**

10.3 Extended Script

10.3.1 Introduction of the Focus Group

What: presentations and procedures

Duration: Approx. 20 minutes

Welcome

- While participants enter: Click for Slide 1 (OneAquaHealth Logo)
- Welcome the participants. Click for Slide 2 (Focus group presentation)
- Introduce yourself, your work and background
- Explain very quickly your role as moderator (e.g., "*My role is to maintain the focus and to guide and stimulate the discussion*").
- Introduce the other collaborators present (if any, such as note taker and collaborators). Explain their role during the event (e.g., "*they won't take part in the discussion but are very interested in what happens during the workshop and will assist with data reporting*")

Practicalities

- Remind that they have signed a consent form. If anyone is missing in the collection, remind them that they can also do it now and handle 1 form over. Remind that there is a need for audio or video recording because results need to be transcribed, summarized, and elaborated.
- Provide some practical instruction (e.g. safety briefing and emergency exits, as well as where to find the toilets)

Icebreaker and presentations

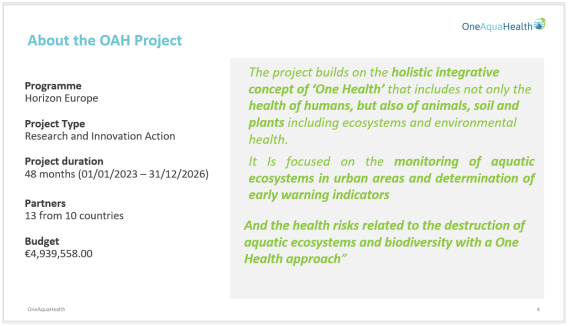
- Ask the participants to introduce themselves briefly by mentioning their name, a little bit about themselves, and the general experience they have with freshwater bodies (rivers, streams) or with nature in their area. Make a full round of all participants.

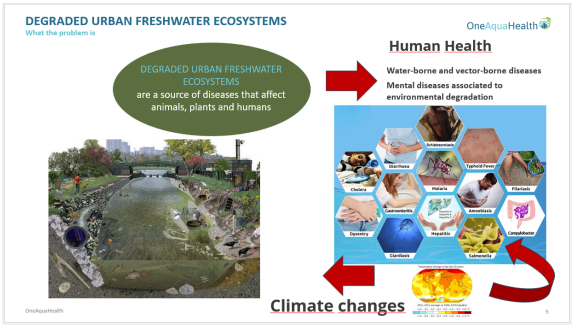
Explain: What is the activity?

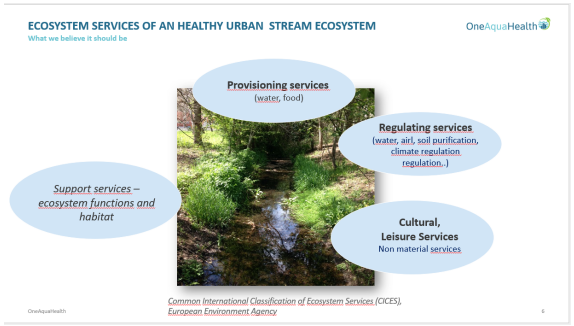
- Click for Slides 3 to 8 progressively (OAH Concept)
- Explain that they have been invited to participate in the Focus Group activity belonging to the OneAquaHealth project. Quickly use the slides to illustrate the main project's goals. Remember to

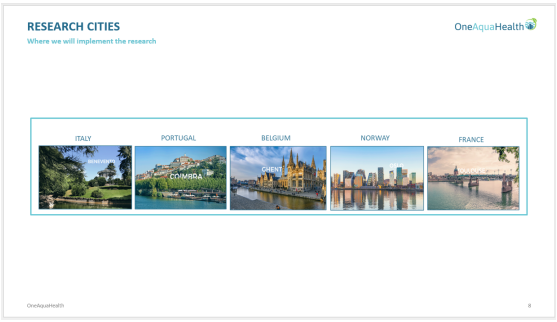
be straight to the matter, do not go too much into detail and provide a down-to-earth, easy explanation.

- Click for Slide 9 (T4.2 Concept)
- Explain the objectives of this part of the project where their activity is framed. Quickly use the slide to illustrate the main activity goals and why there is a report on citizen's needs. Introduce what the focus group is and what will happen in the session.





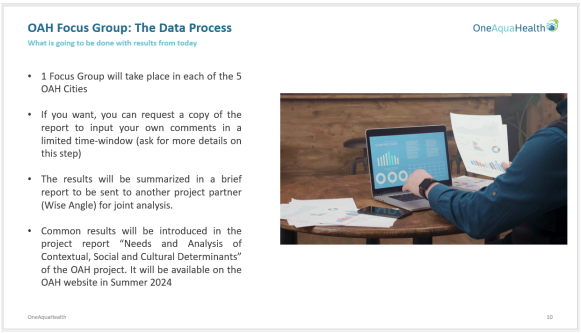




Example of Moderation:

"We have chosen to use focus groups for this project, which are group discussions. During this focus group you will be asked to do various exercises and brainstorming, and to discuss your opinions with the rest of the group. You will be shown some essential concepts through PowerPoint and will be given some templates to express your ideas and for providing your inputs. You are all personally invited to this focus group, so we are interested in each of your individual ideas and opinions. All answers are valuable. There are no wrong answers. Please feel free to speak up and be actively involved. This focus group will last between 2 ½ and 3 hours. It consists of two main exercises and some sub-activities, with a break halfway."

- Click for Slide 10 (Data Process)
- Explain that what will happen after this focus group is that the results will be summarized in a brief report.
- Explain that if participants are willing to, they may have the possibility of checking the focus group summary report by requesting it via e-mail (with limited time for feedback).
- Explain that data from 5 focus groups happening in the 5 research sites of the project will be analyzed by the WISE ANGLE partner.
- Explain that the results will be incorporated into a public deliverable and provide opportunity to follow-up on it upon publication on the OAH website.
- Claim that it is now time to start the activity!
- *(Possible slot for pictures.* Make sure to check that participants have agreed to this in the Informed Consent forms first*)*



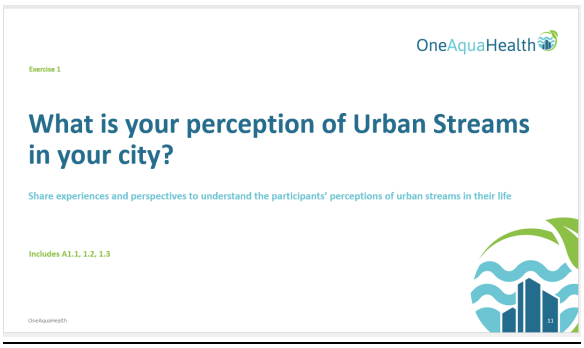
10.3.2Exercise 1: What is your perception of Urban Streams in your city?

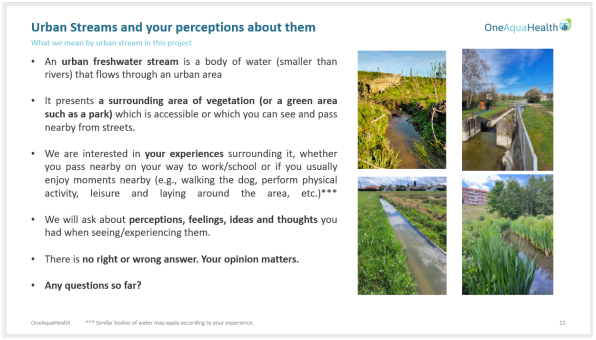
What: Share experiences and perspectives to understand the participants' perceptions of urban streams in their life (A1.1, 1.2, 1.3)

Duration: Approx. 1 hour and 10 minutes

Define Context and Objective

- Click for Slide 12 (Urban Streams and your perceptions about them)
- Explain the definition of "urban stream" and "urban stream area" as understood in this project, as well as the elements that we are trying to identify through these activities (e.g. perceptions, experiences). Use the slides to illustrate these.
- Ask if there any questions or anything is unclear.





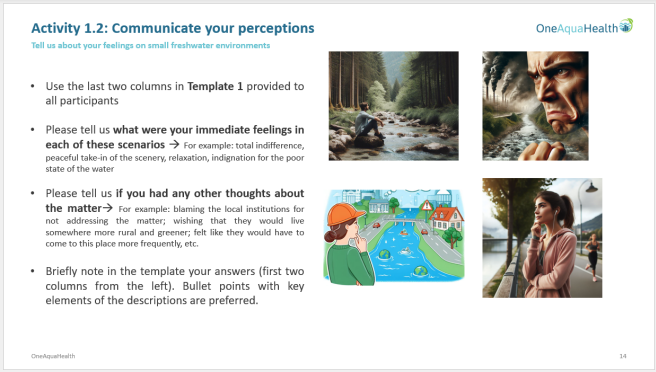
Activity 1.1: Daily life experiences with urban streams

- Click for Slide 13 (Activity 1.1 Instructions 1)
- Explain that you are going to hand out **Template 1** to all the participants. We would require them to describe 2 episodes in which participants found themselves in an urban stream area from their city (if they only have one stream in your mind, they should still think of different situations when interacting with it).
- Hand out Template 1. Explain that for now we only need them to fill the first two columns from the left.
- Explain that we would need participants to be as detailed as possible about the typology of interaction. Use the text from the slide for examples.
- Explain that we would also need them to describe the scenery. Use the text from the slide for examples.
- Explain that you are going to give them up to 5 minutes for filling the columns. Bullet points with key elements of the descriptions are preferred. If you see that they are done before the time, proceed.
- **Short Discussion**: Ask for 2-3 volunteers to describe their scenes. Thank them for their contribution. Then ask if anyone else has any scenario that looks different from what currently exposed. Try to summarize the current content (see example below). See if there any further opinions. When you feel it is done, go to the next activity.

Example of Moderation:
"if I understand correctly, you have described experiences of walking nearby when going somewhere (work, school) and have used the urban stream areas for leisure and physical exercises. You have also described them to be in quite a degraded state. Have you got anything else? Any other situations non-described before"

Activity 1.2: Communicate your perceptions.

- Click for Slide 14 (Activity 1.2 Instructions)
- Explain that it is now time to reflect on feelings and perceptions evoked from the two episodes. Use the text from the slide for examples.
- Explain that you are going to give them up to 5 minutes for filling the remaining columns in Template 1. Bullet points with key elements of the descriptions are preferred. If you see that they are done before the time, proceed.
- **Short Discussion**: Ask for 2-3 willing volunteers to describe their perceptions. Thank them for their contribution. Then ask if anyone else has any different feeling from what currently exposed. Try to summarize the current content (see example below). See if there any further opinions.
- When you feel it is done, don't forget to collect Template 1 from all participants and go over to the next activity.



Example of Moderation:
"if I understand correctly, some of you agreed on feelings of peace, beauty and contact with nature in the case of clean stream and green areas, but I also heard about indignation for certain degraded areas and a blaming of local institutions for failing to address these issues. Have you got anything else? Any other situations non-described before? Or can you please elaborate further on your feeling of indignation?"

Other possible probing questions:
- *What is causing your concern? Can you explain more?*
- *Do others recognize this as well?*
- *Is it more related to A or B?*
- *Has it been a concern for a long time in your area, or only more recently?*
- *How important/relevant is this for you?*

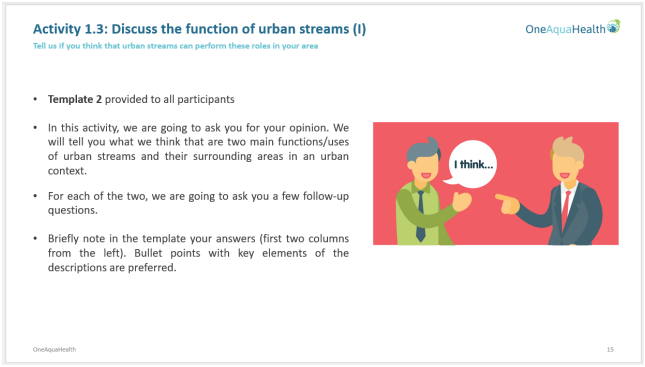
Activity 1.3: Discuss the function of urban streams.

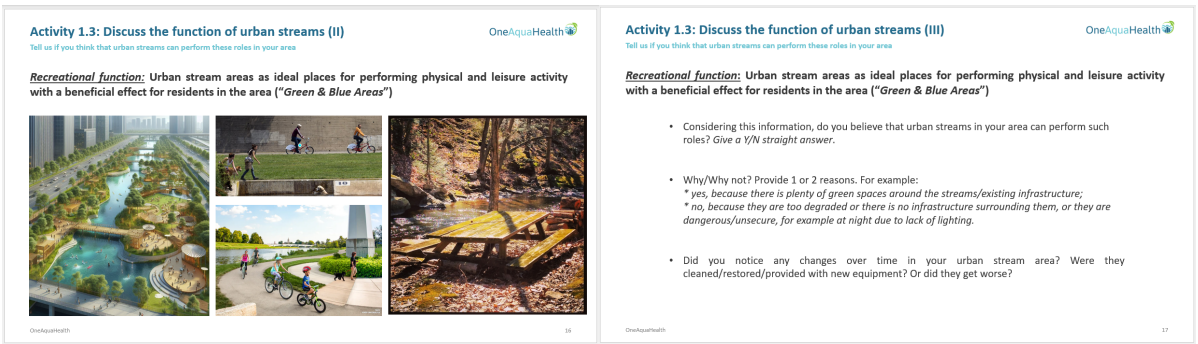
- Thank everyone for their contribution so far. Click for Slide 15 (Activity 1.3 instructions). Explain that you are going to introduce some new and simplified information about how the OAH team understands the function/usefulness of urban streams and their surrounding areas in an urban context. Distribute **Template 2** to all the participants.
- Click for Slide 16 (Recreational Function Concept and Pictures).
- Explain to them A. Recreational Function. Use the slide concepts and pictures to illustrate this concept. Click for Slide 17 (Questions for Recreational Function).
- Guide them through the various questions in the template and explain the content (also use examples). Also explain the last information question in the function (changes over time).

Concept and Questions for Recreational Function

A. Recreational function: Urban stream areas as ideal places for performing physical and leisure activity with a beneficial effect for residents in the area ("Green & Blue Areas")

- *Considering this information, do you believe that urban streams in your area can perform such roles? Give a Y/N straight answer.*
- *Why/Why not? Provide 1 or 2 reasons. For example:*
  ** yes, because there is plenty of green spaces around the streams/existing infrastructure;*
  ** no, because they are too degraded or there is no infrastructure surrounding them, or they are dangerous/unsecure, for example at night due to lack of lighting.*
- *Did you notice any changes over time in your urban stream area? Were they cleaned/restored/provided with new equipment? Or did they get worse?*





- Explain that you are going to give them up to 5 minutes for filling the columns. Bullet points with key elements of the descriptions are preferred. If you see that they are done before the time, proceed.
- **Short Discussion**: Ask for 2-3 willing volunteers to give their opinion (try to involve different people each time!). Thank them for their contribution. You could also ask people to raise their hand for the Y/N answer and count difference in opinions. You can also ask if anyone has a diverging opinion and their reasons. Tackle the first part (reasons on why/why not) and then move to asking about changes over time. Try to collect difference in opinion. Comment that if anyone has any follow-up on what someone else has said, they are free to do so. Take notes on blackboard/your own notebook if needed. No more than 5-10 minutes for general discussion. Towards the end, try to summarize the current content (see example below). See if there any further opinions. When you feel it is done, go to the next activity.

Example of Moderation:
"if I understand correctly, you seem to agree that urban streams in your city hold the potential to be recreational areas. You seem to agree that the local council has done many restoring of the green spaces close to the streams in the past 5 years. Have you got anything else? Any other situations non-described before?"

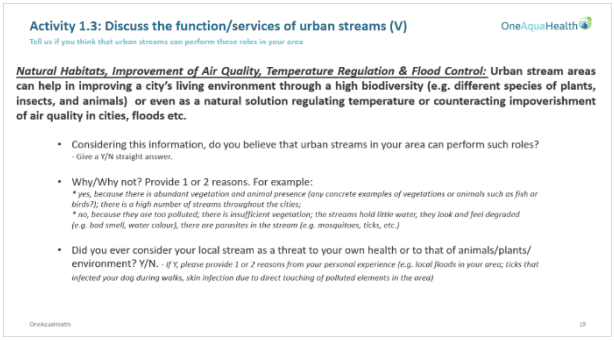
- Click for slide 18. (Habitats, Air Quality, Temperature Regulation and Flood Control Concept and Pictures).
- Explain to them B. Natural Habitats, Improvement of Air Quality, Temperature and Flood Control. Use the slide concepts and pictures to illustrate this concept. Click for Slide 19 (Questions of Habitat Function).
- Guide them through the various questions in the template and explain the content (also use examples). Also explain the last information question in the function (threat to health)

B. Natural Habitats, Improvement of Air Quality, Temperature Regulation & Flood Control: Urban stream areas can help in improving a city's living environment through a high biodiversity (e.g. different species of plants, insects, and animals) or even as a natural solution regulating temperature on counteracting impoverishment of air quality in cities, floods etc.

- *Considering this information, do you believe that urban streams in your area can perform such roles? Give a Y/N straight answer.*
- *Why/Why not? Provide 1 or 2 reasons. For example:*
  ** yes, because there is abundant vegetation and animal presence (any concrete examples of vegetations or animals such as fish or birds?); there is a high number of streams throughout the cities;*
  ** no, because they are too polluted; there is insufficient vegetation; the streams hold little water, they look and feel degraded (e.g. bad smell, water colour), there are parasites in the stream (e.g. mosquitoes, ticks, etc.)*
- *Did you ever consider your local stream as a threat to your own health or to that of animals/plants/ environment? Y/N. If Y, please provide 1 or 2 reasons from your personal experience (e.g. local floods in your area; ticks that infected your dog during walks, skin infection due to direct touching of polluted elements in the area)*

- Explain that you are going to give them up to 5 minutes for filling the columns. Bullet points with key elements of the descriptions are preferred. If you see that they are done before the time, proceed.
- **Short Discussion:** Ask for 2-3 volunteers to give their opinion (try to involve different people each time!). Thank them for their contribution. You could also ask people to raise their hand for the Y/N answer and count difference in opinions. You can also ask if anyone has a diverging opinion and their reasons. Tackle the first part (reasons on why/why not) and then move to asking about threats to health. Try to collect difference in opinion. Comment that if anyone has any follow-up on what someone else has said, they are free to do so. Take notes on blackboard/your own notebook if needed. No more than 5-10 minutes for general discussion. Towards the end, try to summarize the current content (see example below). See if there are any further opinions.
- When you feel it is done, don't forget to collect Template 2 from all participants and announce the 15-minute break.

Example of Moderation:
"if I understand correctly, you seem to agree that urban streams in your do not hold enough potential to be natural habitats. In line with what we discussed earlier, you believe that they are too much degraded in area due to wild vegetation and pollution. You also mentioned that, although you never thought about this before, the local streams could be a threat to your area. You never experienced floods because they have little water, but you commented that one of the participants' dogs got ticks during one walk, and you generally avoid them because there are many mosquitoes. Have you got anything else? Any other situations non-described before?"

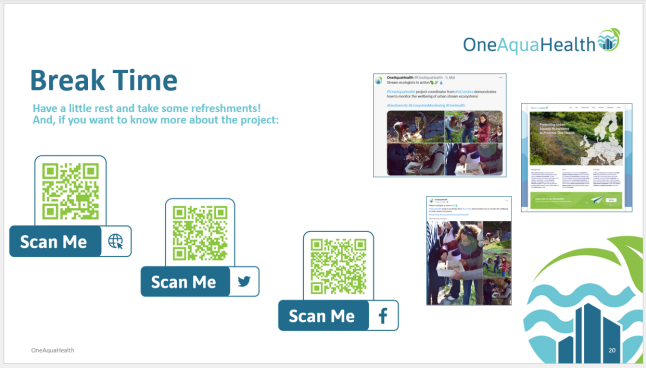


10.3.3The Break

Duration: 15 minutes

- Click for Slide 20 (Break)
- Alternatively, if you wish, put on pictures, a slideshow or any other OAH material during the break.
- Clean the tables of all unnecessary items, rubbish to have enough working space for the second half.
- Discuss with other participants from your team how it is going. Did you miss something important? Is everybody having a say? Is everybody respectful towards each other's input. Are there already interesting outcomes you want to come back to?

- Be attentive of interesting discussions during the break that you can link into the discussions during the second half of the focus group.
- Take care of refreshments if needed and have some small talk with participants.
- *(Possible slot for pictures.* Make sure to check that participants have agreed to this in the Informed Consent forms first*)*



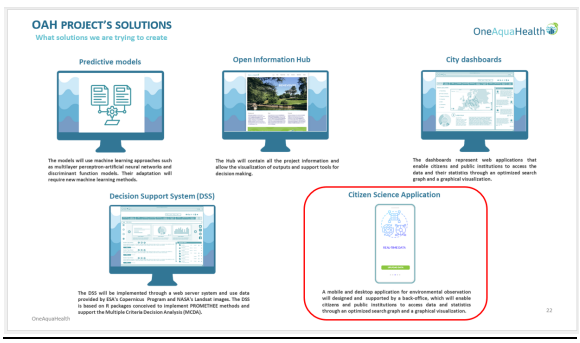
10.3.4Exercise 2: How and why would you actively contribute to environmental observations?

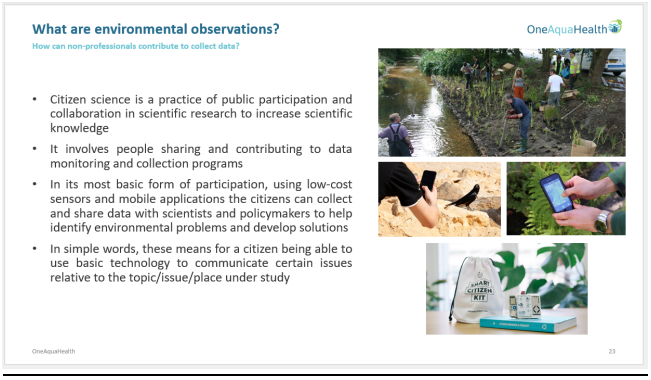
What: Activities for understanding how and why citizens would actively contribute to environmental observations (A 2.1, 2.2, 2.3)

Duration: Approx. 60 minutes

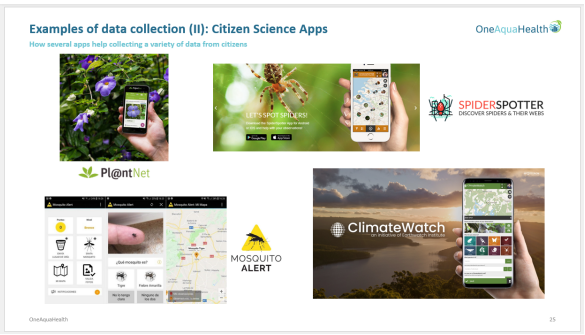
Define Context and Objective

- Click for Slide 21, 22, and then 23 (Title, Previous argument, and Environmental Observations Topic)
- Introduce the new session. Explain the definitions provided (Use the slides). Then explain that the goal of Exercise 2 shifts the focus into understanding what would motivate/prevent people from participating in citizens' observations and what kind of interaction they would want to have for urban streams.





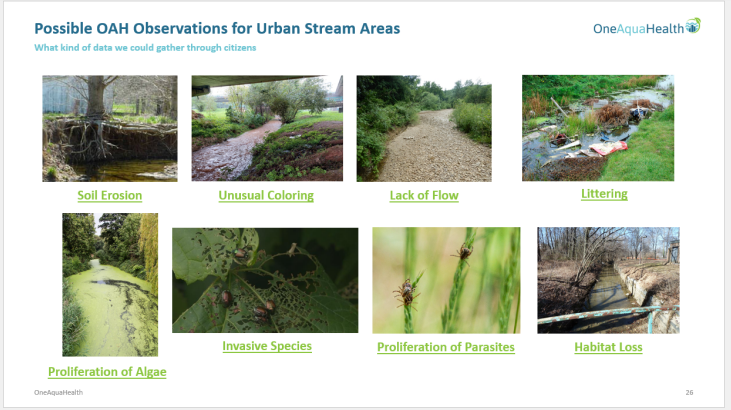
- Click for Slide 24 and 25 (Examples of Data Collection)
- Show examples of most used digital channels for communicating observations for a variety of topics. Use the slides to illustrate these.



Direct examples

They include apps such as Waze (for traffic report and road conditions), Wikiloc (tracing routes for excursions and fieldtrips with accurate data on route), community groups on social media (e.g. local town community group on Facebook) and an example of citizen science via use of given sensors (etc. example of sensor attached to bag for live measurements). Each research site may also choose to include national apps that can be presented as well and, if possible, that are related to the topic (examples from Portugal: Plantnet, Invasoras, Citizeen app, Na Minha Rua).

- Click for Slide 26 (OAH Observations)
- Explain to participants that the OneAquaHealth project is also trying to develop its own tool for engaging citizens. Show the slide with different pictures showing degraded urban streams and freshwater ecosystems. These could be at four different levels of degradation, from those displaying high level of littering and garbage, weird water colour, wild vegetation, presence of invasive species, and others. Explain that you are showing them this because you want them to understand possible examples of reporting issues.
- Ask at this point if there any questions or anything is unclear



Activity 2.1: How would you like to report these issues?

- Click for Slide 27 (Instructions Activity 2.1)
- Distribute to all participants **Template 3**. Tell them that at this stage they should only fill the first part of the form by ticking all the preferred options. Give them up to 5 minutes for filling the columns. If you see that they are done before the time, proceed.

What digital and technological features would you use for an observation? Tick on those that are relevant for you. They should also provide a written note on reasons for choosing in the form.

A. Having a specific app on your mobile phone to be used for observations [ ]

B. Having the possibility to report via a system integrated in an already existing tool (e.g. local council app) [ ]

C. Writing a text-based post on social media to inform the local community (e.g. Facebook) [ ]

D. Writing a text-based message only to local authorities based on standard form with quick access [ ]

E. Having a quick form where you can select options rather than writing [ ]

F. Having a quick conversation about your observation with a virtual agent [ ]

G. Allow the tool to automatically extract specific coordinates' information about the location of the observation (Geolocation) [ ]

H. Personally introduce information about the specific location where you took the picture (No satellite location) [ ]

I. Just taking a quick picture/video of the place of observation to be included in the observation [ ]

J. Including both text and audio-visual content in the observation (picture/video) [ ]

K. Sharing the content of your observation with peers via existing and external social media (Facebook, Instagram, Tik Tok, others) [ ]

L. Be willing to carry around a digital sensor while you cross urban stream areas (for example, a keychain shaped object attached to your bag. Data would be automatically acquired with no further action from you) [ ]

M. Be willing to stop and take out a digital sensor that will only be activated by you via mobile when you want to make an observation [ ]

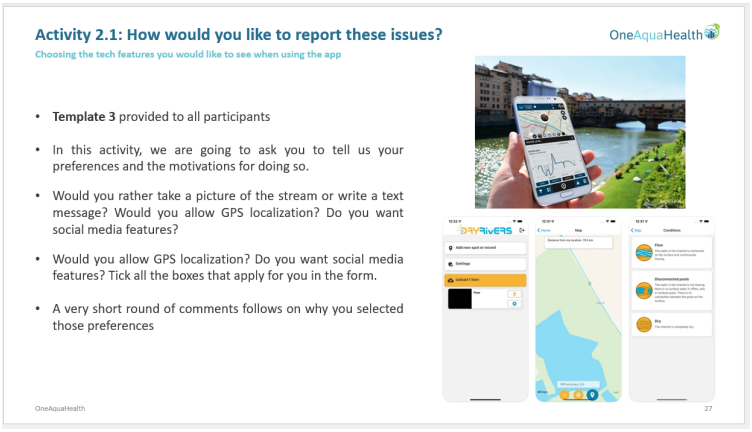
N. Be willing to install a sensor on your garden, balcony, or rooftop if you live nearby an urban stream area [ ]

O. Other: _____ [ ]

- **Short Recount and Possible Discussion:** Once everyone has finished, explain that you are going to call out each item on the list and ask participants that have selected that option to raise their hand and be counted. Briefly take note (or ask notetaker to do so). Next, try to set up a brief discussion of 5 minutes where willing volunteers should briefly motivate selected reasons. In this case. try to summarize and gather common conclusions for the participants. When you feel it is done, go on to the second part of the activity.

Example of Moderation:

"From this recount, I can tell that most of you would like to have access to a quick photo/video features for an observation, but many also requested the lack of automatic geo-localization. Why do you think these are the most motivated reasons? What are the reasons for this choice? Do you want it to be a fast operation? Do you care for privacy? .... Also, I see that none of you selected the idea to carry a digital sensor with you.... But some said they would install them outside of their house. Can you tell us more?"



Activity 2.2: Why would you choose to do this?

- Explain that after having discussed the typologies of interactions with an app, you would like the participants to stop and think for a minute about the deeper motivations for contributing through an environmental observation.
- Click for Slide 28 (Instructions for Activity 2.2)
- Explain that you would now like for them to fill the second part of the template. They need to provide 4 reasons on why they would feel compelled to use the app and 4 why they would not. Use the examples in both the slides and the template to describe possible motivations to them. Bullet points are preferred for key concepts. Give them up to 5 minutes for filling the columns. If you see that they are done before the time, proceed.

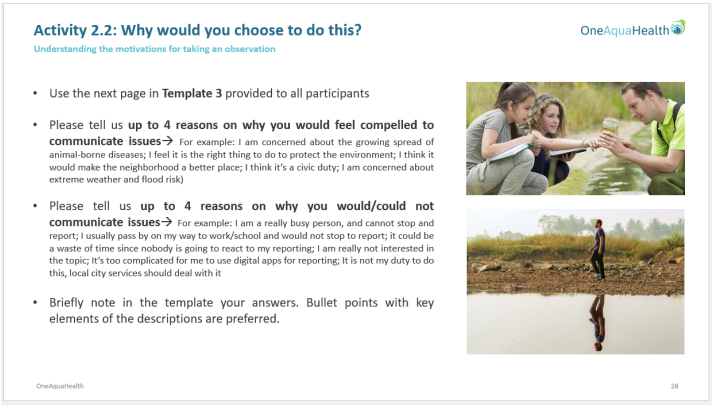
Extract from template and slides:

- *They are asked to fill in **up to four reasons on the form on why they would feel compelled to communicate issues** in the Urban Stream area with an app. (For example: I am concerned about the growing spread of animal-borne diseases; I feel it is the right thing to do to protect the environment; I think it would make the neighbourhood a better place; I think it's a civic duty; I am concerned about extreme weather and flood risk)*
- *They are asked to fill in **up to four reasons why they will/could not communicate issues** about the Urban Stream area with an app. Think about practical reasons or beliefs that would make you "look the other way" (For example: I am a really busy person, and cannot stop and report; I usually pass by on my way to work/school and would not stop to report; it could be a waste of time since nobody is going to react to my reporting; I am really not interested in the topic; It's too complicated for me to use digital apps for reporting; It is not my duty to do this, local city services should deal with it)*

- **Short Discussion**: Ask for 2-3 willing volunteers to give their reasons (try to involve different people each time!). You can also ask if anyone has a diverging opinion and their reasons. Try to collect difference in statements. Comment that if anyone has any follow-up on what someone else has said, they are free to do so. Take notes if needed. No more than 5-10 minutes for general discussion. Towards the end, try to summarize the current content (see example below). See if there any further arguments in the group.

Example of Moderation:

"From your discussion, I feel as if many of you have a genuine interest in civic participation and environmental protection, motivating you to participate. Some of you also indicated that you want a cleaner and nicer neighborhood. However, you were also confirming that you may lack the time, the motivation, or the attention to identify troubling issues in streams and could skip reporting. Does this make sense? Do you have any more comments or follow-ups to this?"



- When you feel that it is done, thank all participants for their contribution. Don't forget to collect Template 3 from all the participants. Tell the participants that you are very close to the end and that there is only one more issue to be discussed.

Activity 2.3: What would you like to know in return?

- Click for Slide 29 (Instructions for Activity 2.3)
- Explain that interactions with the OAH app for urban streams will not only be about reporting data to scientists and public authorities, but also about receiving feedback, information, and further opportunities for engagement. The last thing the researchers want to ask to citizens is what kind of information they would like to receive in return.
- Distribute **Template 4** to all the participants.

What kind of information would you like to receive from a citizen tool (e.g. App)? Tick on those that are relevant for you. They should also provide a written note on reasons for choosing in the form.

A. Information about environmental status of urban aquatic areas around their residence (example: general levels of pollution and degradation, health status of water and soil) [ ]

B. Information about policymaking decisions affecting the urban aquatic areas (example: inauguration of new infrastructure, public works and their duration in the stream area, approval of new policy strategies or citizen initiatives, etc.) [ ]

C. Information about cultural and leisure activities taking place around the urban aquatic areas (example: NGO activities, festivals, sporting events) [ ]

D. Environmental warnings about the status of urban aquatic areas (example: risk of floods during severe weather episodes; severe pollution due to industry leak or similar) [ ]

E. Public health warnings and precaution advice on water-borne, mosquito-borne and other vector-borne diseases (example: high presence of parasites like ticks or mosquitoes; danger of exposure to substances or invasive species, risk of relevant diseases) [ ]

F. Social media feeds internal to the app and illustrating people's observations and their comments (examples: pictures taken by fellow citizens, other people's perceptions, concerns and need in the surrounding community) [ ]

G. Sharing contribution with peers via existing and external social media (Instagram, Tik Tok, others) [ ]

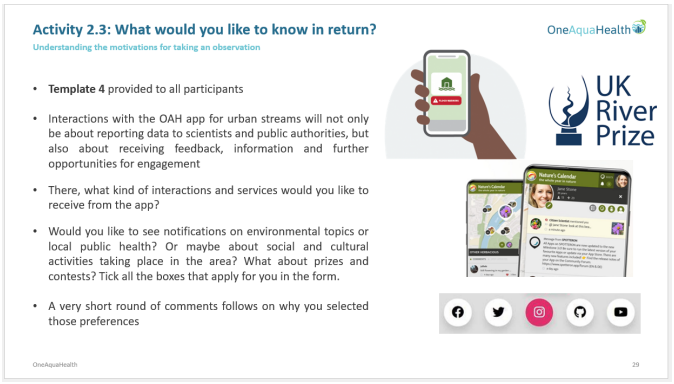
H. Being given the opportunity to participate into thematic contests on similar subjects (e.g. enter your observation for the chance of winning a prize) [ ]

I. Other: _____ [ ]

- **Short Recount and Possible Discussion:** Once everyone has finished, explain that you are going to call out each item on the list and ask participants that have selected that option to raise their hand and be counted. Briefly take note (or ask notetaker to do so). Next try to set-up a brief discussion of 5 minutes where willing volunteers should briefly motivate selected modalities. In this case try to summarize and gather common conclusions for the participants. When you feel it is done, go on to the conclusion of the Focus Group.

Example of Moderation:

"From this recount, I can tell that most of you would like to be informed about environmental and public health warnings. You would also like to have social media features to share contributions and you like the idea of winning prizes. Can you tell us more?"

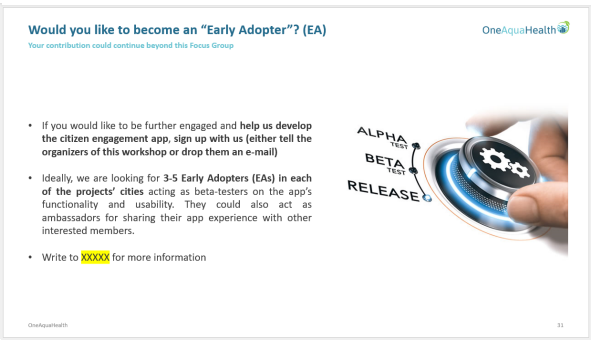


10.3.5Conclusion

What: Feedback session & Early Adopters Recruitment

Duration: Approx. 15 minutes

- Click for Slide 30 (Thank you and contact details)
- Announce that the Focus Group is now concluded. Remember your contact details (introduce them in the slide) and that participants can request to see the results of the session if they wish so.
- Provide a little space for open feedback on the activity. Ask the participants about the experience and if they have any comments. No more than 5 minutes.
- *(Possible slot for pictures.* Make sure to check that participants have agreed to this in the Informed Consent forms first*)*
- Click for Slide 31 (Call to Early Adopters)
- As a final argument, ask to the participants:
  - If they would like to be further engaged in the development to become **Early Adopters (EA).** In this way, they will help us develop a citizen engagement app for monitoring urban streams, public health / engagement opportunities and health threats. These individuals will provide critical feedback and insights during pilot testing in five diverse locations, ensuring the app's functionality and usability align with users' needs and preferences. We estimate that 3-5 EAs are required per site.
  - Further meetings with the Focus Groups' participants may be envisaged in a later stage (if they wish to attend). The EAs may have the opportunity to present the results and main motivations to the rest of the Focus Group members.



11 After the Focus Group: Guide to Reporting

11.1 Guidelines and format for the short summary report of discussions

- Once completed the execution of the Focus Group, results need to be transmitted from the place of the activity to the OAH partner responsible for data analysis in the citizens' need analysis (WISE).
- To do so, each Research Site (preferably the moderator of the event or an additional note taker/attending researcher, if present) needs to write **a short summary report** of the focus group they have been running **in English (minimum 1500 words)**, so that findings may become universally accessible to all involved partners. Try not postponing writing the summary, as the information should be fresh. **The research sites have been provided with a Focus Group Reporting Template to ease this task**.
- Remember that the Exercise templates are already there for assisting you in summarizing the arguments and stories from the citizens, and that they will also need to be shared with the other partners. Therefore, focus on arguments of discussions during the activity, so that we may all capture the additional information (e.g. opinions, perceptions) developed during feedback exchange.
- Remember that participants should in principle have a right to review results. Therefore, they might request to view and comment on the summary report. If asked, you should send them a copy via email and request for feedback in maximum one week. If there are specific comments from citizens, please make sure to include them and highlight what kind of changes/additional notes were requested. Do not correct the feedback unless there are clear mistakes.
- Whereas possible, **it is deemed extremely useful to record the Focus Groups** in order to produce comprehensive summaries. In this regard, research sites' responsible leads may find this resource including tips and suggestions relevant to achieve the best recording quality possible: How to record a focus group for transcription (productiontranscripts.com).

We provide more detailed instructions on how to write the summary report in this section, whereas the full template is available in the corresponding Annex.

Part I: Introduction

- First, fill out a series of technical details:
    - City of the Focus Group
    - Location (Venue)
    - Date & Time of the activity
    - Full name and title of the Moderator
    - Full name of note taker or any other observers
    - List of the participants, including your own matrix/table of how these fulfilled the criteria

- Then, describe shortly the group in such a way that an outsider gets a feel for the people who joined the focus group. It should depict the group as a whole, possibly singling out one or more members related to some characteristic. Note any other aspect that characterises the group or

any particular dynamic that occurred during the focus group execution (e.g. the “talkatives”, the “silent ones”, high/low involvement).

Part II: Exercise 1

- Provide a summary of group discussion in A1.1 and describe the type of daily life experiences of participants in urban stream areas. Make sure to capture the peculiarities of their descriptions and their impressions about the aquatic areas. If there are any specific arguments/points particularly worth of note, please remark them.

- Provide a summary of group discussion in A1.2 and describe the type of perceptions or additional thoughts given by participants. If there are any specific arguments/points particularly worth of note, please remark them.

- Provide a summary of group discussion in A1.3 (Recreational Function) and describe the type of reasons or additional thoughts given by participants. If there are any specific arguments/points particularly worth of note, please remark them.

- Provide a summary of group discussion in A1.3 (Natural Habits and Flood Control) and describe the type of reasons or additional thoughts given by participants. If there are any specific arguments/points particularly worth of note, please remark them. Please consider separate paragraphs for the role of streams as natural habitats and for the public health threat considerations.

Part III: Exercise 2

- Provide a summary of group discussion in A2.1 (Digital and technological features). Focus on ranking the most selected options for the features of the app and note down all comments as to why they chose to select them.

- Provide a summary of group discussion in A2.2 (Why would I choose to do this?). Try to summarize and rank the main and most frequent reasons for making an observation via app and the ones for not doing this. If there are any specific arguments/points particularly worth of note, please remark them.

- Provide a summary of group discussion in A2.3 (What would I like to know in return?). Try to summarize and rank the main and most frequent choices of feedback from the app. Try to capture the main reasons/preferences behind these choices. If there are any specific arguments/points particularly worth of note, please remark them.

PART IV: Conclusions

- Provide a summary of any final open discussion and feedback on the activity, if any.

- Provide the list of voluntary Early Adopters (EA) that would be likely to help in development and future testing of the citizen engagement app.

11.2 Format for the translation of written feedback (templates)

- To take the most out of available data, we also require you to fill a second part of the form in which you will provide a literal translation in English of the written feedback provided by participants.
- For most activities, you need to fully translate the notes written in the templates.
- For multiple choices, you will be requested to list a ranking that allows us to have minimum quantitative data.

11.3 Materials to be delivered

Please, remember that for the successful completion of the activity, you must provide:

- All the consent forms of the participants duly signed.
- Visual proof of the execution of the activity (pictures, short videos)
- The Focus Group report in English language, of minimum 1500 words and filled through the instructions above and in the template form in the Annex.
- A translation of the written feedback provided in the templates by all participants according to the template form in the Annex.

11.4 Deadline for Submission

Please, remember that for the successful completion of the activity, the responsible partner (WISE) **must receive all the reporting materials by the end of April 2024**. This will provide the necessary time for analysis and integration of the findings in the report.

Annex B: Focus Group Template 1

Exercise 1: What is your perception of Urban Streams in your city?
Activity 1.1 - 1.2

OneAquaHealth

Name of Participant (City):

Describe the type of experience	What was the general scenery of the area and the state of the water? Please describe	What were your immediate feelings in each of these scenarios?	Did you have any other thoughts about the matter?
For example: strolling nearby for a walk; heading to school/work and crossing/walking nearby/doing physical exercise; having a picnic/ laydown/playing by a streamside; hanging out with friends; etc..	For example: large/small, sideroad, isolated, immersed in green area, heavily urbanised... Also, what was the stream like? Did it look nice and green? Was it "dirty and ugly"? Was it dry during summer; it is much greener and "nicer" in spring or winter...?	For example: total indifference, peaceful take-in of the scenery, relaxation, indignation for the poor state of the water.	For example: blaming the local institutions for not addressing the matter; wishing that they would live somewhere more rural and greener; felt like they would have to come to this place more frequently, etc.

1/2

Exercise 1: What is your perception of Urban Streams in your city?
Activity 1.1 - 1.2

OneAquaHealth

Name of Participant (City):

Describe the type of experience	What was the general scenery of the area and the state of the water? Please describe	What were your immediate feelings in each of these scenarios?	Did you have any other thoughts about the matter?
For example: strolling nearby for a walk; heading to school/work and crossing/walking nearby/doing physical exercise; having a picnic/ laydown/playing by a streamside; hanging out with friends; etc..	For example: large/small, sideroad, isolated, immersed in green area, heavily urbanised... Also, what was the stream like? Did it look nice and green? Was it "dirty and ugly"? Was it dry during summer; it is much greener and "nicer" in spring or winter...?	For example: total indifference, peaceful take-in of the scenery, relaxation, indignation for the poor state of the water.	For example: blaming the local institutions for not addressing the matter; wishing that they would live somewhere more rural and greener; felt like they would have to come to this place more frequently, etc.

2/2

Annex C: Focus Group Template 2

Exercise 1: What is your perception of Urban Streams in your city?
Activity 1.3

OneAquaHealth

Name of Participant (City):

Function/Services of Urban Streams (check the slide in front of you)	Recreational function (Urban stream areas as ideal places for performing physical (walking, dog walking, running) and leisure activity (picnic, hanging out) with a beneficial effect for residents in the area ("Green & Blue Areas")
Why or why not? Reason 1 and 2	
Did you notice any changes over time in your urban stream area? Were they cleaned/restored/provided with new equipment? Or did they get worse? Bullet points	
Can Urban Streams (and surroundings) in your area perform this function?	YES / NO

Exercise 1: What is your perception of Urban Streams in your city?
Activity 1.3

OneAquaHealth

Name of Participant (City):

Function/Services of Urban Streams (check the slide in front of you)	Natural habitats, Improvement of Air Quality, Temperature Regulation and Flood control (Urban stream areas can help in improving a city's living environment through a high biodiversity (e.g. different species of plants, insects, and animals) or even as a natural solution regulating temperature or counteracting impoverishment of air quality in cities, floods etc.
Why or why not? For example: YES, because there is abundant vegetation and animal presence (any concrete examples of vegetations or animals such as fish or birds?); there is a high number of streams throughout the cities; NO, because they are too polluted; there is insufficient vegetation; the streams hold little water, they look and feel degraded (e.g. bad smell, water colour), there are parasites in the stream (e.g. mosquitoes, ticks)	
Did you notice any changes over time in your urban stream area? Were they cleaned/restored/provided with new equipment? Or did they get worse? Bullet points	

Can Urban Streams (and surroundings) in your area perform this function?	YES	NO

Annex D: Focus Group Template 3

Exercise 2: How and why would you actively contribute to environmental observation?
Activity 2.1

OneAquaHealth

Name of Participant (City):

What digital and technological features would you use for an observation? Tick on those that are relevant for you. They should also provide a written note on reasons for choosing in the form

Having a specific app on your mobile phone to be used for observations	
Having the possibility to report via a system integrated in an already existing tool (e.g. local council app)	
Writing a text-based post on social media to inform the local community (e.g. Facebook)	
Writing a text-based message only to local authorities based on standard form with quick access	
Having a quick form where you can select options rather than writing	
Having a quick conversation about your observation with a virtual agent	
Allow the tool to automatically extract specific coordinates' information about the location of the observation (Geolocation)	
Personally introduce information about the specific location where you took the picture (No satellite location)	
Just taking a quick picture/video of the place of observation to be included in the observation	
Including both text and audiovisual content in the observation (picture/video)	
Sharing the content of your observation with peers via existing and external social media (Facebook, Instagram, TikTok, others)	
Be willing to carry around a digital sensor while you cross urban stream areas (for example, a keychain shaped object attached to your bag. Data would be automatically acquired with no further action from you)	
Be willing to stop and take out a digital sensor that will only be activated by you via mobile when you want to make an observation	
Be willing to install a sensor on your garden, balcony, or rooftop if you live nearby an urban stream area	
Other	

1/2

Exercise 2: How and why would you actively contribute to environmental observation?
Activity 2.2

OneAquaHealth

Name of Participant (City):

Why would you choose to do this?

Please provide up to four reasons on the form on why they would feel compelled to communicate issues in the Urban Stream area with an app (For example: I am concerned about the growing spread of animal-borne diseases; I feel it is the right thing to do to protect the environment; I think it would make the neighbourhood a better place; I think it's a civic duty; I am concerned about extreme weather and flood risk)	
Please provide up to four reasons why they will/ could not communicate issues about the Urban Stream area with an app. Think about practical reasons or beliefs that would make you "look the other way" (For example: I am a really busy person, and cannot stop and report; I usually pass by on my way to work/ school and would not stop to report; it could be a waste of time since nobody is going to react to my reporting; I am really not interested in the topic; It's too complicated for me to use digital apps for reporting; It is not my duty to do this, local city services should deal with it)	

2/2

Annex E: Focus Group Template 4

Exercise 2: How and why would you actively contribute to environmental observation?
Activity 2.3

OneAquaHealth

Name of Participant (City):

What kind of information would you like to receive from a citizen tool (e.g. App)? Tick on those that are relevant for you. They should also provide a written note on reasons for choosing in the form

Information about environmental status of urban aquatic areas around their residence (example: general levels of pollution and degradation, health status of water and soil)	
Information about policymaking decisions affecting the urban aquatic areas (example: inauguration of new infrastructure, public works and their duration in the stream area, approval of new policy strategies or citizen initiatives, etc.)	
Information about cultural and leisure activities taking place around the urban aquatic areas (example: NGO activities, festivals, sporting events)	
Environmental warnings about the status of urban aquatic areas (example: risk of floods during severe weather episodes; severe pollution due to industry leak or similar)	
Public health warnings and precaution advice on water-borne, mosquito-borne and other vector-borne diseases (example: high presence of parasites like ticks or mosquitoes; danger of exposure to substances or invasive species, risk of relevant diseases)	
Social media feeds internal to the app and illustrating people's observations and their comments (examples: pictures taken by fellow citizens, other people's perceptions, concerns and need in the surrounding community)	
Sharing contribution with peers via existing and external social media (Instagram, Tik Tok, others)	
Being given the opportunity to participate into thematic contests on similar subjects (e.g. enter your observation for the chance of winning a prize)	
Others	

Why did you choose these options?	

Annex F: Focus Group Reporting Template

OneAquaHealth

PROTECTING URBAN AQUATIC ECOSYSTEMS TO PROMOTE ONE HEALTH

Grant Agreement: 101086521

REPORTING TEMPLATE FOR RESEARCH SITES

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OneAquaHealth

PROTECTING URBAN AQUATIC ECOSYSTEMS TO PROMOTE ONE HEALTH

Guidelines and format for the short summary report of discussions

- Once the execution of the Focus Group has been completed, results need to be translated from the place of the activity to the OAH partner responsible for data analysis in the citizens' need analysis (WISE).

- To do so, each Research Site (preferably the moderator of the event or an additional note taker/attending researcher, if present) needs to write **a short summary report** of the focus group they have been running **in English (minimum 1500 words),** so that findings may become universally accessible to all involved partners. Try not postponing writing the summary, as the information should be fresh.

- Remember that the Exercise templates are already there for assisting you in summarizing the arguments and stories from the citizens, and that they will also need to be provided to the other partners. Therefore, try to focus on the arguments discussed after filling in the templates, so that we may all capture the additional information (e.g. opinions, perceptions) developed during the discussions.

- Remember that some participants may request to view and comment on the summary report. If asked, you should send them a copy via email and request for feedback in maximum one week. If there are specific comments from citizens, please make sure to include them and highlight what kind of changes/additional notes were requested. Do not correct the feedback unless there are clear mistakes.

A. Main Summary Report Template

Part I: Introduction

1. Technical Info

Research site information	
City of the Focus Group	
Location (Venue)	
Date & Time of the Activity	
Moderator (Full name and Title)	
Notetakers and/or other research team attendants	

2. Matrix of Participants

Participants' List	Admission Criteria (e.g. sex, age, background)
Participant 1	
Participant 2	
Participant 3	
Participant 4	
Participant 5	
Participant 6	
Participant 7	
Participant 8	
Participant 9	
Participant 10	

3. Describe the Group

Describe shortly the group in such a way that an outsider gets a feel for the people who joined the focus group. It should depict the group, possibly singling out one or more members related to some characteristic. Note any other aspect that characterises the group or any dynamic that occurred during the focus group execution (e.g. the "talkatives", the "silent ones", high/low involvement)

Part II: Exercise 1

1. Activity 1.1: Daily life experiences

Provide a summary of group discussion in A1.1 and describe the type of daily life experiences of participants in urban stream areas. Make sure to capture the peculiarities of their descriptions and their impressions about the aquatic areas. If there are any specific arguments/points particularly worth of note, please remark them.

2. Activity 1.2: Perceptions

Provide a summary of group discussion in A1.2 and describe the type of perceptions or additional thoughts given by participants. If there are any specific arguments/points particularly worth of note, please remark them.

3. Activity 1.3: Recreational function

Provide a summary of group discussion in A1.3 (Recreational Function) and describe the type of reasons or additional thoughts given by participants. If there are any specific arguments/points particularly worth of note, please remark them.

4. Activity 1.3: Natural Habitat & Flood Control function

Provide a summary of group discussion in A1.3 (Natural Habits and Flood Control) and describe the type of reasons or additional thoughts given by participants. If there are any specific arguments/points particularly worth of note, please remark them. Please consider separate paragraphs for the role of streams as natural habitats and for the public health threat considerations.

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Part III: Exercise 2

1. Activity 2.1: Digital and tech features of the app

Provide a summary of group discussion in A2.1 (Digital and technological features). Focus on ranking the most selected options for the features of the app and note down all comments as to why they chose to select them.

2. Activity 2.2: Why would I choose to do this?

Provide a summary of group discussion in A2.2 (Why would I choose to do this?). Try to summarize and rank the main and most frequent reasons for making an observation via the app and the ones for not doing this. If there are any specific arguments/points particularly worth of note, please remark them.

3. Activity 2.3: What would I like to know in return?

Provide a summary of group discussion in A2.3 (What would I like to know in return?). Try to summarize and rank the main and most frequent choices of feedback from the app. Try to capture the main reasons/preferences behind these choices. If there are any specific arguments/points particularly worth of note, please remark them.

Part IV: Conclusions

1. Final Open Discussion & Feedback to the activity

Provide a summary of any final open discussion and feedback on the activity, if any.

2. Early Adopters

Provide the list of voluntary Early Adopters (EA) that would be likely to help in development and future testing of the citizen engagement app.

Full Name	Email address

B. Instructions for written Translation Reporting

- To take the most out of available data, we also require you to fill a second form in which you will **provide a literal translation in English of the written feedback provided by participants**.
- For most activities, you need to fully translate the notes written in the templates.
- For multiple choices, you will only find a basic ranking table that allows us to have minimum quantitative data.

1. Template 1 (EX1, A. 1.1 and 1.2)

- Provide a list of the various episodes of interaction with urban stream water. If they are repeated, please count them, and indicate how often they were mentioned
  Examples:
  - *Passing through when going to work/school x 3,*
  - *Walking the dog x 2)*

- Provide each individual description of the stream as noted by participants in the template.
  Examples:
  - *Stream was small, dirty, full of littering and wild vegetation, tick experiences reported by friend with dog.*
  - *Stream was very clean, nice park area around it, gardened, could see fish swimming inside*

- Provide a list of all the feelings described by participants for these episodes in the template.
  Examples:
  - *Feelings of peacefulness and relaxation x 3 (for clean stream)*
  - *Feeling of disgust x 2 (for dirty stream)*

- Provide a list of the additional thoughts experienced by participants for these episodes and reported in the template.
  Examples (can be either in 1st or 3rd person) :

  - *"The local council is stealing our money, and they don't do anything for the city and the environment!"*
  - *Belief that they should move to the countryside.*

2. Template 2 (EX1, A. 1.3)

- Provide a recount of Y/N answer to Recreational function
  (e.g. Y x 3, N x 7)

- Provide a list of all the reasons listed by participants for recreational function.

Examples:
- For Yes:
** We have a lot of people experiencing green areas and streams already*
** The local council is really invested in making this possible*
** We have beautiful green areas in our city*

- For No:
** It's too dirty and it's impossible to access areas near them*
** The local council does not care about this in our city*
** We have too many industries polluting our area*

- Provide a list of answers to the question on changes over time.
  Examples:
  - Yes, small improvements, but only gardening, no infrastructure
  - No, nothing has changed for at least 10 years

- Provide a list of all the reasons listed by participants for natural habitat function.
- *Examples:*
  - For Yes:
  ** We have green areas very rich with vegetation and animals*
  ** I heard the local council has set up a plan for flood control by using rivers and streams*
  - For No:
  ** You can see it's too dirty and there are no plants or fish*
  ** It's full of mosquitoes, ticks, and other horrible parasites*

- Provide a list of answers to the threat to health.
  Examples:
  - Yes, my dog got ticks around the stream a couple of years ago and it made me suspicious for my health
  - Yes, the river is full of algae and smells bad, makes me worried it is polluted
  - Yes, the last few rains there have been small episodes of flooding, they had to close the street nearby
  - No, nothing has changed for at least 10 years
  - No, I never thought about it.

3. Template 3 (EX2, A. 2.1 and 2.2)

- Provide a ranking of the multiple-choice answers based on times they were selected:
  Examples:
  1. Having a specific app on your mobile phone to be used for observations (7 mentions)
  2. Just taking a quick picture/video of the place of observation to be included in the observation (6

mentions)
etc.

- If any additional discussion was given on motivation for these features, please list them below:
  Examples:
  - Everyone agrees these days that you need social features in an app!
  - I don't want to lose more than 1-2 minutes for doing this!
  - I do not want to be geolocated, I car about my privacy!
  etc.

- Provide a list of all the reasons listed by participants for taking an environmental observation (positive commitment)
  Examples:
  - I am concerned about the growing spread of animal-borne diseases
  - I feel it is the right thing to do to protect the environment
  - I think it is a civic duty.

- Provide a list of all the reasons listed by participants for not communicating the issue in urban stream areas (lack of commitment)
  Examples:
  - I am a busy person and cannot stop and report
  - I usually pass by on my way to work/school and would not stop to report
  - It's too complicated for me to use digital apps for reporting.

4. Template 4 (EX2, A2.3)

- Provide a ranking of the multiple-choice answers based on times they were selected:
  Examples:
  1. Environmental warnings about the status of urban aquatic areas (example: risk of floods during severe weather episodes; severe pollution due to industry leak or similar) (5 mentions)
  2. Being given the opportunity to participate into thematic contests on similar subjects (e.g. enter your observation for the chance of winning a prize) (3 mentions)
  etc.

- If any additional discussion was given on motivation for these features, please list them below:

Examples:
- I'd love to be informed through notifications
- I think that sharing buttons on social media are useful for spreading the word
etc.