Fraunhofer

Event Report of the Digital Morgenstadt Conference

Water in the City of the Future

Within the Network

MorgenStadt
City of the Future

Editorial

For many municipalities, climate adaptation is no longer new territory. However, as in the area of climate protection, an intensification of municipal activities is necessary to shape the future in the best possible way. The Morgenstadt Network of the Fraunhofer Society therefore aims to network interested participants in this topic and to promote cooperation among each other. In addition, the Morgenstadt Network would like to use this conference to initiate concrete new projects in the field of climate-adapted water management.

The conference was organised in cooperation with the Fraunhofer Institutes IAO, IGB and ISI in an interactive digital format with an international orientation. The event was supported by the partners HafenCity University Hamburg, HAMBURG WASSER and the Agency for Environment, Climate, Energy and Agriculture of the City of Hamburg. In the following you will find an event report to read about the conference contents.

Day 1

September 30th, 2021

Welcoming address at the opening of the conference

Dr. Eva Ottendörfer opens the digital Morgenstadt conference "Water in the City of the Future" with a brief introduction of the Morgenstadt initiative. Dr. Renate Taugs, Head of the Office for Water, Wastewater and Geology of the Hamburg Ministry for the Environment, Climate, Energy and Agriculture, also welcomes the participants and emphasizes Hamburg's role as a pioneering city in the field of climate adaptation. Especially in the field of sustainable urban water management, she said, the City of Hamburg's 2019 "Hamburg Climate Plan" marks the importance of the issues for municipal administration and urban infrastructure development. The linking of different stakeholders as well as area-wide investments in the field of water infrastructure are two particularly important challenges for the city of the future. In this context, the Morgenstadt Conference promotes the networking of stakeholders, stimulates the exchange of knowledge in the areas of water management, climate adaptation and climate protection and thus makes a decisive contribution to initiating further projects.

Dr. Eva Ottendörfer,
Fraunhofer Institute for Industrial Engineering IAO

Dr. Renate Taugs,
Hamburg Ministry for the Environment, Climate, Energy and Agriculture

Successful climate adaptation in cities. Interaction of strategic perspectives and their operational implementations

Keynote

The "Climate Report Hamburg" published in September 2021 shows that the temperature increase in the city over the last 140 years has already reached the 1.7 °C mark. The far-reaching consequences include a longer vegetation period and an associated increase in the water requirements of plants. Heavy rainfall events are increasing in frequency and intensity in Hamburg, but districts affected by them are difficult to predict. In addition to the need to adapt to climate change, Hamburg is a growing city with a growing need for infrastructure maintenance.

In the keynote of the first day "Successful climate adaptation in cities: Interplay of Strategic Perspectives", Dr. Birgit Schiffmann, Head of the Climate Adaptation Unit/ RISA at the Hamburg Ministry for the Environment, Climate, Energy and Agricultural Economics, vividly presents the individual elements of Hamburg's climate change adaptation strategy. Important pillars are the Hamburg Green Roof Strategy, the Hamburg Climate Plan and the Rain Infrastructure Adaptation (RISA). The current Hamburg Climate Plan, which for the first time also deals with heavy rainfall precautions and sustainable rainwater management, heat precautions and security of supply for critical infrastructures, is thus closely related to the overarching goals of RISA. The heavy rainfall hazard map, which is in great demand, is one of the technical planning foundations on which the development of the city's blue-green infrastructure is based. Its integration in existing buildings as well as in neighbourhood development is illustrated by numerous best practice examples. The close cooperation of local stakeholders from planning to implementation is an important prerequisite.

In the second part of the keynote, Christian Günner, Head of Infrastructure Coordination and Urban Hydrology at HAMBURG WASSER, discusses the implementation of the above-mentioned strategies in Hamburg. He emphasizes the necessity of thinking about material flow separation and different uses of wastewater, gray water and rainwater at an early stage in the planning process. Central to this are multifunctional facilities for rainwater management, which help to ensure that areas no longer drain rainwater into the sewage system. As a joint municipal project of HAMBURG WASSER and the Department of the Environment and Energy, RISA has created a dynamic with regard to rainwater management, which now needs to be transformed into a process in the next step. This should be handled in line by the administration and by the company and coordinated by the RISA control centre. The RISA process includes content-related topics such as flood prevention or dealing with drought and heated soils, but also the creation of data bases, the supervision of concrete implementation projects and communication with owners and investors.

In response to the audience's question about the future challenges of urban water management in Hamburg, Günner emphasised the need for greater agility and the development of communication and information tools that support water management companies in infrastructure development through simulation. He also emphasises the importance of pilot projects as well as the interlinking of infrastructure projects, for example in the field of water and wastewater, in order to bring about city-wide implementation.

Dr. Birgit Schiffmann,
Hamburg Ministry for the Environment, Climate, Energy and Agriculture

Christian Günner,
HAMBURG WASSER

Source separation sewer system and recovery plant in Helsingborg, Sweden.

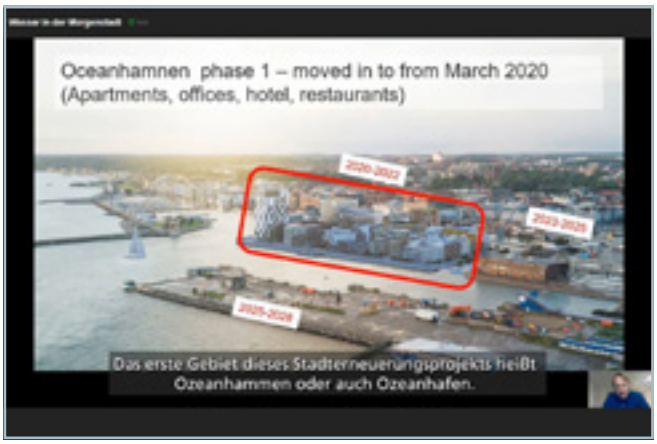
Impulse lecture 1

What does a holistic approach to wastewater management and resource recovery look like? The first keynote lecture is held by Dr. Hamse Kjerstadius from NSVA (Nordvästra Skånes Vatten och Avlopp) on an urban regeneration project in the Swedish city of Helsingborg. The project will transform an industrial area by the old harbour into a mixed-use area with flats, shops, hotels and restaurants. The project is in its first phase, where the first residents have already moved into the new flats in the Oceanhamnen area, which are equipped with kitchen waste disposal systems and vacuum toilets. A three-part sewage system allows the collection of food waste, black water and gray water.

Central to this holistic approach is the district's wastewater and food waste recovery facility "Reco Lab," a demonstration of the wastewater treatment plant of tomorrow, equipped with a test environment and showroom. This enables the recovery of up to 80% of gray water as drinking water, as well as the extraction of energy, and nutrients and organic materials from the black water, which can be recycled as fertiliser pellets developed with the cooperation of agriculture.

Dr. Kjerstadius also reports that especially the waste management meets with great approval among residents. In conclusion, he states that the biggest challenge at the moment is the dissemination of already available information about the innovative developments in the field of wastewater. In the discussion that follows, Dr. Kjerstadius continues that the implementation of the project by private developers under specifications for the required systems has been very successful.

The water extraction in drinking water quality is highlighted as particularly interesting, which finds many areas of application and is initially used in a swimming pool with the long-term goal of use as drinking water. A major challenge is currently the treatment of sewage sludge for agricultural purposes, as this contains micropollutants that must not be allowed to enter the soil. As an outlook, reference is made to a follow-up project in the storage and utilization of (waste) water on the island of Gotland in Sweden.



Urban renewal project "Ozeanhammen", in Helsingborg, Sweden.

Dr. Hamse Kjerstadius,
NSVA – Nordvästra Skånes Vatten och Avlopp

Transformation potentials in the water management of urban districts

Impulse lecture 2

What are the challenges and opportunities of urban water management from an administrative perspective? The second keynote speech, given by Cristina Saravia Arzabe from the Federal Environment Agency, deals with transformation potentials in the field of water management of urban districts. With regard to new challenges in urban water management, she talks primarily about increasing urbanization and the associated competition for space, as well as climate change, the effects of which were particularly evident this year with flooding caused by heavy rainfall events. However, it also highlights that the transformation of water infrastructure offers opportunities for increased quality of life, environmental protection and economic efficiency.

Looking at the history of wastewater treatment and disposal, it becomes clear how far-reaching and closely linked the different aspects of health protection, resource use and pollution prevention are and how important the reuse of water will be in the future. In the course of the presentation, the question of the future viability of centralised wastewater treatment is also raised and the need for a strong infrastructural change as well as an increase in acceptance and identification of the city's inhabitants is pointed out.

The project "Leipziger BlauGrün" (Leipzig BlueGreen) serves as an illustration of the topics discussed, in which the comprehensive integration of blue-green infrastructure is planned for the development of a resource-efficient and drainage-free urban quarter with the aim of relieving the sewer system and making rainwater usable for irrigation. Furthermore, reference is made to the working group "Urban Environmental Protection" at the Federal Environment Agency, which focuses on ways to drain-free urban neighbourhoods, infrastructures of urban growth regions, climate-resilient and sustainable infrastructures and controllable urban material flows.

In the conclusion, Cristina Saravia Arzabe points out how important it is to take advantage of windows of opportunity, especially in new construction and renovation, as well as to create greater awareness and identification with the issue among the population. In the discussion, the disposal and recycling of wastewater in the urban district is taken up, which will also play a major role in the future. The most urgent challenge at the moment, the change in local weather due to climate change, is also addressed again. The lecture impressively illustrates the relevance of the close interaction between research and administration.

Leipziger BlauGrün – Blue-green district development in Leipzig.

Cristina Saravia Arzabe,
Federal Environment Agency

Blue-green-grey infrastructures and their contribution to climate-friendly urban development

Impulse lecture 3

At the beginning of the keynote speech on "Blue-green-grey infrastructures and their contribution to climate-friendly urban development", Martina Winker from the Institute for Social-Ecological Research (ISOE) presented the project "netWORKS", which aims to investigate possible couplings of blue-green-grey infrastructures. The project analyzes different infrastructures with regard to their potential and differentiates between the benefits of different infrastructure components. Based on this, product info maps were created to assign the measures to different urban climate areas and to give an overview of different climatic areas and the corresponding measures.

From the monitoring of the planning processes of the projects in Berlin and Norderstedt, the conclusion can be drawn that planning should be more strongly oriented towards the framework conditions and resources of the city in order to formulate concrete goals and thus work out the real potential of the measures.

Dr. Winker pleads for the topic of climate justice to be taken into account in a holistic sense as early as the preliminary planning stage by looking at different perspectives, such as the rainwater perspective or the heat perspective, and thus focusing on particularly vulnerable groups.

In the subsequent discussion, the difficulties in integrating technical issues are addressed. The central challenge is to address all urban stakeholder groups in a way that is appropriate for the target group and includes the respective perspective. With regard to the availability of resources for planning projects, the discussion points out that large cities are often already well positioned, but smaller municipalities face capacity-related challenges in organizing processes. Often, a large amount of information exists, but specific implementation on site does not take place due to staff capacity bottlenecks. Here, blueprints, templates and a mutual transfer of knowledge could support the municipalities.

Steps in the preliminary planning phase.

Dr. Martina Winker,
Institute for Social-Ecological Research
ISOE

How can the implementation of innovations in the neighbourhood be accelerated?

Workshop

The acceleration of transformation processes in neighbourhood development is the starting point of the first workshop of the conference, led by Dr.-Ing. Marius Mohr and Christiane Chaumette from Fraunhofer IGB.

After a short round of introductions, which shows a diverse field of participants from research, city administrations and industry, discussions take place in two working groups. The first group focuses on concrete experiences in neighbourhood development and the drivers of past and future changes in the neighbourhood. The second working group focuses on the factors that hinder and accelerate innovation in the neighbourhood.

Various implementation experiences are shared in the first working group, including the implementation of tree rigs and green infrastructure in Bochum, the HAMBURG WATER Cycle®, an integrated rainwater concept in Lünen, and the "DEUS 21" project in Knittlingen. A common feature in the "brake blocks" of the projects was a lack of communication at the beginning of the projects due to a multitude of involved offices, implementing companies and disciplines. In some cases, this led to a slowdown in implementation, which was mostly overcome in the further course of the project by establishing a common project language and improved communication between the specialist levels. With regard to the changes of the past years, the working group points out that there is currently a lack of graduates in the administrations, which leads to a shortage of skilled workers due to an unattractive wage structure. A lack of a cooperative climate between municipalities and consulting firms is also highlighted as a further problem. With a view to future changes, the group emphasizes the increasing importance of climate change in public perception and the importance of joint implementation of projects by municipalities, business and civil society.

The second working group looks in detail at the factors for accelerated implementation of innovations in the neighbourhood and takes a closer look at networks, associations, organizational structures as well as laws and funding programmes. In the area of organizational structures, the systematic provision of information on the basis of guidelines, which could stimulate further pilot projects, is introduced in particular. In addition, the topics of cooperation, involvement of actors in the urban system beyond a concrete project, as well as the promotion of the agility of city administrations through the reorganization of official structures are at the center of the debate. The use of data-based decision-making and the increased use of digital tools are seen as helpful in this context. In the context of possible legislative changes to promote innovation, the proposals focus on the obligation to implement necessary adaptation measures in the neighbourhood, such as private rainwater storage. In addition, flood proofing as well as the use of flood maps for planning could be prescribed by law and thus function as a basis for action and decision-making at the municipal level. The criticism here is that planners and architects often do not check all water management issues, partly due to a lack of specialist knowledge. This could be counteracted by centralizing the area of responsibility.

Following the exchange in the working groups, the results of both groups are presented in the plenary and feedback on the results of the work is obtained.

Dr.-Ing. Marius Mohr,
Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB

Christiane Chaumette,
Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB

HAMBURG WATER Cycle® in the “Jenfelder Au”

Digital Excursion

The digital excursion to the HAMBURG WATER Cycle® in the Jenfelder Au takes place with the help of a 360° application configured from various panoramic images of the study area in the east of Hamburg. This gives the participants a comprehensive insight into the area and, with the help of the integrated image and video material, they learn more about individual measures and technologies. The participants are guided by Narne Hinrichsmeyer (engineer for project development at HAMBURG WASSER) and Mario Wolf (research assistant at the Bauhaus University Weimar), who explain the individual technological components and their integration into the overall material flow system. In addition, Narne Hinrichsmeyer provides information on technical and operational factors surrounding the HAMBURG WATER Cycle® project.

At the beginning of the virtual tour through the Hamburg urban quarter Jenfelder Au, Mario Wolf gives a general introduction to the history and goals of the quarter and the research project. The HAMBURG WATER Cycle® is a sustainable wastewater infrastructure system based on an integrated holistic material flow separation system. Participants will learn how the individual wastewater sub-streams of rainwater, gray water and blackwater are separately collected, discharged and managed. Rainwater management is carried out via retention basins (Kühnbach pond) and green spaces with design and urban development added value.

The management of gray water (total wastewater without toilet discharge) is currently at the research stage. In the HAMBURG WATER Cycle®, the gray water is fed into the depot via separate pipes and measured to determine its composition and concentrations. Due to its properties, the gray water is purified in the depot in an energy-saving manner and then made available to the households in Jenfelder Au as service water (toilet flushing water, irrigation water).

The more complex management of blackwater is carried out with a negative pressure network, which transports the blackwater from the negative pressure toilets installed throughout the area in negative pressure pipes to the HAMBURG WASSER depot adjacent to the neighbourhood. In the pumping station, co-substrates (from the food industry) are first crushed for increased energy production and then added to the blackwater. During the digital excursion, the participants learn how resource-efficient wastewater management is implemented and operated in the Hamburg city district by separating the material flows into black and gray water.

City District “Jenfelder Au”. Hamburg.

Mario Wolf,
Bauhaus-University Weimar

Narne Hinrichsmeyer,
HAMBURG WASSER

Day 2

October 1st, 2021

Welcome and outlook for the day

The second conference day begins with a short summary of the first conference day and an outlook on the second, with presentations on urban water management, nature-based solutions, climate change mitigation and climate impact adaptation, a workshop on data-based solutions for urban water issues and a concluding digital excursion through the Hamburg district "Am Weißenberge".

Dr. Eva Ottendörfer,
Fraunhofer Institute for Industrial Engineering IAO

Susanne Bieker,
Fraunhofer Institute for Systems and Innovation Research ISI

Water management instead of urban area water drainage – Transition using the example of an urban district in Lünen

Keynote

Coming from the transition theory, Dr.-Ing. Jutta Niederste-Hollenberg from the Fraunhofer Institute for Systems and Innovation Research ISI explains the pressure for action in the areas of climate, demography, technology and society that affects the system in which we move. Here she highlights in particular the poor water quality in German waters and the land congestion in cities, which require climate adaptation at different levels: in the city, in the countryside, and in relation to rivers.

Dr.-Ing. Niederste-Hollenberg pleads for a paradigm shift in urban water management towards targeted water management. She illustrates this by presenting the water infrastructure concept i.WET (integrated water-energy-transition concept), which combines sustainable water management with high resource efficiency and the potential for successive implementation in existing buildings. The core of the concept is the i.WET avenue shown, which encompasses both the inside and outside of the building.

The i.WET concept is being implemented on the industrial "Coers site" in Lünen (NRW). The multi-apartment buildings currently under construction can be occupied from spring 2022 and the performance of the i.WET alley can be tested in operation accordingly from mid-2022. The central element of the sustainable rainwater management are three large cisterns, which serve the retention and storage of rainwater and the irrigation of the greenery. Gray water treatment including heat recovery takes place in the basement of the buildings and is used for toilet flushing.

In summary, the speaker emphasized that windows of opportunity, such as depreciation cycles or renovation cycles for the integration of sustainable water management systems, must be recognized and used in order to react to the changes in the course of climate change by means of blue-green infrastructures, among other things. An innovative combination of decentralized and centralized, but also conventional and innovative elements in the treatment, storage and use of water is essential. This combination and introduction of new components requires the early involvement of all relevant actors and a consistent will for change in the local authorities and municipalities.

The i.Wet concept.

Dr.-Ing. Jutta Niederste-Hollenberg, Fraunhofer Institute for Systems and Innovation Research ISI

Ressource efficient city districts, selected water highlights.

Impulse lecture 1

During the first keynote lecture of the second day, Michael Richter, research associate at HCU, provides insights into the joint project "BlueGreenStreets (BGS)", which deals with blue-green infrastructures in street spaces.

When dealing with precipitation water in street spaces and urban neighbourhoods, the retention and storage of water for plant irrigation and its subsequent evaporation is preferable to infiltration or drainage. In this context, Richter emphasizes the goal of decentralized water management, for example in the creation of vital tree sites, as their irrigation with drinking water is no longer fit for the future. The effects of the individual BGS measures on the soil water balance will be scientifically monitored and evaluated over the next few years. The current media coverage in Hamburg shows that the communication of the BGS measures has a strong political appeal in the transition to sustainable transport systems.

Christiane Chaumette, research associate at the Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB, presents findings from the "Road of the Future" and "Leipzig BlueGreen" projects in the second part. As part of the "Road of the Future" project, samples of the road runoff of a bicycle and a car road in Ludwigsburg were taken and the variability of contamination was investigated with regard to different influencing factors. The exemplary life cycle analysis (LCA) of a 1m³ rainwater cistern illustrates the environmental impacts, for example, in connection with the transport of the collected water (shown below in blue), which from an ecological point of view argues for a local use of the water.

In the context of the "Leipzig BlueGreen" project, Chaumette presents a carport with a retention green roof at the Helmholtz Centre for Environmental Research in Leipzig, which consists of a water retention space, the substrate or soil and a plant layer. The various sensors installed serve different research purposes, such as the decentralized control of the water supply on the roof using weather data. The weight and water balance, aspects of building air conditioning and biological water purification are also being investigated.

In the discussion that followed, the speakers emphasized the need for many more pilot projects like the i.WET-Allee, which also need to be rolled out more quickly. This could provide an impetus for regulatory institutions to adapt currently inhibiting regulations to the requirements of blue-green infrastructures. To this end, the actors must leave behind the silo thinking in infrastructure planning and focus more on the interfaces between buildings and the external infrastructure.

Tree locations in Hölertwiete, Hamburg.

Christiane Chaumette,
Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB

Michael Richter,
HafenCity University Hamburg

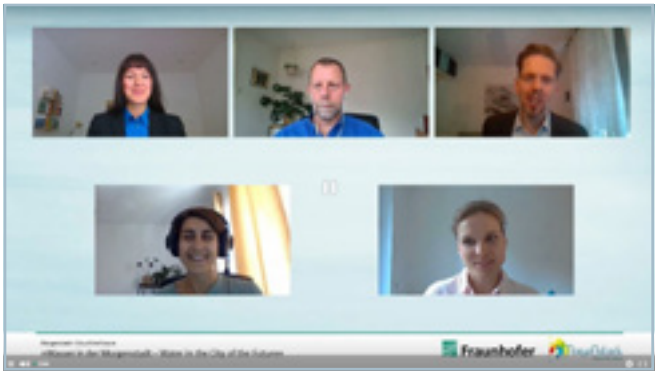
SMARTilience – climate protection and climate impact adaptation

Impulse lecture 2

Olga Izdebska (HafenCity University Hamburg) and Alexandra Idler (City of Mannheim) jointly present a current project in the context of climate protection and climate impact adaptation in the second keynote lecture. Olga Izdebska begins the presentation by introducing the BMBF-funded project "SMARTilience" to the audience. On its platform, various relevant climate protection areas and adaptation measures can be selected from a governance toolbox and information such as cost overviews or argumentation aids for specific goals are made available. Olga Izdebska also explains the work in the real laboratory in Mannheim in the SMARTilience project and the practical test field for measures relating to heat and heavy rain. In addition to the creation of a heat action plan and a geodata use strategy, the city is a test field for the Urban Governance Toolbox and is in close exchange with other municipalities. For a better understanding, she explains the creation of a heavy rain hazard map for Mannheim-Casterfeld, which is used as a basis for planning adaptation measures. Another measure of the real laboratory are two new climate measuring stations, which as a pilot project are to contribute in the long term to the establishment of an area-wide measuring network according to DWD standards in the Mannheim region. This should improve the assessment of weather conditions and support any climate adaptation planning measures.

The geodata use strategy will also serve as a basis for planning and coordination documents and create implementation measures, identify optimisation potentials and data gaps, record danger areas for flooding and thus contribute to formulating adaptation needs. The collected data will be centralised via this system and should thus be able to be used more specifically and efficiently for the formulation of goals and measures in the field of climate impact adaptation.

In the subsequent discussion, the importance of the sponge city principle in Mannheim is emphasized. Climate protection and climate adaptation are in conflict with each other in some cases, but can be dealt with in a complementary and synergetic way by means of a joint department or joint monitoring, as the example of Mannheim shows.



Discussion forum

Olga Izdebska,
HafenCity University Hamburg

Alexandra Idler,
City of Mannheim

Nature-Based Solutions for Urban Water Challenges

Impulse lecture 3

After a short introduction to the UNALAB project, Luuk Postmes (City of Eindhoven) highlighted the challenges that the city of Eindhoven is facing with rising heat and constant flooding in the inner city area. To prevent both hazards, Eindhoven is greening public spaces as well as streets and building facades.

The analysis of these measures showed that green spaces with grass and flowers are cheaper to implement than sealed streets. With regard to water, UNALAB is experimenting with various nature-based solutions, such as greening options based on natural cycles. From the implementation experiences, a handbook was created that illustrates different nature-based solutions and describes their effects. A key finding of the implementation so far is that green spaces are used more often and more intensively than sealed surfaces. In addition, investors are to be activated to invest in new construction methods and near-natural area designs. Ultimately, such activation can often only be achieved through binding guidelines.

In the concluding discussion, the adaptation of nature-based solutions to the accompanying increase in water demand in the city was discussed. For a long time, Eindhoven had no irrigation problems due to high groundwater. However, the summers of 2019 and 2020 showed that new solutions will also be needed in the future. For this, Eindhoven relies on the selection of more drought- and heat-resistant plants, as irrigation with drinking water is to be dispensed with.

Nature-based solutions in Eindhoven, Netherland.

Luuk Postmes,
City of Eindhoven

Mini Workshop with DKSR – Data based solutions for urban water challenges

Workshop

What are the biggest challenges in the field of water that could be overcome with data-based solutions? The second day of the conference featured a workshop by the Data Competence Centre Cities and Regions (DKSR), led by Eva Schmitz and Lukas Koch. DKSR provides cities and municipalities with an urban data platform as well as the necessary know-how to put them on the path towards smart cities with the help of data-based solutions.

Using the method of the design thinking process, workshop participants first collect challenges on the topic of urban water management and identify involved actors in a second step. Using a "how might we" question, the different aspects are summarized in order to find possible solutions for the individually defined scenarios. In the subsequent exchange, challenges and ideas for their solution are discussed and concretized by means of different data.

The challenges discussed range from extreme weather events and irrigation problems to difficulties at the management and strategy level. In the course of the exchange, it became clear that data-based solutions in these areas offer a wide range of possible applications, be it in the area of demand-based irrigation or in the creation and updating of heavy rainfall hazard maps.

The course of the workshop simulates the procedure model of the DKSR, which provides for a thematic delimitation in close cooperation with the respective municipality, taking into account its municipal or digital strategy. The aim is to learn more about the possibilities of data-based approaches and to test them together. The workshop provided all participants with interesting insights into the challenges of water in the city and optional data-based solutions.

Eva Schmitz und Lukas Koch,
DKSR – The Data Competence Center for Cities and Regions

Insights into Rainwater Management in the Residential Quarter Hamburg – "Am Weißenberge"

Digital Excursion

The virtual tour through Hamburg's urban quarter "Am Weißenberge" is led by Michael Richter (HafenCity University Hamburg) and is dedicated to the importance of green roofs for sustainable rainwater management in this water-sensitive residential quarter.

Due to the high amounts of precipitation in Hamburg and a possible overloading of the sewage systems, the residential neighbourhood was developed with the aim of keeping all the rainwater that accumulates in the area ("runoff-free"). All new buildings were equipped with green roofs and the open spaces with interconnected swale systems to ensure retention, infiltration and evaporation of the incoming precipitation. The traffic areas designated in the neighbourhood, including parking areas, were not sealed over their entire surface in order to guarantee sufficient infiltration. The rainwater is cascaded through the infiltration trenches to a retention basin, which only fills up when there is a lot of rainfall, as the rainwater troughs in the cascade system already allow infiltration.

In the next step, the individual green roof types are illustrated and their characteristics explained. Retention green roofs are characterized by the fact that they have no slope and have up to 10 centimeters of storage space for rainwater below the thick substrate level to store water during precipitation. This water is additionally used for root formation and enables the growth of larger plant species. If the height of the substrate layer is low, the roofs are less lush.

With the extensive roofs, the participants are presented with another type of green roof and its characteristics, which enables a combination of vegetation and solar thermal or photovoltaic systems. The synergy effect that occurs here is the up to 5 percent higher electricity yield due to the cooling effect of the green roof on the PV systems.

In new construction or post-densification projects, joint planning of the two components is another cost-saving synergy effect that is emphasized as particularly important in the discussion. Another point of discussion revolves around the current implementation deficit for green roofs. From this, the participants deduce further need for action in the implementation of such projects.

Michael Richter,
HafenCity University Hamburg

Conclusion and outlook

At the end of the two-day event, Dr. Eva Ottendörfer summarized the conference topics for all participants. The conference content will remain available to all participants in the form of video recordings on the event platform for three months. Dr. Ottendörfer also gave a preview of next year's Morgenstadt conference, which will focus on "Data in the City of the Future." After a final vote of thanks to all those involved in planning the conference, the two-day Morgenstadt conference "Water in the City of the Future" came to an end.

Dr. Eva Ottendörfer,
Fraunhofer Institute for Industrial Engineering IAO

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