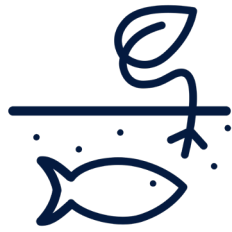




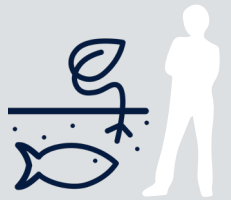
Living Lab Dortmund



NBS 4

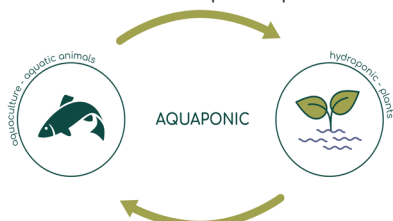
Aquaponics as soil-less
agriculture on polluted sites

Community managed aquaponics system



NBS 4 Aquaponics

The sustainable aquaponics food production system combines fish and plant production.



Being the Living Lab Dortmund-Huckarde's focal point, it combines implementing nature-based solutions (NBS) on post-industrial brownfields at industrial monument sites.

Two identical 200 m² greenhouses are constructed on 1,200 m² area of former Hansa Coking Plant. Firstly, to technically develop the concept of aquaponics plants will be produced in the greenhouses. Food products are not marketed as in conventional models; the hydroponic beds are rented to interested citizens. The economic performance of aquaponics facilities is subject to a strong scaling effect, and sustainable business models could be developed for small to medium facility sizes. These allow at best interim use of already planned brownfield sites for several years. The aquaponic facility is operated and supervised by the project partners die Urbanisten and South Westfalia University of Applied Sciences (SWUAS) within the timeframe of proGREG (2019-2023).

Aim & goals

In comparison to existing aquaponics systems, this NBS focuses on social and technological innovation solutions using natural processes (fig. 1) to achieve circular economy effects, resource savings, educational and scientific offering:

- Producing food on post-industrial sites with poor soil or contaminated land
- Using natural fertilizers from fish waste
- Higher productivity/m² than conventional farming
- Potential to intensify urban-rural connections

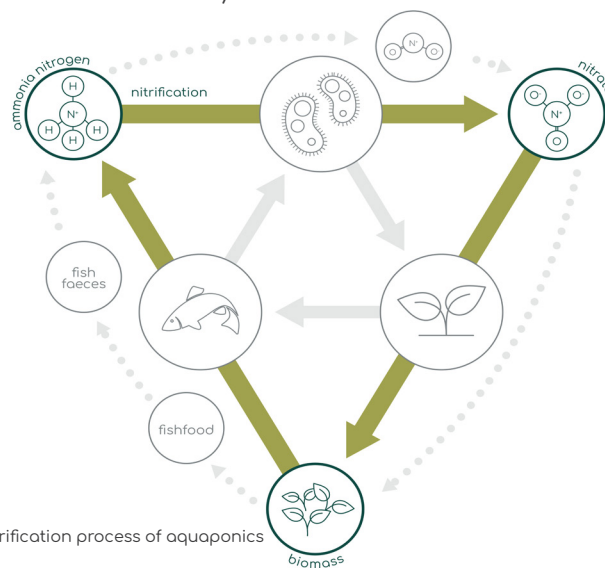
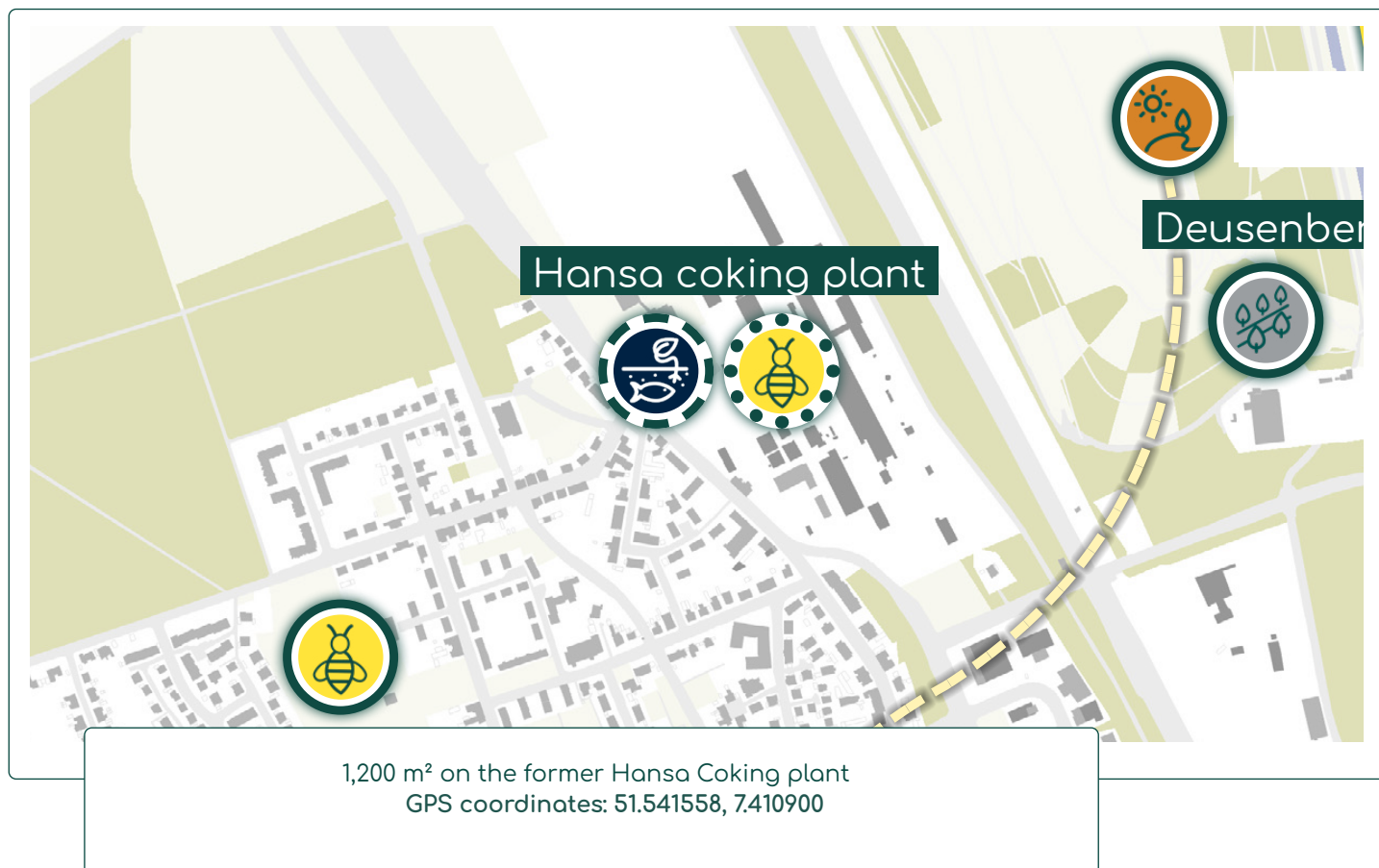
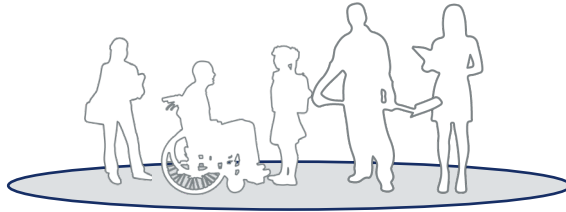


Fig. 1: Nitrification process of aquaponics



Target groups (beneficiaries)

- interested citizens including families in Huckarde and one-person households,
- students of schools and university from Huckarde district, Dortmund and beyond



Stakeholder constellations

Main responsible partner

The NGO Die Urbanisten responsible for:

- preparing building permission in cooperation with an architectural firm,
- pre-implementation and implementation phases,
- organizing future workshops to introduce the facility to the general public within the timeframe of proGReg until May 2023
- co-guarantee the continuity of this NBS over time



ProGReg partners involved

South Westphalia University of Applied Science (SWUAS) responsible for planning, economic viability, technical and organizational hurdles, operational optimization of aquaponics. Also, environmental monitoring of the aquaponics system and collaborating in dissemination incl. conference, international trade fair, scientific papers.

Aquaponik Manufaktur GmbH developed sizing and technical planning in collaboration with SWUAS: Aquaponics filter, piping design and operational mode of the system for maximum flexibility when running. Optimize the technology readiness level (TRL) of the aquaponics in collaboration with SWUAS

Heitro: supported the concept in early development stages.

Department of Urban Renewal, City of Dortmund proposed the Hansa Coking Plant site, supported in obtaining building permission and facilitated communication between NBS partners and other city departments involved during the planning process

Other stakeholders involved

Department of Urban Planning and Building Regulation (Stadtplanungs- und Bauordnungsamt), City of Dortmund

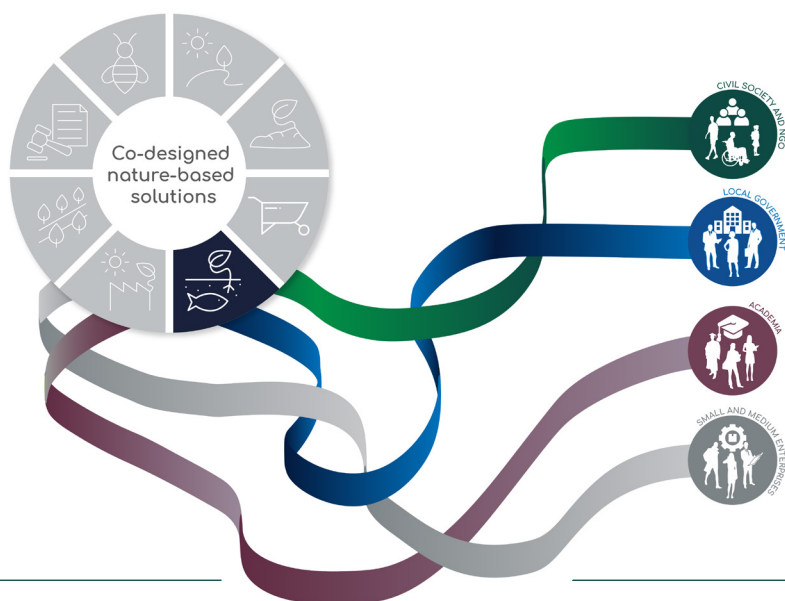
- Granting building permit - Foundation for the Preservation of Industrial Monuments and Historical Culture (Stiftung Industriedenkmalpflege und Geschichtskultur, IDS)

Site owner - renting and extending the rent contract beyond the proGReg timeframe to guarantee continuity.

- Mense (Architectural Firm): jointly preparing building permit application with project partners
- Ahlenberg (Consultant Engineering firm): soil contamination test
- Geotechnik Institut Dr. Höfer GmbH & Co. KG: Monitoring construction phase for ground cover layer
- Glass Tiefbau GmbH (construction company): construction preparation work
- Exner grüne Technik (greenhouse construction company)
- N.N.: testing produced plants quality for ration of toxic gases
- Team of the International Garden Exhibition, IGA 2027



Co-design activities, stakeholder engagement, and pre-implementation activities



The complex technical, administrative and legal procedures for this NBS limited the involvement of citizens in the early stages of the co-design process. However, intense stakeholder exchanges took place between local authorities, academia and aquaponics manufacturers, technicians and land owners.

Planning and preparatory activities (administrative and technical procedures)

The Hansa Coking Plant site was proposed by the City of Dortmund. Its unrivaled location in the Living Lab and during International Garden Exhibition IGA 2027 offers maximum public visibility given its historical significance and high visitor numbers, despite obvious soil contamination issues.

As a prerequisite for signing the contract, the site owner (IDS) demanded a deposit of 10,000 € from Die Urbanisten. Due to limited financial resources as a small NGO, the University of Applied Sciences

South Westphalia became official tenant by signing the contract in February 2020, thus solving the stalemate. Otherwise the City of Dortmund had also taken a political resolution to pay the deposit.

The contaminated soil on-site has posed a number of challenges in the process of obtaining building permission. Despite aquaponics being soil-independent, further backfill was necessary. The contaminated soil is remaining on-site and only secured by a top soil layer, prohibiting any soil interventions.

Implementation budget



Total implementation budget:
ca. 243,500 €

proGReg funding: 199,500 €

Die Urbanisten:	137,000 €
FH SWF (SWUAS):	62,500 €
City of Dortmund:	44,000 €
(overhead proGReg fund)	



Co-design and engagement activities

Co-design activities were necessary with various stakeholders. The landowner of the coking plant was engaged in the process since the first co-design workshop in December 2018.

- die Urbanisten prepared the aquaponics building permission application in collaboration with an architectural firm to the Department of Urban Planning and Building Regulation at the City of Dortmund. To meet all legal requirements, several meetings with respective involved departments of the City of Dortmund were necessary in order to work out licensable solutions.
- During construction phase, intense communication with project partners, involved companies and the site owner took place to ensure that all interests and necessities were met.
- Onsite meetings with representatives of other development projects such as IGA 2027 future perspectives for the aquaponics facility were envisioned creating synergies with other projects beyond proGReg.
- Adaptations of the rent-a-raft business model are explored: citizens can rent microgarden units for producing own food but no need in having an allotment garden. Plants are watered and cared for and are very productive.

Key achievements and implementation results

Given planning an aquaponics system of this size for the first time, the planning and construction process has been an inter- and transdisciplinary learning process lasting four years. Intense communication, information exchange with all involved stakeholders were necessary to meet complex organizational, administrative and legal aspects and to overcome financial constraints. This meant significant adjustments to the concept and operating model throughout the building permission process to work out realizable solutions. Key achievements include:

- Gain of knowhow to implement aquaponics innovative solution and food production on contaminated industrial sites
- Conception of energy optimization of aquaponics facility
- Social innovation of renting rafts inside the facility (rent a raft approach)

Critical implementation issues and barriers encountered



Several administrative and technical barriers were met during the implementation process.

- Building permit was mandatory. After several feedback loops, the building application was submitted in November 2020, requiring major conceptual changes and operating model on EU research project level.

Challenges: Building permission for foil greenhouses could not be granted for public use given structural design is certified for agricultural uses only, requiring additional calculations of the building's structure and load-bearing capacity, hampering co-design activities.

> Solution: adopt „rent-a-raft“ concept, allowing for workshops outside the greenhouse and venues at Hansa Coking Plant.

- Gaseous emissions from contaminated soil at the aquaponics site required an impermeable foil underneath the greenhouses and additional food analysis for harmful substances

> Solution: food analysis regarding harmful substances will be done

- Challenge: Increasing construction costs of around 90,000 €.

> Solution: In February 2021, funding gap was secured by budget shift of c. 90,000 € between project partners (~ 1/3 of overall costs, e.g. construction of contamination-proof foundation 71.000 €, experts 15.000 €).

- Challenge: 15 months implementation time frame, human resources

Necessary, but time-consuming preparations pre-construction until end 2021 led to shortage of left-over operation time (expected June 2022 to May 2023).

Personell shortage solved by budget shifts until May 2023.

Synergies with other proGReg activities




NBS 8: Pollinator diversity by planting pollinator-friendly species around the aquaponics facility

Work Package 4: NBS monitoring and assessment (General questionnaire, air quality and air temperature, economic and labor impact questionnaire, environmental footprint).

Communication activities



- Die Urbanisten organized workshops about aquaponics in several Dortmund schools: students could build and operate their own school aquaponics system with the goal among others to establish interest and cooperation options for the "Hansaponic" system.
 - Presenting the aquaponics facility during the VertiFarm trade fair about future vertical farming in Dortmund in Sep 27-29, 2022
 - Communication through social media channels
-  [project homepage](#)

Links with other external projects or activities

- The facility is likely to further developed and operated through the international research project INCiTIS-Food, coordinated by SWUAS until 2026.
- International Garden Exhibition IGA 2027.

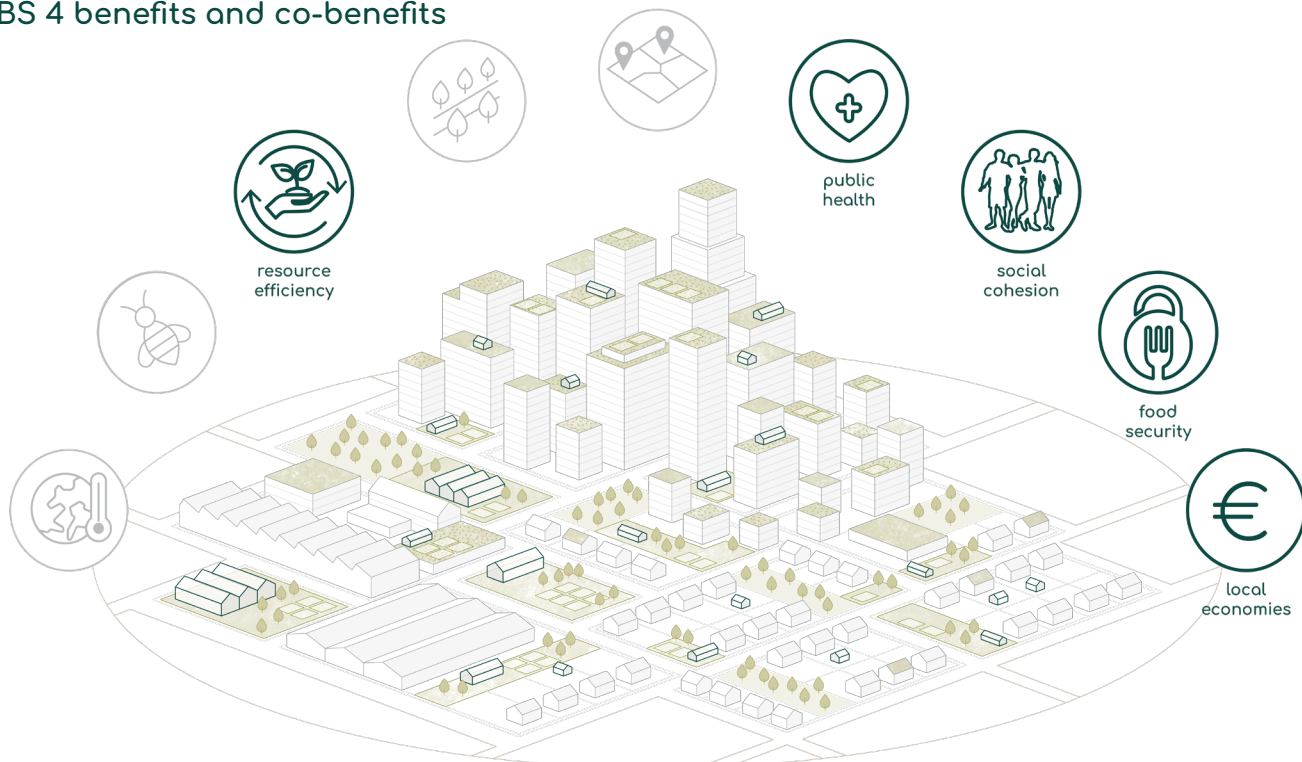
Maintenance & Sustainability beyond proGReg

During proGReg, Die Urbanisten and SWUAS are jointly managing and running the facility. The operation will be continued by SWUAS until the end of the International Garden Exhibition in 2027 (aquaponics facility is located in the main exhibition area). IGA will co-manage and maintain the facility. Research is conducted into a low-tech heat storage system based on water tanks to improve energy optimization of aquaponics greenhouses.

NBS benefits and co-benefits for the Living Lab Dortmund-Huckarde

The NBS has been an experimental testbed for all stakeholders involved, providing a steep learning curve. Soil-less aquaponic systems can utilise spaces e.g., contaminated brownfields for urban regeneration otherwise not usable. Resource efficient food production can enhance food security of the neighbourhood providing fresh products, thus reducing food transport emissions and lowering the CO2 footprint. If operated with the right business model, medium scale systems may create and support the local economy. Medium and small scale systems can foster and support community cohesion through the rent-a-raft model. Being part of the IGA 2027 will further strengthen local identity.

NBS 4 benefits and co-benefits





Fact Sheet



Aquaponics as soil-less agriculture on polluted sites

Hansaponik - Community managed aquaponics system

Contact

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Partners



Fachhochschule
Südwestfalen
University of Applied Sciences

Stadt Dortmund



aquaponik
manufaktur

