

JOURNAL

PROJECT

GreenQuays - Urban
River Regeneration
through Nature
Inclusive Quays

📍 Breda, The
Netherlands

TOPIC

Sustainable use of land
and nature based
solutions

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EXPERT

The GreenQuays project on its last mile - Journal 3

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The third Journal of GreenQuays explores how the project continues to deal with seven general implementation challenges of innovative project as well as extra challenges of short timing and sky-rocking material prices.

Breda's GreenQuays project intends to be a pilot for bringing more nature into the densely built-up medieval city centre by re-opening the river Mark and greening its quays. The challenges are greening it despite the river flowing between steep quay walls and making the greening nature-inclusive in enabling native plants and animals to invade the place. Everybody is eager to see the GreenQuays coming to life soon.

The project is in the middle of its technical construction, which will run until August 2023. This will create the foundation and structure for plants and animals to invade the quay walls and riverbed – making it green at the end. Over its course, the project has faced typical challenges of innovative projects and mastered them well. In particular, leadership is exceptional with politicians further supporting the project with its nature-inclusive quay design (NIQ) and including this design in further stretches of the river Mark revitalization project despite high increases of material costs. There are no major issues on implementation challenges left, although some, like monitoring and upscaling need still specific attention.

1. State of implementation



On the ground of GreenQuays. Image: Jansen/ Jimke Joling.

After the plans for the design of the Real-Life pilot - a stretch of 175m of the new river Mark which is called the GreenQuays – had been finished and the construction work procured, FL B.V. has been awarded the contract on building the quays in February 2022. Construction work has then started in June 2022. In the middle of the city, the riverbed has been dug out and the future quay walls stabilised. The technical construction shall be finished by August 2023, when GreenQuays ends. However, at that point the GreenQuays will still be grey due to the specific concept of nature-inclusive quays (NIQ). With suitable materials and structure, the technical foundation will have been created for plants and animals to invade the vertical walls and the newly established riverbed. After the prolongation of the project due the delays triggered by the COVID 19 crisis, the work is going after plan now.

Before the construction work has started, an ex-ante [monitoring of biodiversity](#) at the space and in reference areas has been performed and the baseline created. Citizens' participation has picked up at the pace of restrictions from the pandemic getting lifted. Notable, the [city safari and the map of opportunities](#) have been organised and will be repeated now. The experience has been documented and prepared for replication in an Inclusive and Participatory Urban Planning Process Guide. Two more guides are under development - a River Restoration and Daylighting Design Guide and a Green Quays Design & Implementation Guide. At the side of GreenQuays, [first spin-offs](#) have been developed using experience from the project – a drystack wall system built and tested in Delft by the partner Delft University and appropriate substrates for trees in contained spaces by Tree Ground Solutions.

2. Implementation challenges

Challenge

Observation

Leadership
Challenge level



Current leadership by the city council and alderman is very supportive to Green Quays even despite extremely increasing prices for material and thus the construction due to the war in Ukraine. Politicians embrace the project also due to its innovative character, which brings them high visibility.

Public procurement

Challenge level ●

The main public procurement has been for the construction of the Real-Life pilot and has been finished in February 2022. Looking from nowadays perspective on the procurement process, it can be stated that Breda has established an effective procurement process that has met or even exceeded the expectations.

Organisational arrangements within the urban authority

Challenge level ●

Collaboration between departments in Breda is smooth. However, it is still happening on an ad-hoc basis as there is no coordinating unit for such multi-purpose projects like GreenQuays. With the project coming gradually to life and visible, the collaboration has also grown.

Participative approach for co-implementation

Challenge level ●

Participation takes place at different levels – with citizens, with project partners and other partners. With the city safari and the map of opportunities the project has developed successful co-creation methodologies that will also be applied to the next phases of the river Mark revitalisation as well as to other areas. A joint office between the constructing company and the construction team of Breda municipality has been shown very effective for enabling effective co-creation at this level.

Monitoring and evaluation

Challenge level ●

The monitoring of the baseline situation has been well performed. The challenge is that the impacts of the project on biodiversity and other benefits cannot yet be measured when the project ends. Only then, nature will start to develop and unfold its associated benefits. The municipality is committed to make an arrangement to continue doing the monitoring for years after the end of the project.

Communication with target beneficiaries and users

Challenge level ●

The focus of communication is currently on the construction and keeping up the mood while construction work brings a lot of nuisances to residents. DeBouwApp has been proved to be very effective for communication in this regard. The concept of nature-inclusive quays, which means some type of wilderness and spontaneous nature development in the city centre, is new to citizens. Breda provides different types of communication – flyers, social media, workshops, nature excursions – to prepare the ground for growing awareness on the benefits of nature.

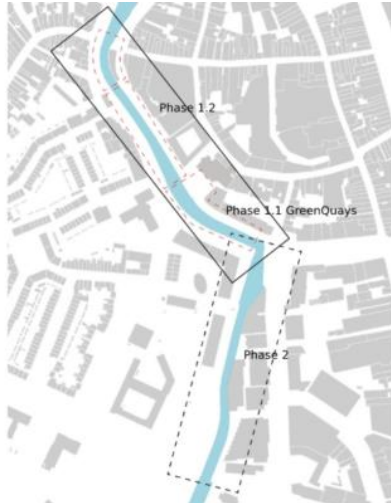
Upscaling

Challenge level ●

Inside Breda municipality, upscaling is well ensured. The nature-inclusive quay technology (NIQ) will also be applied in the following phases of the new river Mark project for which the GreenQuays stretch serves as a blueprint. There is a high potential to use that technology in many other cities across Europe too. While a design guide is developed, Breda tries to distribute the information in different conferences and networks. This has still to be explored more comprehensively to find the most effective ways to approach other cities and encourage an uptake of NIQ elsewhere.

2.1 Leadership

The support by city leaders concerning the project has remained very good for this highly innovative project, even when the costs of building the nature-inclusive quays (NIQ) became higher than building them in a conventional design. These higher prices can only be justified when considering the extended multiple benefits for the neighbourhood and the city overall. The quays will deliver space for nature in the middle of the historic centre, additional attractive space for social activities, health benefits by nature, climate change adaptation, better quality of life attracting people and businesses, upgrading the appeal of businesses along the quay, and branding Breda as an innovative city. Although many of these benefits will first unfold in the future and can only be partially measured in quantitative terms, Breda's politicians have understood the future benefits and continue supporting the project. A long-term municipal climate for greening the city and trying out new strategies has prepared the ground for such support. The project is well embedded in Breda's Environmental Strategy and Vision for 2040, which aims to turn Breda into a city in a park. Hence, even when the alderman changed recently, the support has continued.



The phases of daylighting the river Mark (left) and alderman Daan Quaars with Davie Franken (FL B.V.) at the deepest point. Image: Jansen/ Jimke Joling.

Keeping the GreenQuays project running has been challenged by increasing scarcity of material resources and sky rocketing prices as a consequence of the war in Ukraine. Even in this difficult situation, the alderman Daan Quaars has decided to continue with the NIQ design by agreeing on phase 1.2 and phase 2 of the river Mark regeneration.

Success factors have been to constantly inform the political level about new developments in the project and bringing in the City council at each step of the decision-making process for approval. By doing so, the team not only informed the decision-makers but kept their enthusiasm and trust up.

2.2 Public Procurement

The main procurement activity of GreenQuays has been concerning the construction work for the Real-Life pilot stretch of the new river Mark and establishment of adjacent green spaces. The company FL B.V. has been awarded the contract for the technical construction of the GreenQuays in February 2022, and work started soon after. Indeed, the procurement approach chosen by Breda municipality seems to work out as expected. With the technical expertise in-house, the municipality has developed very detailed plans and documentation for the construction, which then has been procured. This reduced the risk for the constructor to fail as most questions concerning these new and innovative solutions had been discussed and decided before the actual procurement. Furthermore, the constructor is only obliged to deliver the technical construction of the quays in a way that plants and animals can invade and green it naturally afterwards. This waived important risks, such as plants and animals not thriving on the construction as expected, from the successful bidder and transferred it to the municipality.

Nevertheless, it is an unusual project for FL B.V. The company is used to guarantee for high quality of their works, but here, they are asked to let nature "destroy" their work. This means not building a perfectly smooth surface of bricks and joints but doing them rough with niches, cracks and mortar partially falling out, nevertheless having a stable foundation. While FL B.V. has understood this, it needs to make sure that also sub-contractors understand this correctly. This requires providing clear instructions and sufficient explanation to them.

In the current construction phase, Breda municipality has a dedicated project manager and formed an own team to closely observe and steer the technical implementation of the quays. They work even physically in a joint office together with the constructor directly alongside the construction area. Being an innovative project, but also by

acting on the historical centre of Breda, work inherits uncertainties. The proximity allows to follow up construction work constantly and discuss challenges immediately. Both sides perceive the implementation of the contract as very satisfying.



Discussions on the construction site. Image: Birgit Georgi.

For the procurement of the next phases of the river Mark revitalisation, Breda municipality considers passing on also the technical design to the tender, no longer doing it itself in-house. This becomes possible due to the experience made in procuring and implementing the GreenQuays, which serve as a blueprint for the NIQ design of the future phases.

2.3 Organisational arrangements within the urban authority

The project is nested in the department for spatial planning in Breda municipality, is well known and appreciated in the administration, in particular, since the massive construction work in the middle of the centre started to leave a visual mark. However, there is no overarching unit for coordinating activities such as GreenQuays, having potentially many impacts and benefits for several departments. Therefore, collaborations happen still rather on an ad-hoc basis. But once established, the collaboration with departments such as the ones responsible for green space or for climate change is smooth (see also [Journal 2](#)).

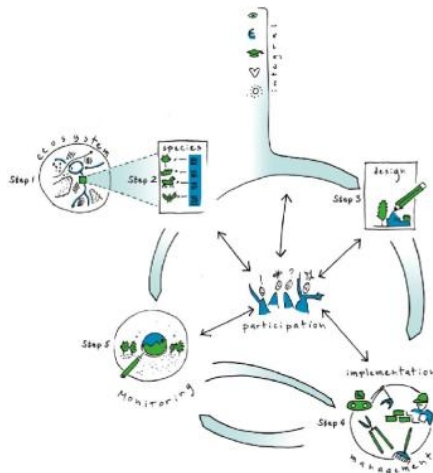
In the past design phase, the COVID 19 pandemic has additionally challenged the collaboration; much had to be done online without physical meetings. With the withdrawal of the pandemic's restrictions, that situation has improved now. For the implementation of phase 2, the project group has been broadened with more departments participating in than in phase 1. As already mentioned, the project has now an own project office next to the site, where design meetings are hold.

2.4 Participative approach for co-implementation

There are three different levels where participation for co-implementation can take place - with citizens, inside the project partnership, and with other partners outside the partnership. The major and decisive part of citizens participation for GreenQuays has been taking place before the actual start of the project. For the area of the Real-Life pilot - the GreenQuays, the approach has then been more on keeping people informed on what is going on and how the area will look like. This is in particular important as the construction work is disturbing the people living there or passing the area. It does not look nice and appealing at all. The project uses an app - BouwApp - to inform people on the schedule concerning work going on as well as providing information on the project and people working there, giving it a more personal touch. This creates a

feeling for residents of rather being part of the process.

With the quays taking shape and preparing the phases 1.2 and 2, the project increased again its participative activities actions with citizens. Of particular value has been the city safari end of 2021, the related workshops to deepen the exchange and to co-design, which resulted in a [Map of opportunities](#). This activity shall ensure more nature in the neighbourhood, create a healthier and more attractive environment, and adaptation to climate change impacts like prolonged heat waves. This action will now be repeated and continued. Without COVID restrictions, it is expected that access will be easier for people, and more will show up. Outdoor activity, e.g., in a tent offering a nice atmosphere, where people without any registration can easily walk in and discuss with experts, express their ideas and needs are considered now. In the design of the Fellenoord area, Breda also uses the methodology of the Map of opportunities and the approach became part of the Urban Governance Atlas of the [EU INTERLACE Hub](#).



Participation scheme and workshop. Image: Joao Cortesao.

A specific way of citizen participation has been the [biodiversity monitoring](#) of GreenQuays. It is based on trained volunteers. These are citizens of Breda or the surrounding area with a personal interest in flora or fauna. They are curious to see how nature develops, which species can be found in the inner-city area, and how the NIQ-design will work out. By even further interacting within their personal social networks, they become ambassadors informing and encouraging friends and other neighbours in getting a closer look on nature in the city. The experience that these volunteers and others gain may also find its way into re-designing private courtyards and gardens.

The lessons learned from the different participation activities have been summarised and synthesised in the [Inclusive and Participatory Urban Planning Process Guide](#). This helps further projects in Breda and other cities to organise effective citizen participation.

The major focus of co-implementation with the project partners is currently on the construction between Breda municipality and FL B.V, the constructor. It has been proven to be an excellent idea to establish a joint office at the site. Using one office has shortened the lines of communication; better and faster decisions are being made. This setting allows easy daily interaction, exchange of experience just made with the construction work, discover challenges early, and find solutions together. Both sides have been able to learn from each other, which has been perceived very positively. It was also Breda's project management at the construction site that could learn from the constructor, get new ideas and inspiration and vice versa. This way much positive energy in the construction team has been felt, and trust is being built up forming a strong basis for effective implementation. The relationship is marked by mutual respect and perceived rather as a partnership than, as it is formally, a typical orderer-contractor-relationship.

For the broader partnership of GreenQuays, the design process had earlier been a major part of co-implementation with project partners. Over the last year, collaboration activities have been at a lower level. It is mostly about the biodiversity monitoring, where the partners Natuurplein de Baronie and RAVON can feedback results into the construction process as well as into the design of the broader river Mark development. This activity and the up-coming tasks of dissemination and upscaling of the results should be used to keep up the valuable partnership and the climate for co-creation between partners. Physical visits of the partners on the site and seeing their project coming to life have helped to foster the partnership. Outside the original partnership, a collaboration with the regional health service (GDD) has developed in particular. Another round of the health monitoring is being performed and is planned to be repeated in 2-years'

time after the project has already been finished. With the current heavy construction work, more negative feedbacks have been expected due to the nuisance. In fact, there has been also positive feedback due to the lack of traffic and traffic jams as the road passing by is closed, in particular during the weekends when even construction work ceases. Beyond GreenQuays and as a result of the collaboration, the GDD is included in further park designs – the wider river Mark and the Seeligpark in Breda.

2.5 Monitoring and evaluation

To measure the success of the GreenQuays with their nature-inclusive quay design, biodiversity monitoring is highly important. The monitoring is done on flora (wall plants) and fauna insects, birds and bats, fishes. Three areas are monitored: close to the GreenQuays area as baseline area; and a reference area further away to compare with. The latter one can, at the same time, be the source area from which flora and fauna can migrate to the new quays. The monitoring of each species group follows a specific protocol. Over the last two years, flora has been monitored twice per year, fishes 1-2 times per year, birds in spring, and insects on a weekly (butterflies), bi-weekly (dragon flies) or monthly (bees and wasps) basis between March and October. A specific feature of the monitoring is that it is performed with the support of volunteers (see previous chapter 2.4)



Monitoring at a reference site by volunteers. Image: Jacques Rovers.

The challenge for the biodiversity monitoring and in particular the evaluation of its results is the short time frame of the project as already mentioned in earlier Journals. The project will end with the technical construction of the quays, and only then, the plants and animals can start to invade the space. While the first species will come soon, the whole process will last many years, stretching far beyond the project's time. However, monitoring results are necessary for the municipality to prove the effectiveness of the solution and justify the investment, but also to inform the further design of the other phases of the river Mark revitalisation. This necessity is clearly acknowledged by the municipality as well as the different partners that all are eager to find out how the NIQs work out. Thus, the municipality has decided to look into ways and find budget to monitor in 5 years instead of the 1 year. Single partners have decided to leave sensors in the area, like the ones measuring climate parameters. The regional health service GDD intends to continue with the health monitoring.

Apart from monitoring biodiversity, also other benefits such as health, micro-climate, social interaction, quality of life, business revenues, innovation levels of the municipality and more should be monitored to provide proof of the extra benefits of the nature-based solutions and justify the extra costs for the innovative design. For example, the mobility department of Breda municipality became very much interested. Due to the road closure along the GreenQuays, they suddenly find themselves in the rare situation where they can "test" car-free areas over a longer period. All these environmental, social and economic benefits would need to be monitored beyond the project lifetime when the place starts to become greener and to provide benefits.

2.6 Communication with target beneficiaries and users

Communication with the target beneficiaries – the residents of the neighbourhood and of the whole city as well as the businesses along the new river Mark - has faced great potentials but also challenges in the current construction phase. On the one hand, the projects started to take shape in reality, but on the other hand, there is still quite some imagination needed to see the future green – not grey - quay walls. In addition, construction comes along with much of nuisance by noise, dust and access restrictions.

At the beginning of the construction phase, the project organised a citizen event, where the intentions and the further process of the project have been explained. When citizens know where this project will head to, they are more likely to accept nuisance during the construction time. The public event in June 2022 has been attended by more than 100 people.



information on the construction process and the BouwApp. Images: Birgit Georgi.

In addition to traditional flyers, the project uses in particular a web application - deBouwApp - to inform citizens about the progress as well as upcoming phases of nuisance. Furthermore, the thread is enriched with stories around the project and people behind. All this has created a bigger acceptance by people. They are eager to see the final quays. Specific talks are held with entrepreneurs along the future GreenQuays (cafes, hotel, etc.) on ways to reduce nuisance during the construction phase and on which special arrangement can be taken for the phase 2 of the river Mark revitalisation.

A challenge for communicating with people, in particular in the future, may be the appearance of the GreenQuays in some parts. The walls shall mimic old, weathered walls, and the quays won't be immediately green after the project ends. Nature still needs time to invade and develop. In this process, parts of the walls may not look appealing to people. Wilderness in the inner-city, and unplanned development of greenery is not everybody's preferred aesthetics. This concept still needs to be explained and well communicated. To prepare the ground, the project offers regular excursions in and around Breda for interested citizens to learn about biodiversity and to appreciate nature.

This new concept of nature-inclusive quays needs to be also well communicated to future maintenance staff, who need to apply a new maintenance scheme and accept wilderness. Yet another group is the staff in the municipality responsible for green spaces in other parts of Breda. The nature-inclusive quays can be a blueprint for dealing with nature in the city and promote a paradigm shift.

2.7 Upscaling



Detail of design from the Design Guide (left) and visualization of the whole new river Mark project.

GreenQuays has been planned as a pilot stretch of 175 m of the broader project of bringing back the river Mark in the city centre. In this regard, upscaling in the broader regeneration project is already built in. It can be seen as a great success that, despite the dramatic price development, the upscaling and implementation of phase 1.2 and phase 2 of the river Mark development are decided by Breda's politicians.

Upscaling is furthermore ensured as the department of the municipality responsible for the GreenQuays is also responsible for the broader development of the river Mark. The concept of nature-inclusive design is furthermore relevant for other green spaces re-development and management. GreenQuays creates thus space for others stakeholder to test new ways of providing urban green in nature-inclusive ways. It sets a new standard and helps to increase ambitions elsewhere.

The potential of upscaling is thereby much higher. Many cities in Europe and else have conventional quay walls. As the NIQ technology consists in principle of brick panels detached to a conventional strong quay construction of steel or concrete, this solution of bringing more nature into the cities can be generally applied to many more cities. A Green Quays Design & Implementation Guide is in development to facilitate this. Breda municipality has shown and will show its case to others and disseminate the information broadly, e.g., in the [2023 Cities Forum](#), and is planning a final European event later in 2023. At the same time, an overview on potential events, platforms and networks for mainstreaming and upscaling is continuously updated to explore further opportunities for distributing the results and networking.

A challenge is however that the municipality does neither see itself in the position nor having a mandate to develop a business model and sell this NIQ technology. The partners from Delft University face a similar challenge. Inspired by the small-scale test site developments of GreenQuays they have developed some ideas further outside the project. Such resulting [spinoff](#) are for example dry-stack walls that have been built and successfully tested in Delft. The work of researchers is finished with this. In both cases, it needs someone else, like the construction company or provider of nature-based solutions to pick up these technologies and develop them into a business. In the case of the business partner Tree Ground Solutions this has worked. They learned from the appropriateness of different growth substrates for trees in small wall containers and uses that knowledge now in developing [effective SuDS solutions for planting trees in constraint inner-city places](#).

Beyond the technical solutions, Breda has made valuable experience on governance with citizens as well as with building an innovative partnership. This knowledge and very positive experience need to be kept and used for other initiatives. The experience on the co-creation with citizens in the process of the city safari, the related workshops and the map of opportunities has been introduced into the Urban Governance Atlas of the EU INTERLACE project and the guide on [Inclusive and Participatory Urban Planning Processes](#) keeps the lessons learned and makes them accessible for other projects.

2.8 Other challenges

Already the COVID crisis has challenged the delivery of materials, but with the war in Ukraine – material and energy prices have risen extremely high. Bricks can be 40-60% more expensive due to their production, which needs lots of heat and thus energy. Because of the high gas price, some factories have considered closing the production. To tackle that problem, the project tried to buy all the materials needed immediately and no longer trust in just in time delivery. The same strategy has been applied for steel. The price had, at that point in time, already been higher by 15-30% but not as high as in later months. As mentioned under chapter 3.1 on leadership, there has been a strong political will to go on with this project as planned and the city has accepted the higher costs. Facing the changed financial situation, the design of the following phases 1.2 and 2.0 will be a bit simpler in parts. While still making the quays fully nature-inclusive, other parts of the design, like the lower quay ways close to the water table, are left out. Substantial funds originally foreseen for renovating the sewage system in the neighbourhood could also be reallocated to the new river Mark development, which will take over this function.



Steel pipes. Image: Birgit Georgi.

Time, as it was already pointed out at earlier stage of the project, has proven to be another challenge. Nature needs its time to develop. Only then, the results and benefits of GreenQuays will fully unfold. Monitoring needs to go on far beyond the GreenQuays project. Accounting all benefits in a long-term perspective will enable to prove the success and the overall cost-effectiveness of the solution.

3. Conclusions

Despite serious challenges of costs and timing, GreenQuays is on a very good way to being implemented and scaled up. Political leadership, the city vision of Breda as being a "city in a park", broad communication efforts with citizens and all type of partners, co-design, and an innovative, highly motivated partnership have been the factors this positive development has been built on. All the mentioned implementation challenges are tackled professionally at high level.

[Nature based solutions](#)

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