



Case Study #1

Climate Smart Urban Development in Mpigi District, Greater Kampala, Uganda

Project location

Nsimbe, Mpigi District, Greater Kampala, Uganda

Project team

A UKAid-funded consortium of spatial planners, landscape architects, urban designers, engineers, water experts and private sector development specialists. Cities and Infrastructure for Growth Uganda (CIG Uganda) was overseen by Paul Turner AssocRTPI, from the UK Foreign, Commonwealth & Development Office, and also involved Christopher Cripps MRTPI, as Urban Theme Lead.

Project description

Under the auspices of UKAid's global Cities and Infrastructure for Growth programme, Cities and Infrastructure for Growth Uganda commissioned an international team of experts to devise an urban plan and framework for an outlying, partially rural, area within Greater Kampala – Nsimbe. The area is expected to rapidly urbanise as a new highway is built through the district, providing speedy access to Kampala.

The plan responds to concerns over recent years around urban expansions across the Greater Kampala Metropolitan Area that urbanisation has typically been rapid and unplanned, resulting in potentially unsustainable communities with poor access to infrastructure and damaging effects on the local environment. Climate change will only exacerbate these problems.

The team identified that **water** was a **key** challenge for Nsimbe if it was to experience '**climate smart**' urbanisation and set about designating necessary projects and designing appropriate spatial planning for development that would ensure an adequate water supply and sanitation capacity for an anticipated growth in the population.

Drainage challenges are at the front and centre of the new local plan, with projects targeting the reduction of flood risk, absorbing wastewater for groundwater re-charge, preventing pollution of water sources from

organic and industrial waste, and supporting waste recycling for biomass generation for clean local energy. Green and blue infrastructure have been mapped out in the new plan to ensure the maintenance of wetlands in the valleys and preventing the loss of permeable surfaces on higher grounds, all ensuring a **porous landscape** is maintained in the coming era of rapid urban development.

The team understood that water transportation network systems for water, as for power, will not be adequate to cope with the boom in demand expected in the area. So **local-demand-led solutions and traditional sources of water** have been prioritised in the new plan to handle the lack of reliability found in existing and likely, future mains systems in Uganda. For instance, the plan maintains the original small-scale farming boundaries and watercourses of the area, intending their drainage patterns to be maintained in the future street network of this new peri-urban town. Existing farm boundaries are also to form the future green infrastructure and walking and cycling network of the town.

The project is a pioneer in Uganda and the region. The plan accommodates and designs for a flourishing, new urban area which can handle future climate challenges, including water scarcity, quality, and flood risk. In doing so, it is hoped it can inspire similar rural to urban transitions in Uganda, East Africa and beyond.



Unique role of the planner

Planners played a **crucial role in coordinating** usually disparate infrastructure specialists to come together to consider the challenges Nsimbe is likely to face. In doing so, they helped identify the, initially surprisingly, **central role** that **water** needed to **take in any new plan for sustainability**. Their consultations with experts and technical specialists identified the track record of problems to emerge in rapidly urbanising sites across Greater Kampala as well as the nature of the landscape in Nsimbe and the likely challenges it would present.

Stakeholder engagement

A key tenet of Uganda's National Resistance Movement was that "Land belongs to the people". This principle underpins planning in the country where **community engagement on land use matters is emphasised**.

The Ministry of Lands, Housing and Urban Development's system of 'Rapid Physical Planning Appraisal' is intended to help allocate land in the plan. This ensures that local communities are engaged in the planning process and is relied upon where land is to be ceded for infrastructure and to receive landowner support. The project has also brought in the opinions of private developers and inward investors who might normally be excluded from such engagement.

Community engagement activities have sought to involve low-income migrants in the area, along with community leaders. Beyond principles of democracy, it was felt that this was important to ensure that the "informal sector" within the economy, which will be where many climate smart technologies will be deployed, is represented.



Image credit: CIG Uganda Construct



Link to the Sustainable Development Goals

The project plans for an expansion to Greater Kampala that will have adequate **water supply and sanitation**, breaking the trend of previous urban expansions and so primarily addresses SDG 6's goal of water and sanitation for all.

The **Climate Smart Urban Development programme** plans for the expansion of Uganda's capital city in a way that will be sustainable, both for the landscape and the people who move to its expanded areas. It therefore addresses SDG 11 whilst also considering how to sustainably preserve local ecosystems, land conditions and biodiversity and therefore addresses SDG15. In considering how these plans can be climate smart, it addresses the need to design interventions that **help communities and the landscape adapt to the impact of climate change** and so addresses SDG 13.

The plan's focus on infrastructure addresses SDG 9's goal of **resilient infrastructure**, seeking to achieve this through a mixture of modern infrastructure and the use of traditional methods.



Impact of the project

The urban plan and framework has now been approved by the African Development Bank for full feasibility funding, which should unlock finance for its implementation within the next 3-4 years.

It is hoped that this pioneering work will inform more efforts to plan for expansion of ever-changing cities against the threat of climate change and threats to water resources, particularly in the Ugandan and sub-Saharan African context. The plan has already been factored into strategic planning efforts for wider Greater Kampala.



Below: Community participation events in Nsimbe



Below: Aerial view of part of Nsimbe



Image credits:
CIG Uganda Construct

Below: A typical unplanned urban extension within Greater Kampala





Case Study #2

Wadi Hanifah, Riyadh, Saudi Arabia

Project location

Riyadh, Saudi Arabia

Project team

Arriyadh Development Authority, MRTPI planners at Buro Happold, Moriyama and Teshima planners, Nelson Environmental Inc, and Badan Agricultural and Contracting company

Project description

The southern and south-eastern regions of the Arabian Peninsula are exposed to **risks of flooding** from tropical cyclones during the pre-monsoon season (May-June) which affect wide parts of Oman and Yemen. The central and western regions, encompassing much of Saudi Arabia, the UAE and Qatar, experience flooding from convective rainfall in the winter months (November-April). While cyclones and convective storms themselves are usually considered low-risk events, the heavy rainfall they bring can lead to flash floods due to a combination of poor drainage systems and urban development constructed too close to water courses. Across the peninsula, the human and material losses have been substantial, bringing the focus back on to **managing these risks through integrated urban and environmental planning.**

The Arabian Peninsula lacks permanent rivers but has numerous Wadis, which are riverbeds that are either intermittently or permanently dry. When it rains, significant volumes of water can flow through the Wadis, often carrying a substantial amount of water and sediment during a flash flood, increasing the risks to people and property where development encroaches into the wadi corridors.

Wadi Hanifah is a 120km long, 4500 sq. km. watershed that passes to the west of the city of Riyadh in Saudi Arabia. Located in the middle of the Najd Plateau, Wadi Hanifah extends from the Tuwaiq Escarpment to the open desert south east of Riyadh. The Wadi has more than 40 tributaries, while the valley is home to many villages and ancient buildings.

From the early 1970s, the expansion of Riyadh westwards led to development coming into close proximity to the Wadi's west bank. While the Wadi was utilised to serve the city with its growing demands for water, mineral and construction aggregates were intensively extracted to support rapid urban development. By the 1980s, water resources could not cope with demand and water levels dropped below sustainable levels. The uncontrolled dumping of industrial and domestic waste also led to the contamination of ground and surface water.

In 2002, the Royal Commission for Riyadh City commissioned a Comprehensive Development Plan, a master plan for the future of the city. The plan identified areas for future growth, and presented proposals for environmental protection, landscape rehabilitation and flood risk management. As part of this programme, a Wadi Hanifah **Environmental Rehabilitation Project** was started, with this involving a variety of measures to restore the valley, re-grade the banks of the Wadi, and re-plant natural flora. Planners provided strategic advice to the development of the Comprehensive Development Plan and associated rehabilitation project including a detailed site appraisal over half of the Wadi network, mapping and recording all assets and features that were at risk from flooding.

Unique role of the planner

Planners involved in this project have consistently advocated a comprehensive and multidisciplinary approach to help plan for Wadi Hanifah. Addressing **water management** challenges, and establishing **sustainable urban infrastructure**, requires the engagement of experts from a variety of fields, including engineers, environmental scientists, economists, architects, and others. Planners played an important role in facilitating this engagement, by providing **strategic insight** and playing a vital role in **mediating** between different interests and demands. Collectively, the parties involved have helped to cultivate a **shared vision of sustainable and equitable urban development** for this part of the Arabian Peninsula. To implement the strategy, the team has also prepared a **decision-making framework**. This ensures the allocation of appropriate land uses and the application of appropriate **development management** to ensure key parts of Wadi Hanifah are protected, and that plans for **climate-resilient infrastructure** and sustainable urban development are properly facilitated.

Stakeholder engagement

Planners played an important role in drawing key interests together, which has involved the sharing of knowledge and local intelligence. While understanding the many different pressures affecting Riyadh has been key, the team has consistently sought to highlight the importance of safeguarding and enhancing Wadi Hanifah and its key ephemeral flow paths. The team has also sought to highlight the multiple benefits that flood prevention can give rise to, for example, through positively contributing to the city's green infrastructure network.



Above: Wadi Hanifah Image credit: Buro Happold

Link to the Sustainable Development Goals

The comprehensive planning of Riyadh has sought to target a wide variety of SDGs, with SDG 11 having overall relevance. Preparation of the **Flood Management Plan**, and associated strategies, has sought to **improve the adequacy of infrastructure** (SDG 9), and to make the **city more resilient** to climate change (SDG 13). A key goal has been to **improve the supply of clean water and to deliver improved sanitation** (SDG 6), which has also helped the city to pursue good **health and well-being** (SDG 3). Improving the quality of the local environment has also prove beneficial for both life below water (SDG 14) and life on land (SDG 15).



Impact of the project

The **environmental rehabilitation** of Wadi Hanifah has led to the **re-grading of banks**, the clearance of waste, the removal of unauthorised uses, and the formal designation of land for stormwater management. Water-related infrastructure has been planned creatively, while facilities for **stormwater storage and attenuation** have been creatively planned into new green networks. **Water-sensitive design** has been applied where opportunities have arisen. There has also been innovation too. For example, the Wadi Alaysan Stormwater Strategy proposes to **incorporate drainage facilities into undevelopable corridors** of land accommodating high-voltage power cables.

The success of Wadi Hanifah shows that urban green space, when delivered to a high standard, can become a defining part of a city's character. Wadi Hanifah now has its own identity, with improved recreation space for visitors, improved urban **biodiversity**, improved **health and well-being** and many other benefits, whilst protecting the city from flooding events.



Below: The Wadi Hanifah Flood Management Plan acts as an important benchmark for future flood risk management and mitigation work.

Image credit: Buro Happold

“Growing up in the city of Muscat, it was during my early years that I bore witness to the aftermath of devastating tropical cyclones, including Gonu, Phet and others. Even as a young observer, I’ve realised the significance of effective environmental and spatial management, especially when it came to addressing the flood risks that my home faced. I wanted to play a part in finding solutions that harmonized our cities with the natural world while fostering the development of thriving communities and I decided to pursue a career in planning”.

Faris Hussain MRTPI. Faris is part of the Buro Happold Strategic Planning team in the Middle East.





Case Study #3

The Thimphu Structure Plan: A Catalyst for Regeneration

Project location

Thimphu, Bhutan

Project team

Bhutan's Department of Human Settlement, MRTPI planners at Prior and Partners, Arup, Gerald Eve, and Peter Studdert Planning

Project description

Set in the Eastern Himalaya, Bhutan is at a turning point. Rural to urban migration – and the whole process of accelerating urbanisation, is placing acute pressure on limited available land, precious natural assets, and threatening irreversible damage.


The capital city of Thimphu has grown rapidly since 2003, yet the quality of life for the majority of residents is falling short of Bhutan's foundational aspiration of Gross National Happiness. Since 2019, an interdisciplinary consultant team has been working arm-in-arm with the Royal Government of Bhutan with the guidance of an expert international advisory panel, including Kate Raworth and the Doughnut Economics Action Lab. The team have developed the vision and future spatial strategy for Thimphu and the surrounding region, integrating Gross National Happiness firmly within the Doughnut.

Thimphu's location in the seismically active Himalayas Mountain range, and its exposure to a variety of hydro-meteorological conditions make Thimphu highly prone to intense and recurring natural hazards such as landslides, flooding, wildfires and ground related hazards. Further hydrometeorological changes due to climate change are likely to further intensify the frequency and severity of hazard events within the region.

There is good coverage of water mains throughout the city delivering potable water, and a good coverage of existing sewers serving the city to collect wastewater, and the network is continually being expanded. The Wang Chhu is the primary river which flows through Thimphu. Numerous tributaries join the Wang Chhu, collecting stormwater run-off from developed areas through a network of open and closed drains. There is no stormwater treatment which results in poor water quality.

The newly adopted **Thimphu Structure Plan** provides a key tool to catalyse a more **regenerative and distributive approach** to socio-economic development over the next 20+ years. The goal is to invest in creating a place of opportunity for the benefit of the **whole community**; cultivating a better balance with nature and the living culture of Bhutan, a vision that is inspiring to all stakeholders.

The principle of directing **good growth in the right places** will guide the long-term transformation of the City and region, ensuring that the social conditions of residents are improved in a way that protects Bhutan's unique Buddhist culture, while working within the ecological ceiling of a globally important, carbon positive forest reserve. 60,000 new jobs will be created to build critical capacity and diversify the economy, while over 20,000 secure and affordable new homes will help reinforce the social foundation in this rapidly changing urban context.



Unique role of the planner

The Thimphu Structure Plan was the product of the close collaboration between the consultant team's chartered town planners and urban designers and Bhutan Government's team of planners and their peers at Thimphu Thromde (Municipality). This was an opportunity to create a point of reference plan for Bhutan, a country with a relatively new spatial planning system. Reform of planning tools and procedures is needed to deliver better outcomes for current and future residents. The planners played a crucial role in establishing a reformed framework for development management decisions and procedures based on international best practice policies, regulations, and standards.

From the outset, the team were determined to ensure that both the Royal Government of Bhutan and UK-based team members spent time working together in each other's city, to cultivate relationships, and absorb a fuller sense of complex planning and engineering needs. Ideas were scrutinised and best practice learning was developed through an active dialogue between teams and local communities – a demanding, but hugely enriching activity.

Between Thimphu and London, the teams worked collaboratively to establish a planning process that is open to regular review into the future. By building in a cyclical review process now, the Structure Plan can be

adapted every five years, integrating public investment priorities in response to the prevailing economic context. This review process will also absorb census data and will be informed by a Gross National Happiness survey experience on the ground, measuring performance against the vision.

The planners worked closely, together with engineers and stakeholders, to align the **Structure Plan proposals with the water priority programme and other infrastructure improvements**. These priority projects will better balance the demands of people while protecting nature. Their purpose is to **provide safe, equitable and reliable drinking water** to all of Thimphu's residents and to ensure the **water supply network is resilient to future shocks and stresses**, such as climate change and population growth.

A key proposal is to **increase Water in Storage** through the expansion of existing storage reservoirs or by additional new storage reservoirs. This is supported by initiatives to **Reduce Water Losses** through data collection from flow and pressure monitoring to help to identify leaks in the system to target operations and maintenance that reduce water losses. Moreover the plan promotes the incorporation of **Sustainable Urban Drainage Systems** to reduce runoff flow rates, improve water quality, and improve amenity and biodiversity.



Planners also led on ensuring the vision for an active landscape integrates a suite of well-defined policy protections to help secure the tangible and intangible heritage of Bhutan and its Buddhist culture. A new Royal Parks and green infrastructure network will extend along the main Wang Chhu river valley and tributary streams, linking communities and **building resilience naturally**. Walking, e-cycling and a pioneering low emission, bus-based public transport system will reduce car dependency, releasing space for active use, bringing people together.

The policy framework addresses **geohazards, and storm water** to better safeguard the city from climate shock and extreme events such as landslides and floods. The planners played a critical role in coordinating studies and updating the land use plan based on hazard zone criteria provided by specialist engineers. Furthermore, this collaboration helped define recommendations for critical hazard and risk assessments, and suitable mitigation and resilience proposals to be undertaken through the future Local Area Plans preparation process.

Stakeholder engagement

In collaboration with the client team, planners helped to bring the vision to life by identifying 'what life looks like now' for a series of imagined households: young, old, those building careers and forming families. Arising through a city-wide consultation process led by Bhutan Government's planning team and presented through an innovative **virtual engagement platform**, this visioning process helped paint a picture of the current struggles being faced, and how these problems will be transformed over time by improving access to the right kinds of skills and livelihoods; affordable high-quality housing and community-based social infrastructure; and the key places that are important to people every day.



Link to the Sustainable Development Goals

The environmental credentials of the plan will help to make Thimphu more **resilient to climate change** (SDG 13) and promote better health and well-being (SDG 3). It supports the delivery of improved infrastructure (SDG 9) including that **designed to improve water supply and sanitation** (SDG 6). Providing new areas of **blue and green infrastructure** are expected to enhance life both below water (SDG 14) and on land (SDG 15).

A new Design Code for Thimphu seeks to improve the form of development and quality of the built environment overall within the city. Over time, other inspiring good examples will help define success in an urban context and guide change. The application of new technology with social purpose will re-connect nature, people and place and help re-establish continuities between the past and a distinctive contemporary architecture, intrinsic to Bhutan's identity. Collectively, the plan makes a positive contribution to SDG 11.

The plan will also help to transform the local labour market, from one that has been traditionally associated with imported and low skilled jobs, to one that will offer jobs in all stages of the development cycle. These include those associated with ecological

forest management to the fabrication, assembly, and management of new buildings. The plan is therefore expected to support SDG 8.

The commitment to stakeholder engagement has helped to develop new partnerships which will help to make the city of Thimphu, and its communities, more sustainable (SDG 11).



Impact of the project

Alongside other Doughnut Economics Action Lab models like Costa Rica, Thimphu is a case study in how we can leapfrog some of the negative industrialisation to get to smarter ways of developing the economy. There is capacity for all socio-economic needs to be met within the city's current boundaries over the next 20+ years, while simultaneously cultivating an enterprising and thriving local economy, realizing the vision for Gross National Happiness within the Doughnut.

This whole project provides the opportunity to show what living well in a city can look like – not measured simply by high GDP, but by a well-adjusted Gross National Happiness. How can we make our cities

more inclusive, and more equitable while also living within the ecological ceiling? The case of Thimphu shows that is not necessary to simply keep extending the city, by consuming precious land. Instead, it is far better to regenerate what's already there, with gentle intensification and reorganisation towards more distributive practices. The Plan also provides a **good example of a holistic approach being taken to consideration of the water environment**. The needs of future residents can be met while protecting natural resources. This is critically supported through **Water Demand Management strategies** helping to manage water resources, with a focus on reducing water demand by encouraging efficient usage.



Above: Preparing the Thimphu Structure Plan collaboratively Image credit: Prior & Partners



Case Study #4

Thames Tideway Tunnel, London, UK

Project location

London, UK

Project team

The Thames Tideway Tunnel is being delivered by Tideway, a company established to deliver the tunnel for Thames Water (the Utility Company). The project benefitted from a large multidisciplinary team, with Quod acting as a strategic planning advisor to Thames Water, supplementing an extensive team of in house planners at Thames Water.


Project description

The Thames Tideway Tunnel is a 16 mile-long combined sewer under construction under the River Thames in London. Its aim will be to capture, store and convey almost all of the raw sewage and rainwater that currently overflows into the estuary of the Thames.

Sewage flows into the Thames when the volume of rainfall exceeds the capacity of London's old Victorian sewer system. This was built by the famous engineer Joseph Bazalgette with a capacity to support just 4 million Londoners. To prevent sewage backing up and flooding people's homes, Bazalgette's system had the ability to overflow into the Thames via 57 combined sewer overflows along the river's banks. With a population of over 9 million today, sewage must regularly flow into London's waters. Climate change is also increasing the severity of periods of heavy rainfall, putting further pressure on London's drains to overflow.

The tunnel will drain 34 of the most polluting combined sewer overflows. The tunnel will capture all the 'first flush' from the sewers after heavy rain. This contains sediment built-up during periods of dry weather and causes the most damage. Instead of over 50 sewage spills a year, there will only be around four. These will mostly contain surface water runoff after heavy storms. The extra capacity of the tunnel will help the sewer cope with the growing demands of London's population and its environment.

First receiving planning permission in 2014, the £4.5 billion project began construction in 2016 and is due to complete in 2025. All tunnelling work under the Thames was completed in 2022. This took place via 20 separate construction sites, some in sensitive rural sites and others deep in the centre of London.



Unique role of the planner

Planners have been involved at every stage of this long-running mega-scheme. The implementation plan was first laid out in the Thames Tideway Strategic Study in the early 2000s.

The 20 sites selected for construction required a deep engagement from planners, both to justify sites selected to consenting authorities and to develop appropriate **plans to mitigate** their significant impacts on surrounding communities.

In particular, with a project of such scale, with hundreds of technical specialists focusing on their key sector, planners were required to take a **holistic view** and articulate the virtues of what would be a **disruptive** but vital infrastructure project for millions of people in the South of England. Beyond the immense **environmental benefits** it is set to bring when it comes online in 2025, London would not be able to develop further without it and planners have been tasked with communicating this not just to locally affected communities but to the public at large.

The planning team had a critical role to play through the formal **consenting process**, which culminated in a 6 month public

examination, which scrutinised every aspect of the project, to test the planning judgements that had been made around site selection and mitigation strategies.

The tunnel's massive construction footprint across London meant that careful consideration needed to be given to its **impact** on the local environment. Over the course of almost four years planners coordinated an Environmental Impact Assessment (EIA) for the project, comprising 24 individual construction sites with 24 individual Environmental Statements prepared for each site. Route-wide and cumulative effects from the tunnelling were assessed in a separate volume. The document ran to over 25,000 pages. This then fed into the **design and mitigation strategies** for the local environment that were implemented for the tunnel. Archaeology and cultural heritage were a key concern with hundreds of listed structures along the Thames and a wealth of archaeology to consider within the river itself. Transport issues were also very carefully considered with more than 90% of the excavated spoil removed to create the tunnels removed from site by boat, keeping cars off the road and providing substantial environmental benefits in the city.

Stakeholder engagement

The cost of the £4.5 billion project is being met by 15 million wastewater household customers in the South-East of England. As a result, the project has an extra incentive to ensure transparent and active community engagement.

Two full rounds of **extensive public consultation** in addition to further interim and targeted consultation to address specific issues, site or changes took place. Public consultation even took place for each of the combined sewer outflows to be addressed and a number of sites were changed as a result.

The EIA team were key attendees at consultation events explaining the potential effects of the scheme to the public. Noise was very high on the list of concerns for local residents as some would be living immediately adjacent to major construction sites in use for up to 7 years. Consultant events were used to explain coping mechanisms put in place such as secondary glazing and even temporary relocation for residents.



Link to the Sustainable Development Goals

The key SDGs to be addressed by the project are SDGs 6, 9, 11 and 14. London's growth had outpaced its infrastructure development. This has led to damage to local watercourses and the River Thames. The final completion of the Tideway tunnel will significantly improve capacity for drainage in London and beyond. Moreover, it will also allow London to grow, ensuring that new development can take place that serves its people and its economy, without concern that it will unduly impact on the water environment.

Below: River Thames



Impact of the project

The tunnel, now constructed, runs 16 miles from east to west London and at its deepest is around 70m deep. Once complete in 2025, the new 'super sewer' will **dramatically reduce sewage pollution** in the River Thames.

Where its construction sites were along the central part of the Thames, the project is also putting in its place seven newly designed **public spaces** for Londoners to enjoy.



Below: River Thames





Case Study #5

Warners Fields Masterplan, Birmingham, UK

Project location

Birmingham, UK

Project team

Dandara Living, MRTPI planners at Turley,
Arcadis, HUW, Howells and BWB.

Project description

Birmingham city centre is seeing a renaissance of development and activity fuelled by recent economic growth and the arrival of high-speed rail. Much of the centre, though once characterised by proud Victorian industry, has lost its charm, particularly around the River Rea. This was canalised to support local industry, effectively hiding it from view.

Warners Fields, and its associated **masterplan**, is seeking to pioneer the regeneration of this area of the city as one of the first developments to be brought forward within Birmingham City Council's **Supplementary Planning Document (SPD)** for the "Rea Valley Urban Quarter". Being adopted in 2020, the SPD envisages mixed use neighbourhoods that can collectively accommodate 5,000 new homes. The SPD also gives emphasis to the provision of new public spaces and a re-imagined River Rea, a primarily canalised watercourse that is situated below street level.

Warners Fields seeks to densify and repopulate the urban core and make the River Rea a defining feature, **creating a place that is permeable for people, water and nature**. The area's vision is defined by a master plan that gives **emphasis to climate change adaptation, water, and flood management and placemaking. Sustainable urban drainage, and 'sponge city' principles**, are used across the 7-hectare site that will involve

the development of 1300 residential units and mixed uses. Features include **rain gardens, permeable paving, filter strips, attenuating rainwater planting**, and specially designed tree pits. **Pocket parks and green roofs** also contribute to the site's drainage strategy.

The masterplan for Warners Fields outlines a **re-naturalisation of the river's edge and bed**. Gravels, boulders, and cobbles will be introduced to help encourage aeration, regulate water speeds, and help with the creation of riffles and pools. By liberating the river from its brick and concrete channel, the master plan enables it to follow a more naturalised course, while additional space is provided for flood storage and mitigation.

The river will become a route for people and wildlife. This new riparian corridor will create a green and blue infrastructure spine within the development site, significantly increasing **biodiversity** and wildlife in the area through nature-based solutions.

Warners Fields mitigates the urban heat island effect by increasing tree canopy (circa 230 proposed trees) to help reduce the need for heating and cooling. These trees have the potential to store over 200,000 kg of CO₂ at maturity, sequestering between 1,250 to 5,000+ kg of CO₂ per year as the trees mature, and reducing PM₁₀ and PM_{2.5} air pollution emissions by around 10% locally.

Unique role of the planner

Planners, working alongside other professionals in the consortium, including hydrologists and flood experts, architects, landscape architects and ecologists, developed the planning strategy for the masterplan. The masterplan outlines key routes and explains how land-uses should be distributed. Key principles, and clear environmental outcomes, are specified for different parts of the development. While drawing from the direction provided by the Council's SPD, the planners undertook detailed research of the area and liaised and engaged with a wide variety of specialists to ensure that key elements of the area's environment were properly understood.

Stakeholder engagement

As with most large-scale urban re-development proposals in the UK, a significant amount of community and stakeholder engagement was undertaken. This was delivered in support of the master plan, and the hybrid planning application. Engagement has been maintained since, thereby helping the surrounding community to be kept informed about the scheme.



Link to the Sustainable Development Goals

As a masterplan, setting out the nature of this future urban landscape, many of the SDGs are addressed.

Masterplans such as this, by pursuing sustainable development principles for new urban districts, inevitably involve the development of close and effective **partnerships**. The project is therefore playing an important role with respect to contributing to SDG 17 (partnerships for sustainable development). Specifically, the master plan involved close collaboration between local government

(in this case, Birmingham City Council), the private sector (the developer and other parties involved in design and planning) and civil society (local communities engaging with the development of the masterplan).

The project seeks to make an important contribution to creating a new **mixed-use neighbourhood**, with **supportive infrastructure** which minimises effects on its surroundings. The project therefore promises to make a positive contribution to SDG 11 and SDG 9. The masterplan pursues the commitment of SDG 8 in that the scheme offers commercial development and seeks to encourage innovation and enterprise. Overall, the scheme focuses on delivering positive climate action, in accordance with SDG 13. Key measures include **reducing flood risk** by re-naturalising the River Rea, and steps to adapt to urban heat through the planting of extensive tree canopies. Overall, the commitment for improving **blue and green infrastructure** positively contributes to SDG 14 and SDG 15.



Below: Looking north along the River Rea **Image credit:** Arcadis



Impact of the project

Following the submission of both a hybrid planning application and an outline planning application in January 2022, the developer and Birmingham City Council are engaged in extensive discussions prior to the determination of the schemes. Proposed amendments to the proposals, principally relating to the detailed design of the hybrid planning application are undergoing a statutory consultation process by the City Council and the application documentation can be viewed and commented on by members of the public online. Eventual construction and delivery will complete in the 2030s.



Below: The Masterplan area Image credit: Arcadis



Below: Arriving in Warners Fields from Birmingham city centre, looking east across the River Rea

Image credit: Arcadis





Case Study #6

Mobilising Adaptation: Governance of Infrastructure through Co-production (MAGIC), Community management of rainwater in Hull, UK

Project location

Hull, UK

Project team

This project was led by Liz Sharp, a Professor of Water and Planning, at the University of Sheffield, an RTPI-accredited planning school. Alongside the university, the team also involved Timebank Hull & East Riding and the Living with Water Partnership

Project description

The UK's current water system is beset by a number of serious and interconnected problems. Climate change is increasing the variability of the water cycle, and the frequency of both heavy rainfall and periods of drought. This may exacerbate river pollution which results partly from heavy rainfall. Though the impact of these changes will be felt by both humans and the environment, our changing relationship to water is not always well understood by the public. In urban environments, the increase in impermeable surfaces is exacerbating the risk of flooding at the same time as rainfall increases. Impermeable surfaces of concern might be on public land, such as roads and street paths, but can also include the roofs and tarmacked front gardens of homes. This project sought to address both public understanding and the potential for urban spaces to be better used to tackle flood risk.

Mobilising Adaptation: Governance of Infrastructure through Co production' (MAGIC) was two-and-a-half-year project trialling new **community-oriented ways of managing surface water in urban areas** that individuals and communities could contribute to using their own homes and properties.

It focused on the flood-vulnerable area of Hull and East Riding, in the North of England. The research worked with the communities using five well-frequented buildings (a church, a primary school, a petrol station with a shop, a civic hall, and a community centre) to identify how rain was collected around their buildings to not only meet community needs, but also to help hold back the rain. **Raintank planters, raintanks** and a pond were installed. The research aimed not only to inspire people to find out more about what they can do to slow the flow of rain around their own domestic spaces, but also to enthuse flood risk officials working in local authorities, water companies, and regulators to consider whether and how the public could help them reduce the risks of flooding and associated pollution.

The team from the University of Sheffield's planning department used the research to produce a guide for water professionals to assist them in **engaging local communities around water infrastructure**. It recognises the constraints under which many professionals are working but also points out significant advantages of engagement, including ensuring that water infrastructure meets a wide range of local needs, working with local knowledge, enabling communities to have some ownership of infrastructure, and reducing vandalism, litter-clearing, and maintenance costs.

Unique role of the planner

The question of how to improve land-use across cityscapes for drainage and tackling flood risk is one that must be addressed by planners. As such, the project was led by planners conducting research into these matters as well as planners bringing their expertise in community engagement on land use matters to the project.

Planners were crucial for **corralling the knowledge of the multidisciplinary specialists** taking part in the project including civil engineers, sociologists, and landscape experts.

Below: Community learning



Stakeholder engagement

The **whole project centred around the question of community engagement**, both in trying to influence local communities to learn about and take on their own drainage solutions but also testing how best to engage with communities on these issues. The project worked alongside the local authority flood managers and planners in Hull City Council, East Riding District Council and Yorkshire Water Services.

The project led to the initiation of a Hull based workers cooperative, Sustainable, which designs, builds, and installs small scale domestic sustainable drainage solutions. It built four out of the five MAGIC community rain management systems and consequently, became integral to the community engagement process.

Below: Children playing with water



Link to the Sustainable Development Goals

The project's research investigated new methods for **helping cities adapt** to the challenges they face as a result of climate change and how to **bring communities onboard**. The project therefore addresses SDG 13 whilst it also addresses SDG 11 in exploring solutions to the challenge of ensuring our cities remain sustainable in the face of, in this case, the growing threat of flooding.

The project is a great example of working towards SDG 17. Achieving the SDGs will require new means of implementing sustainable development agendas.

Community-based implementation, tying up with new technological solutions, is one such way to scale up interventions that will be vital to tackling a particular sustainable development challenge.



Image credits:
University of
Sheffield

Impact of the project

The project has developed significant lessons about how to engage local communities in challenges around local flood prevention and protection. Its engagement with water professionals has generated important **knowledge** on the opportunities and obstacles they face in implementing **sustainable drainage solutions in cities**. This new knowledge is currently being used by the UK government as they develop **new legislation** to ensure that sustainable drainage solutions are included in all new developments in England.

Below: Children playing with water





Case Study #7

Vision 2100: City of Norfolk, Virginia, USA

Project location

Norfolk, Virginia, USA

Project team

Planners in the Department of City Planning, City of Norfolk

Project description

In 2013, the City of Norfolk, Virginia was selected by the Rockefeller Foundation in the first cohort of the 100 Resilient Cities network. This recognised the City's longstanding leadership in addressing the potential impacts of climate change – sea level rise in particular – in the coastal environment. Accessing Rockefeller's resources for the programme led directly to the initiation of the Vision 2100 process.

Norfolk is second only to New Orleans in the USA in the risks it faces from coastal storms. For five years in a row, Norfolk has been the city most affected by sea-level rise on the US' Eastern Coast. Persistent flooding in recent years has damaged homes, businesses and infrastructure and even posed a risk to military assets. The sea level has risen by a foot in the past 80 years.

The city's planning and resilience staff have therefore been stuck with a singular challenge for a long time. Faced with too limited resources to harden all its 144 miles of coastline against the threat of sea level rise, the city needed to determine which of its many coastal neighbourhoods would require the application of new and innovative technologies to reduce flood risk and increase resilience.

The City of Norfolk **Vision 2100** was developed to set out a **high-level strategy to adapt to sea-level rise and flooding** through to the end of this century. By taking this rare long-term approach, Norfolk hopes to begin making planning and investment

decisions now that will help ensure it remains a “dynamic, water-based community” as climate impacts become increasingly acute in the future.

Participants in community engagement activities insisted that Norfolk was not facing a dilemma at all – it was facing an opportunity to reimagine the city for the 22nd Century. They noted that while some areas of the city were at risk, many others, due to their elevation and the existing flood control infrastructure, were not. They also felt that many of the City's higher-ground areas have been developed at very low densities and with less-than ideal uses, covered with sprawling parking lots and underutilised retail and warehouse buildings. It was suggested that while a strategy was needed for maintaining the at-risk areas, a concurrent strategy is also needed for re-imagining and intensifying the higher ground.

The plan outlines a set of citywide actions, including focusing major infrastructure investments in the most resilient areas. Other citywide actions include improving transit connections and developing policies to create a more resilient and affordable housing market.

The plan also divides the city into four distinct areas based on their topography and how sea-level-rise is projected to affect them along with their function for the city. Within each of the four areas, Vision 2100 establishes separate goals and actions to respond to unique challenges and opportunities.

Unique role of the planner

Vision 2100 was led by the city's planning department. The department's staff visited numerous boards and commissions, and held regular meetings to ensure everyone was able to appreciate the goals and ambitions of Vision 2100. This engagement activity helped to break down the traditional functional silos and embark on a collaborative effort from a unified city government. This meant that latter stages of the production of the Vision could feature a multi-departmental effort.

Vision 2100, rather than replacing the city's comprehensive land use guidance, instead speaks specifically to the city's physical, social, and economic development and provides guidance on every city service. Vision 2100 has a much narrower scope. It is a vision, not a plan. However, it became part of the city's plan ('plaNorfolk2030') and is implemented through its framework.

Stakeholder engagement

The Vision document was prepared for and heavily informed by a series of 'community visioning meetings' where local residents inputted into the process.

Community participants identified the specific value or values that many of the city's key assets provide to the city. This led to 40 out of 125 neighbourhoods in the city to be deemed 'assets' in the final Vision and therefore protected from major "transformation" (redevelopment or letting them be subsumed by rising waters).

Link to the Sustainable Development Goals

As a vision for the City of Norfolk, focusing on the city's physical development as it tries to ensure **long-term resilience**, it deals specifically with SDG 11. Norfolk, as it stands, will need to follow the recommendations of Vision 2100 if it is to survive rising waters. The Vision therefore also addresses SDG 13 in seeking to guide actions to respond to the threat of climate change in the city. As noted above, plan making, and associated visioning activity, has sought to increase the resilience of the area and has sought to deliver a **positive climate-action planning framework**. Planners preparing the plans have worked in collaboration with key stakeholders, helping to develop partnerships that are expected to be sustained during the timescales of the plan. The plan therefore positively supports SDG 17.



Impact of the project

Vision 2100 was adopted in 2016 and the visions and actions included within the document have since been used to provide an update to plaNorfolk2030, and to inform a new Zoning Ordinance that was adopted in 2018.

A variety of efforts, ranging from stormwater engineering projects in at-risk neighbourhoods to affordable housing strategies in underperforming neighbourhoods are now underway. These are driven, in part, by their identification in the Vision 2100 plan and will need to consider the recommendations of Vision 2100 as they seek to **improve** Norfolk's **flood resilience**.

An example scheme includes the Ohio Creek Watershed Project which has explored various landscape and hardscape options to address flooding and improve public access to the waterway and connections to the rest of Norfolk. Resilience Park is a key part of the project and includes a flood berm, a restored tidal creek and wetland and other environmental features. The park also includes a multi-use sports field and places for community gatherings, sports and play.

The goals, strategies and actions of Vision 2100 are now being used to create a new comprehensive plan for Norfolk, [NFK2050](#).

Below: Resilient-Park, Ohio-Creek-Project, Norfolk **Image credit:** City of Norfolk, Virginia





Case Study #8

Victorian Murray Floodplain Restoration Project Victoria, Australia

Project location

River Murray within the State of Victoria, Australia

Project team

Planners at Arup with Lower Murray Water

Project description

The Victorian Murray Floodplain Restoration Project aims to channel much needed water back into high-value floodplains along the famous Murray River. As Australia's longest river, it is a much-needed source of irrigation for its surroundings. The catchment around it, the Murray-Darling basin is widely considered Australia's most important irrigated region. .

The **Murray-Darling Basin Plan** set out a **framework for water use across the basin** as well as steps needed to address its long-term challenges. The Victorian Murray Floodplain Restoration Project has been launched by the State of Victoria, as part of its obligations under the Basin Plan, in partnership with Lower Murray Water (a water supply company), local planning and environmental departments and others.

Floodplains and wetlands have been increasingly disconnected from the Murray River with population growth, climate change and river regulation all playing a role. Without this water, these iconic landscapes will continue their decline – along with the many native trees, animals and plants that depend on them in the local water-based ecosystem. The project also aims to improve the resilience of the floodplain ecosystems against a hotter and drier climate.

The Victorian Murray Floodplain Restoration Project is a series of complex water infrastructure projects covering more than 14,000 hectares (34,597 acres) across 1,000 kilometres (621 miles) of Murray River from Echuca through to the South Australian Border. Nine high-value floodplains are targeted along the Murray River, as initially identified in the Murray-Darling basin that is shared between neighbouring Australian states. The Victorian Murray Floodplain Restoration Project plans to remove blockages that stop water flowing into creeks and implement options to manage water effectively and efficiently on the floodplain at the nine sites. It will deliver valuable environmental outcomes pumping less water to the floodplains than would be required to create a natural flood.

The projects involve environmental works such as new channels, flow regulators and pumps. This infrastructure will enable efficient use of water for the environment. For example, pumps move water directly onto the floodplains. Then, regulators keep water on the floodplains for highly water-dependent native plants and animals. The environmental works footprint will be less than 2% of the footprint of the area covered by new watering.

Unique role of the planner

The consultant planning team has worked client-side as 'Approvals Advisor' for Lower Murray Water (the lead proponent, delivering the project on behalf of the State of Victoria). This involves assessing the merits of the projects that are brought forward under the Victorian Murray Floodplain Restoration Project to see whether they comply with the terms of the project and planning restrictions and expectations that apply. To do this planners developed an Approvals Strategy, prepared the expected project schedule, and supported the complex impact assessment processes through delivering the introductory chapters, ecological benefits assessments, environmental risk assessments and environmental management frameworks to assess projects coming forward. Planners have been involved in advising Lower Murray Water on how to reach the best outcomes from the onset of the project..



Stakeholder engagement

Community engagement and consultation has been crucial, particularly during the formal environmental assessment process. The Victorian Murray Floodplain Restoration Project actively approached key stakeholders of the land and the community so that projects not only deliver environmental, socioeconomic and community outcomes, but also respect cultural values.

The intention was for **projects to not only protect the future health of these floodplains**, but also respect the **cultural values and views of Australia's 'Traditional Owners' of the local land** on the best way to deliver these projects. Traditional Owners have cultural, spiritual, and economic connections to land, water, and resources through their relationship with country. Traditional Owners have managed land and water sustainably over thousands of generations and these floodplains are areas of Aboriginal cultural heritage sensitivity. The Victorian Murray Floodplain Restoration Project are working with Traditional Owners to prepare **Cultural Heritage Management Plans** for each site.

Link to the Sustainable Development Goals

The Victorian Murray Floodplain Restoration Project and those projects implemented under it are solely water-focussed engineering projects seeking to restore water-based resources, in this case, floodplain ecosystems. However, their outcomes spread across environmental themes. The project involves the development of **resilient and innovative forms of infrastructure**, thereby supporting SDG 9. The infrastructure, and the ethos underpinning the project, seeks to adapt the environment to the increasing impacts of climate change on river and floodplain systems and the people, plants and nature that depend on them. The project therefore responds to SDG 13. By protecting habitats, and directly addressing water-based resources and their depletion, the project connects with SDG 14. Lastly, the project supports SDG 15 in that it seeks to correct land degradation, support ecosystems and boost biodiversity through improved floodplains and wetlands.



Impact of the project

The projects will provide seasonal water flows which will be managed to respond to a range of factors including the need of the wetlands and the amount of water available in the system. The Basin Plan and the Victorian Murray Floodplain Restoration Project are examples of instruments that enable a more sustainable management of water, delivering better outcomes for nature whilst meeting the needs linked to human activities.



Below: Floodplains on the Murray River in Victoria Image credit: Arcadis.



Below: Map of the Murray-Darling Basin





Case Study #9

Marker Wadden Islands, Netherlands

Project location

North of Lelystad, Netherlands

Project team

The Dutch Ministry of Public Works alongside a large consortium of consultants and contractors including planners from Arcadis, Natuurmonumenten, Boskalis, and Ecoshape

Project description

With nearly one third of the country below sea level, people living in the Netherlands are faced with the constant risk of flooding. As a result they have developed world-renowned expertise in water management and innovation to respond to the challenge.

The Afsluit and Houtrib dikes are two such examples illustrating this expertise and how planning has been key to delivering multiple outcomes. These waterworks projects have provided protection to millions of people. However, they have also had unintended negative consequences for nature. The dikes have created two lakes, Lake IJssel and Lake Markermeer, water which was previous connected to the North Sea but became stagnant with a high concentration of sediments like sand, clay, and silt. This combined with the lack of landmass in the lake means that Lake Markermeer became a hostile environment for fish, birds, and other living creatures.

The Dutch wildlife conservation NGO Natuurmonumenten and the Dutch Ministry of Public Works decided to take steps to stimulate life in Lake Markermeer. A plan was devised that laid out a series of new islands, marshes, and mud flats in the lake, with the goal of creating a new nature reserve: a place for plants and animals to flourish. Planners and construction experts designed the islands to ensure they won't be blown or washed away over time. The islands were also to

include various dunes, mudflats, jetties, and other natural barriers to help create a safe environment for fish to spawn and birds to feed and nest.

The result is the Marker Wadden Islands, five new islands of 1000 hectares. The first island was inaugurated in 2016. These islands are made completely out of sand, clay, and silt taken from the bottom of Lake Markermeer. In total, 30 million cubic meters of sediment was used to make the islands. Experts in sand morphology helped ensure the long, sandy shores of the islands provide adequate protection for the swamp lands and shallows behind them. This creates attractive areas for fish and other wildlife. In contrast to traditional structures such as steep dams and dikes, the gradually sloping natural banks create a dynamic transition between land and water. This has given Lake Markermeer a totally new look and has improved the ecosystem for plants and animals.

The extent of work has represented one of the **largest ecosystem restoration projects** in Western Europe without threatening the flood resilience of this part of the Netherlands. When complete, it will form a series of islands and landmasses covering 100 square kilometres. The islands now form a living laboratory for researchers studying how best to develop new natural systems in marine environments.

Unique role of the planner

The Department of Public Works, Ministry of Infrastructure and the Environment saw the project as an opportunity to pioneer and deliver on the **'Building with Nature'** agenda. To do so, it needed planners to coordinate the incorporation of objectives for both humans and nature from this large-scale engineering project.

Arcadis' planners worked together with landscape architects, dredging experts and engineers to deliver a plan for this revolutionary project. Planners lead on the design of the islands, maintenance plans for the sandy shores, stakeholder engagement and managed necessary licensing procedures.

Stakeholder engagement

Although nestled in the sea, away from communities, much of the monitoring that has taken place since construction to ensure that results for wildlife and nature are being achieved has been conducted by locals engaging in 'participatory monitoring'. Locals have volunteered to collect data for research and monitoring. This further generates local interest in the project and there are intentions to create further opportunities for volunteers, schoolchildren, and visitors in data collection on Marker Wadden.

Below: The new landscape of Marker Wadden



Link to the Sustainable Development Goals

The project regenerates land and builds new islands but the impact of the new landscapes on surrounding water is key. It seeks to **correct the negative consequences of modern infrastructure** of the past and restore damaged ecosystems. In doing so, it addresses both SDG 14 and SDG 15, restoring life below water and life on land. The project is a good example of **climate-positive planning**, while the underlying focus of the project is to deliver effective infrastructure (SDG 9).



Impact of the project

The construction of the Marker Wadden Islands transforms Lake Markermeer into a more dynamic environment that enriches animal and plant life. The first phase of the project was completed in 2020 with the establishment of the five new islands and the surrounding shallow wetlands.

These new islands are now a haven for plants, birds, and other wildlife. The new archipelago allows the lake and new marshland ecosystem to interact more fully. The islands are a mosaic of mudflats, marshland vegetation, creeks, and shallow isolated pools, surrounded by wide channels that provide additional sheltered shallow water, where natural processes now further re-populate vegetation and nutrients in the water.

By far, the largest part of the Marker Wadden consists of closed nature reserves, where birds dominate, including endangered species. The new nature reserve has also helped with the **recovery of the underwater landscape**. One of the islands, however, is also open to the public and includes a visitor centre, a play area for children, hiking trails and a watchtower.

