Case study 2. Mayes Brook river restoration, Mayesbrook park, east London

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Main driver: Climate change adaptation and resilience

Project stage: Constructed 2012

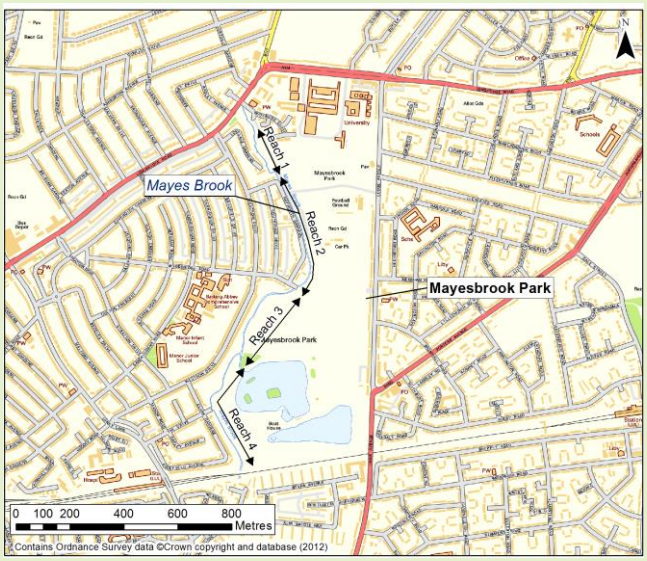
Photo 1: River floodplain restoration post-construction (source: Environment Agency)

Project summary:

This river restoration project was the UK's first climate change park. It transformed a 45ha park in Dagenham in east London (Map 1) to showcase how greenspace can help a community cope with the risk of climate change. The Mayes Brook, which formerly lay in a concrete channel, has been brought out into the park along its 1.6km length. The scheme involved river restoration, increased floodplain storage, numerous sustainable urban drainage areas and a backwater in the middle part of the park. These have contributed to an improvement in the wildlife and recreational value of the park. The landscaping in the middle part of the park has increased flood storage by 1ha to naturally and safely store the anticipated increase in floodwaters expected in future. Modelling shows flood risk has been reduced locally within the park and in neighbouring residential streets.

Key facts:

The lifetime value of restoring the site across the 4 ecosystem service categories yields a total of calculated benefits of around £27 million. This is compared to the estimated £3.8 million cost of the whole Mayesbrook Park restoration scheme, including the river restoration works. This produces a lifetime benefit-to-cost ratio of £7 of benefits for every £1 invested.



Map 1: Location of Mayes Brook project (source: Atkins 2012)

1. Contact details

Contact details	
Names:	Sarah Scott
Lead organisations:	Environment Agency and London Borough of Barking and Dagenham
Partners:	Thames Rivers Trust, Queen Mary University of London, Natural England, Design for London, Greater London Authority, London Wildlife Trust, RSA (Insurance), SITA Trust, Mayesbrook Park Friends group
e-mail address:	Sarah.Jane.Scott@environment-agency.gov.uk

2. Location and catchment description

Catchment summary	
National Grid Reference:	TQ4646884858
Town, County, Country:	Barking, London, Middlesex, UK
Regional Flood and Coastal Committee (RFCC) region:	Thames
Catchment name(s) and size (km^2):	Roding, Beam and Ingrebourne Catchment
River name(s) and typology:	Mayes Brook, low, small, calcareous
Water Framework Directive water body reference:	GB106037028170
Land use, soil type, geology, mean annual rainfall	Urban park Seasonally wet deep loam, sand and gravel, London clay Mean annual rainfall: 585mm

3. Background summary of the catchment

Socioeconomic/historic context

Mayesbrook Park lies towards the middle section of the Mayes Brook catchment and covers an area of around 45ha. The park land is owned by Barking and Dagenham Borough Council. To the southern (downstream) end of the park are 2 linked lakes, created as a result of sand and gravel extraction between 1919 and 1938 as London expanded. A decision was taken in the 1930s not to build on this area but to retain it as an urban park in amongst the sprawl of development. The development of the park was interrupted in 1939 by the start of the Second World War and features such as the Italianate gardens were never completed. The park is now surrounded by dense urban development, including many housing estates and associated infrastructure (Everard et al. 2011).

The park had suffered from a lack of investment in recent years. This 'Adapting to Climate Change' project was an initiative to revitalise the park for the 21st century as a sustainable landscape and is being implemented in 2 phases. While flood risk was not the primary driver for this project, it was important that any scheme developed helped to reduce flood risk.

Flood risk problem(s)

Located in north-east London, the Mayes Brook flows into the River Roding approximately 1.5km upstream of the confluence of the River Roding with the River Thames (Atkins 2012). The combination of the Mayes Brook's size, geology and land use results in a catchment that is highly responsive to storm events. The Mayes Brook flows from its source near Little Heath downstream to the northern most point of Mayes Brook Park at Longbridge Road. From Longbridge Road the brook flows approximately 3.6km along an open channel (via several culverts and structures) to the River Roding confluence. Flow from the Mayes Brook confluence is controlled by Kingsbridge Sluice, which prevents tidal inundation of upstream floodplains.

Other environmental problems

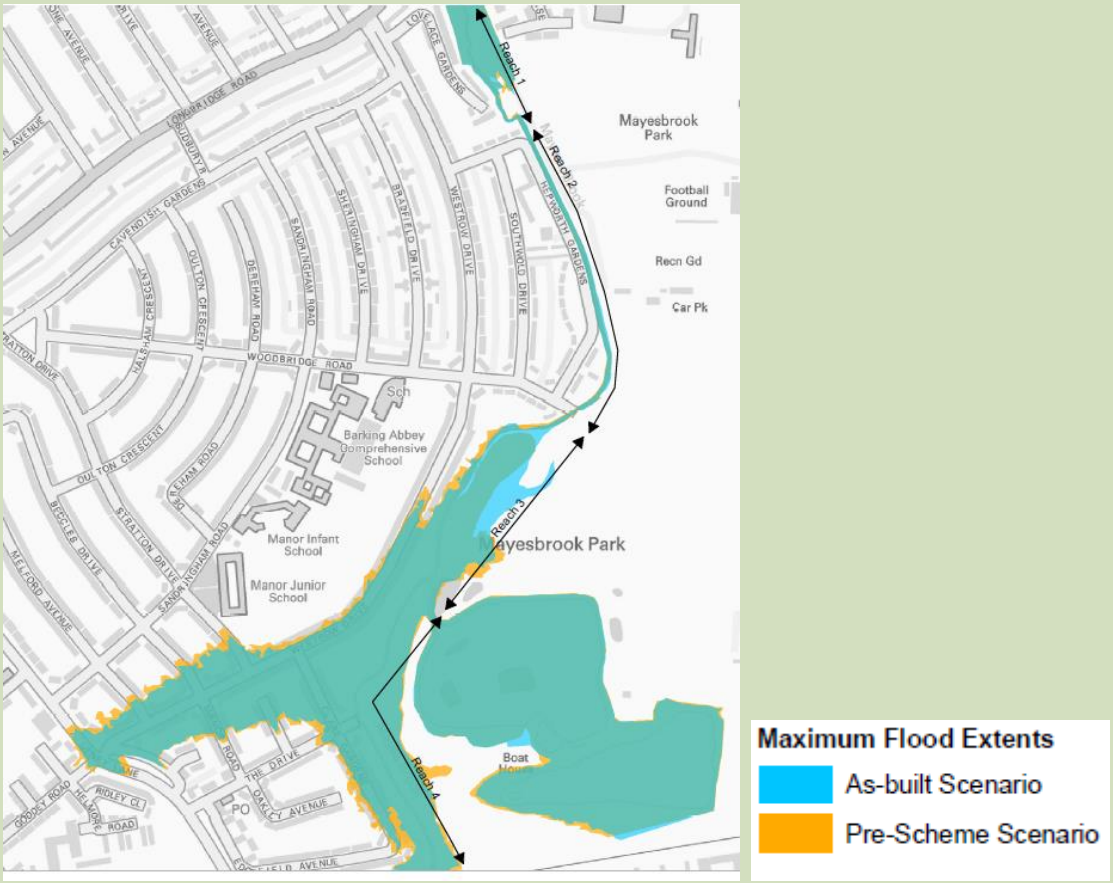
The brook was completely disconnected from the park, fenced off on the park side, and also largely invisible from the park as the channel was deeply sectioned. An embankment on the park side of the channel, resulting from an accumulation of spoil dredged from the brook and piled on the bank, further blocked the view and water flows between river and park. This potentially posed a flood risk to adjacent properties on the right bank, which lie at a lower level than the park side embankment on the left bank. Much of the park area consisted of short mown grass, which provided poor habitat for wildlife and was not used intensively by the neighbouring community. The lakes had become heavily polluted as they have served as a sink for substances from the Mayes Brook storm water overflow entering via the connecting high flow inlet channel. Three metres of polluted sediment had accumulated in the top lake.

4. Defining the problem(s) and developing the solution

What evidence is there to define the flood risk problem(s) and solution(s)

Modelling was used to develop maximum flood extents for the pre-scheme and proposed schemes for the following flood event scenarios: 1 in 5 years; 1 in 20 years; 1 in 100 years; 1 in 100 years + climate change; and 1 in 1,000 years.

The flood risk maps show that the overall effect of the restoration scheme has been to reduce the flood impacts by widening and lowering the floodplain at key locations in Mayesbrook Park (Map 2). This modelling has shown there is a reduction in peak water levels across Mayesbrook Park; the restoration scheme is shown to reduce flood levels most extensively in 1 in 100 years, 1 in 100years +climate change and in 1 in 1,000 year events. Map 2 shows that modelled reductions in flood levels to the local community on the west bank of the scheme are seen in a 1 in 100 years + climate change scenario.



Map 2: Maximum flood extent map – pre-scheme/as-built comparison for 1 in 100 years + climate change flood (source: Atkins 2012)

What was the design rationale?

The project aimed to transform a rundown 45ha park into a showcase of how public greenspace can help a community to cope with the risks from climate change, such as increased flooding and higher summer temperatures. The Mayes Brook, which formerly lay in a concrete channel, has been brought out into the park along its 1.6km length. The scheme involved:

- river restoration
- increased floodplain storage
- numerous sustainable urban drainage (SUDS) areas
- a backwater in the middle part of the park

These have contributed to an improvement in the wildlife and recreational value of the park. The landscaping in the middle part of the park has increased flood storage by 1ha to naturally and safely store the anticipated increase in floodwaters expected in future.

In addition, separate Thames Water work to remedy misconnected drains has dramatically improved the quality of the water in the brook. New trees now cover the equivalent of 3 football pitches; these give shade, help cool the area and provide a home for more wildlife. New footpaths, entrance ways and signage allow the public to better use the park.

Project summary	
Area of catchment (km^2) or length of river benefiting from the project:	The length of river benefiting from this project is 1.6km. The catchment area of the park is 45ha.
Types of measures/interventions used (Working with Natural	River restoration, increased floodplain storage, backwater creations and sustainable drainage systems

Processes and traditional):	
Numbers of measures/interventions used (Working with Natural Processes and traditional):	• 1.6km river restoration • 1.5ha floodplain storage • backwater • SUDS areas/wetland features • 3ha woodland
Standard of protection for project as a whole:	This information is not available, though Atkins (2012) modelling shows reductions in flood risk across all return periods.
Estimated number of properties protected:	Not available (the Atkins study did quantify the number of properties removed from the floodplain as a result of this project)

How effective has the project been?

Flood modelling has shown that the post construction scheme has reduced flood risk locally, but this modelling has not yet been validated through an actual flood event. The project has had many other benefits (see section 7).

5. Project construction

How were individual measures constructed?

The features and river restoration was constructed in the dry and the restored channel was reconnected to the main channel once erosion protection measures had been put in place (Photo 1).

How long were measures designed to last?

Not available

Were there any landowner or legal requirements which needed consideration?

Moving the fence line from the right bank, which bordered residential houses, needed legal interpretation as to ownership.

6. Funding

Funding summary for Working with Natural Processes (WWNP)/Natural Flood Management (NFM) measures	
Year project was undertaken/completed:	Project started January 2008 Construction commenced March 2011 and completed October 2012
How was the project funded:	Funders included: London Borough of Barking and Dagenham, Environment Agency, Thames Rivers Trust, RSA (insurance), Natural England, Greater London Authority, SITA Trust, London Wildlife Trust, Defra
Total cash cost of project (£):	River floodplain restoration: £750,000

Overall cost and cost breakdown for WWNP/NFM measures (£):	Overall cost:- £750,000 Maintenance cost: £5,000 per year
WWNP/NFM costs as a % of overall project costs:	Not available
Unit breakdown of costs for WWNP/NFM measures:	Not available
Cost–benefit ratio (and timescale in years over which it has been estimated):	The lifetime value of restoring the site across the 4 ecosystem service categories yields a total of calculated benefits of around £27 million. This is compared to the estimated costs of the whole Mayesbrook Park restoration scheme at £3.8 million including the river restoration works. This produces a lifetime benefit-to-cost ratio of £7 of benefits for every £1 invested.

7. Wider benefits

What wider benefits has the project achieved?

Everard et al. (2011) made a detailed ecosystem service valuation for the proposed project. They estimated that the lifetime value of restoring the site across the 4 ecosystem service categories (provisioning, regulatory, cultural and supporting) yields a total of calculated benefits of around £27 million. This is compared to the estimated costs of £3.8 million of the whole Mayesbrook Park restoration scheme including the river restoration works. This produces a lifetime benefit-to-cost ratio of £7 of benefits for every £1 invested.

The report by Everard et al. (2011) demonstrated that the restoration of the park was a cost-effective way of improving the well-being of the local community and proved influential in convincing funders to contribute to the project. The report found that more than 88% of the total ecosystem service benefits assessed for the park were:

- benefits to health such as improving air quality
- risk such as reducing potential flood damage
- cultural value such as providing opportunities for education

The report concluded that by restoring ecosystem vitality and functioning, beneficial services are either boosted or maintained across all ecosystem service categories. This contrasts markedly with traditional hard engineering solutions, which tend to maximise single services such as flood risk (see Everard et al. 2011, Natural England 2013).

How much habitat has been created, improved or restored?

This project restored 1.6km of the Mayes Brook and created a new 1.5ha floodplain. It also included riverside wetlands and woodland planting (Natural England 2013).

8. Maintenance, monitoring and adaptive management

Are maintenance activities planned?

Before construction, approximately £10,000 was spent each year on watercourse maintenance activities such as dredging/trimming costs/vegetation management. The study by Everard et al. (2011) suggested that post restoration the need for maintenance should be reduced by approximately 50%, leading to a saving of £5,000 per year.

Details of planned maintenance activities are not available, though it is assumed these will be similar to

those for pre-restoration scheme but at a lesser intensity/frequency.

Is the project being monitored?

Coordinated by the River Restoration Centre and the London Borough of Barking and Dagenham, a monitoring strategy was set up during the conception stage of the project with a range of targets across 4 thematic areas to assess the success of the project in a clear, scientific and transparent way. The 4 themes were:

- climate change
- natural environment (aquatic)
- natural environment (terrestrial)
- people

Photos 2 and 3 illustrate invertebrate monitoring being carried out by the Environment Agency.

Targets were set according to the SMART framework (Specific, Measurable, Achievable, Relevant and Time based). These targets were agreed by the project Steering Group and were designed to incorporate the River Restoration Centre's monitoring guidance document (PRAGMO) (RRC 2011) where appropriate. The strategy reflected monitoring activities related primarily to Phase 1 works (2011 to 2012) which included river restoration, habitat creation and general landscape improvements. It also included targets for the community engagement project, ‘Wild at Heart’ which was delivered in the park concurrently.

The monitoring document identified the overall aims for each theme and a list of individual targets were specified and prioritised in terms of cost, achievability and relevance. Information including what should be measured and existing data was recorded. Delivery of the strategy was overseen by the River Restoration Centre to ensure that all responsible monitoring partners collected their data in a timely and consistent manner.

Monitoring was carried out by different individuals and organisations of the Mayesbrook partnership. The 'climate change', 'people' and 'natural environment (terrestrial)' components of the strategy were led by the London Borough of Barking and Dagenham. With grant funding from Natural England (the Wild at Heart project), the Council employed a full-time ranger between 2011 and 2013 to organise events for local people, co-ordinate volunteers and collect monitoring data. Data were collected to indicate the resilience of restored park features and flora to climate change. Information on the change in area, condition and habitat suitability of acid grassland, meadow grassland and woodland habitat was collected as well as number of birds and bats observed.

From a social science perspective, information was gathered to capture the project's impact on local communities and park visitors in terms of.

- the diversity and abundance of park users
- an increase in outdoor learning and engagement
- participation in volunteering
- public satisfaction

The 'natural environment (aquatic)' component was delivered by the Environment Agency with Nick Elbourne, a part-time MSc. student at Cranfield University. Geomorphology, river habitat, water quality, macroinvertebrate, macrophyte and fixed point photography data were collected between 2011 and 2013. Some comparative baseline data were available from 2008 to 2009.

Photo 2: Monitoring works post construction (source: Environment Agency)

Photo 3: Explaining ecological monitoring with local school children (source: Environment Agency)

Monitoring results have shown that:

- In summer 2012 to spring 2013, the majority of restored sections showed an increase in the abundance and diversity of habitat and flow types compared with the baseline River Habitat Survey data from 2008 and 2009.
- Low rainfall and below average flows (drought-like conditions) in 2011 to 2012 undoubtedly limited the regrowth of macrophytes (after physical works). The backwater and SUDS in the middle reach were

planted up in places by volunteers.

- A scoring method was trialled to score all fixed point photos (before, during and after restoration) on the observed naturalness of habitat and vegetation within the river corridor. The majority of fixed point 'scores' peaked in summer 2012 or spring 2013 after restoration. The photos were taken on a quarterly basis between spring 2011 and spring 2013.
- There was relatively insignificant change in the topography and chainage of the cross-section surveys, collected biannually at 12 transects in the middle (6) and lower (6) reaches between autumn 2011 (immediately after new channel excavated) and spring 2012 (18 months post works). However, there was evidence of evolving in-channel features in parts of the middle reach and natural gravel movements in the upper reach.

Has adaptive management been needed?

None has been needed as far as is known. Phase 2 of the project, which considered the wider landscape and lake habitats, is currently on hold.

9. Lessons learnt

What was learnt and how could it be applied elsewhere?

There were huge benefits to working in a large partnership. Increased funding was beneficial, as well as delivering more in terms of water quality and social engagement. But as more funders became involved, the scope of the project needed to be tightly controlled to ensure core objectives were still being met.

10. Bibliography

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Project background

This case study relates to project SC150005 'Working with Natural Flood Management: Evidence Directory'. It was commissioned by Defra and the Environment Agency's Joint Flood and Coastal Erosion Risk Management Research and Development Programme.