Fonthill Park SuDS Scheme, Bristol

SuDS used

- *Cascading basins used to maximise storage volume within the park*
- *Swales for conveyance and pre-treatment before entering downstream basins*

Benefits

- *Reduces the risk of flooding to residential properties*
- *Provides positive transformational change of the park area, which now provides educational benefits, including a new learning environment for a local school*
- *Improved aesthetic value and biodiversity thanks to tree and wildflower planting, and related wellbeing benefits*
- *Provides improved water quality through taking a SuDS management train approach and reduces potential downstream sewer blockages*

1. Location

Fonthill Park, Southmead, Bristol, BS10 5SN

2. Description

The Fonthill Park sustainable drainage scheme (SuDS) in Southmead, Bristol, UK, alleviates flood risk in one of Bristol's high-risk areas identified in Bristol City Council's surface water management plan, and improves the ecological and aesthetic value of the park.

Following the identification of the area as high-risk, a flood event in November 2012 confirmed the situation, flooding local properties and causing disruption to the local road network. The key flood mechanism was due to runoff from the upstream greenfield catchment area exceeding the capacity of the piped network downstream within the urban environment.

AECOM undertook hydrological analysis of the area and developed a series of stepped cascading SuDS basins complimentary with the park's natural topography. The innovative approach taken by the design team saw the entire park being transformed into a multi-functional, interesting and engaging landscape for the public to experience and enjoy during every day weather conditions as well as an important flood mitigation asset during periods of intense and prolonged rainfall.

Completed in November 2016, the SuDS basins are primarily based on the principles of attenuation, due to the nature of the clay catchment, however some infiltration will take place.

The project uses green infrastructure to protect the area from the adverse effects of excessive storm water, increasing communities' resilience to climate change whilst also delivering multiple additional benefits including improvements in biodiversity, visual amenity, play provision and air quality.

3. Main SuDS components used

Three cascading attenuation basins, which were selected to maximise the storage volume within the park whilst minimising excavation depths, slow down and store surface water runoff entering the park from the upper catchment, where land use includes a golf course and sports pitches. The basins are linked by swales, which convey flow to the basins and form a key part of the management train (Fig. 2).

4. How it works

AECOM developed an innovative SuDS design, taking into account the park's natural topography whilst minimising the removal of existing trees. Three cascading attenuation basins were proposed to slow down and attenuate surface water runoff from the upper catchment (Fig. 3).

Overland flows enter the park directly via an ordinary watercourse, where a new hydro-brake installed at the entrance of the existing culvert restricts high flows entering. Instead, the flow spills over a side weir towards the upstream swale, which conveys flow to the rest of the scheme. This design allows lower flows to continue to enter the culvert (i.e. bypassing the scheme), which reduces storage volume requirements, thus maintaining scheme viability.

In addition to flood benefits, reducing the velocity of surface water flow as it is conveyed along the vegetated swales and held in the basins, allows suspended sediment to 'settle out'. As well as

improving water quality, this reduction in sediment load reduces the potential for blockages in the culverted sections of the downstream network, which has historically contributed to capacity issues.

To improve biodiversity and the aesthetic value within the park, the scheme was seeded with wildflower mix, which support dwindling populations of native pollinators including butterflies, moths and bees (Fig. 4). A traditional water meadow mix was selected that was suitable for seasonally wet soils that may flood for short periods in winter but are usually well drained in summer. Sharp sand was mixed with native subsoils in order to reduce nutrient content and maximise species richness.

5. Specific project details

Delivered within the secured budget, the scheme was funded by a combination of FCERM grant-in-aid, local levy funding and from a funding stream within Bristol City Council. The hydrological analysis identified that the scheme would need to be three times larger than the size originally estimated at the options stage and for which funding had been secured. There were three main reasons for this increase:

- Runoff rates from the golf course and football field, which make up the majority of the upper catchment were estimated to be higher than typical greenfield runoff rates, previously assumed, due to the landscaped and well-maintained nature of sports surfaces;
- The site investigation identified that underlying soils were predominantly clay and not loamy soils as previously assumed; and
- The consideration of longer duration rainfall events, more representative of the 2012 event, identified that more storage would be required within the park to manage runoff from these longer duration events.

To allow for this increase in size an innovative design solution was developed, which allowed the park to remain functional, while providing the storage volume necessary to return the flood benefits.

A constraint on the excavation depth was that to maintain a 1m unsaturated zone between the base of the SuDS and locally observed groundwater levels, the maximum depth was restricted to 0.8m. Further to this, to minimise health and safety risks the scheme was designed to achieve a maximum water depth of 0.6m. Low flow pipes were also installed in weirs between basins to reduce the potential for long periods of standing water, which may pose an additional health and safety risk. (Fig. 5)

Another key design feature was to ensure that exceedance flows greater than the 1 in 75 event were managed to minimise risk to the surrounding properties. Mimicking existing flow pathways, exceedance flows at the downstream end of the scheme would be directed towards the sports club carpark, as opposed to presenting a risk to existing properties backing on to the park.

Residents were engaged in the project from the outset and regular meetings with local community groups attended by diverse members of various age groups were held. This ensured that an inclusive approach to design development was adopted.

6. Maintenance & operation

The scheme has been designed to minimise additional maintenance after the initial establishment. Bristol City Council were already responsible for general maintenance within the park such as mowing and trimming, which would continue for the vegetated swales and basin areas. The only additional maintenance required is the clearance of the new trash screen, hydro-brake and low flow pipes.

A new gate to allow the maintenance team easy access to the new trash screen and vortex control at the culvert entrance was identified as part of Construction Design and Management (CDM) process. Local residents have also been proactive, contributing to the park's maintenance, picking up litter and notifying the council when the trash screen requires clearance.

7. Monitoring and evaluation

The scheme's primary purpose is to reduce the frequency and severity of flooding to local residential properties, and this has successfully been achieved over the last four years.

The Standard of Protection (SoP) provided by the scheme is 1 in 75 years. Rainfall and runoff associated with storm events in 2016 and 2018 had return periods between 1 in 5 and 1 in 10. The scheme effectively manged runoff water during these storms and will continue to be effective in the future considering the effects of climate change.

Bristol City Council have continued in their proactive approach to monitoring the impacts of significant rainfall events in high-risk areas and the effectiveness of the scheme and continue to praise the flood benefits it provides. Ongoing evaluation of the wildflower meadow will be undertaken to ensure continued establishment as is the inspection of control structures to ensure correct functionality.

8. Benefits and achievements

The scheme reduces the risk of flooding to the highway and provides protection to a number of residential properties. Since its completion in November 2016, it is known to have functioned at least twice during named storms. A week after completion in November 2016, the scheme was brought into action to protect properties from flooding during Storm Angus (Fig. 6 and 7). Rainfall depths recorded around Bristol during that time were equivalent to more than 50% of the expected average rainfall in November.

The scheme, which was completed on time and to a tight budget, successfully held surface water runoff within the park, slowly discharging the flow back into the downstream system at a significantly reduced rate. No flooding was experienced along Stanton Road, where properties had previously been affected during the November 2012 flood event. More recently, the scheme prevented potential property flooding during a heavy storm in November 2018. This statement from Bristol City Council highlights the success of the scheme:

"Without the Fonthill Park scheme we surely would have had a repeat of the flooding we last saw in 2012 if not worse… several residential properties were likely saved from flooding as a result."

Additionally, residents and park users welcomed the scheme and appreciate the wider benefits, such as the wildflower meadow and the overall 'tidying up' of the park, which had been neglected over the years. The improved landscape design (Fig 4 and 8) has encouraged the local community to make the most of this public open space. The social and wellbeing benefits of well-designed SuDS are well documented and feedback from the public confirmed that these have been achieved.

The nearby primary school have used the park for outdoor learning experiences regularly since the completion of the scheme. Pupils are given an opportunity to learn about the scheme, how it works and the purpose it serves. Recently, one of the teaching sessions saw teachers asking children to form a line and 'flow' down the route of the system. When they reached a weir, they stopped to consider what would happen to the water and bunched themselves up to demonstrate how water would back up until it reached the crest level. At which point they climbed over the weir and moved further down the system.

9. Lessons learnt

The scheme was constructed over a six-week period between October and early November. This relatively short construction period was due to early contractor involvement.

Although ground conditions were difficult at times due to the wet weather, the project was completed before the first 'named' storm of the year expected to cause significant damage (i.e. Storm Angus) arrived. However, after the storm hit the area the scheme required reseeding, which in the interim left quite an eyesore within the park and public perception had to be managed. Therefore, the main lesson learnt would be to pay close attention to the timing of construction, which should ideally take place during early spring or late summer to allow vegetation to develop.

10. Interaction with local authority

The scheme required a multi-disciplinary design team, a key part of which was formed by the Bristol City Council flood team. Throughout the project the council's flood team were pro-active, supportive and listened and responded to local concerns, which hugely contributed to the scheme's success.

This was especially evident when the requirement to upsize the scheme within the park was identified and further public consultation, led by Bristol City Council, was sought. The high level of public engagement and collaboration was key to the smooth delivery of the scheme.

Photos within this submission are courtesy of Bristol City Council.

11. Project details

Construction completed: November 2016

Cost: £80,000

Extent: 1 Ha

12. Project team

Funders	• Bristol City Council (Local Levy) • Environment Agency (Grant in Aid)	

Client	• Bristol City Council	
Designer	• AECOM	
Contractor	• North Midland Construction	

Fig. 2 – This remarkably versatile SuDS scheme is designed to convey runoff water during extreme weather conditions.

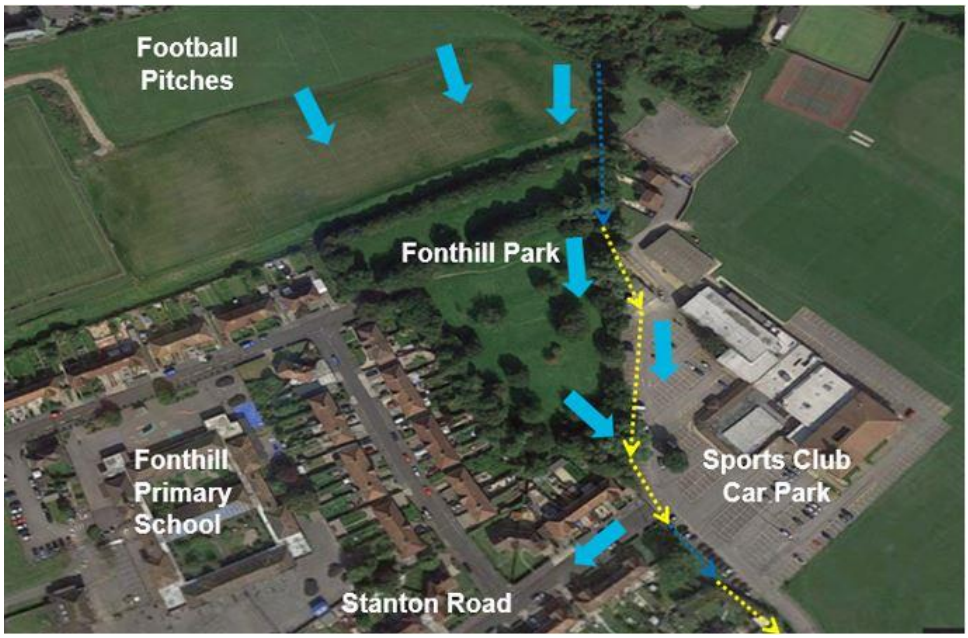

Fig. 3 – The park presented a major opportunity to control and store runoff from the upper catchment to mitigate flooding.

.

Fig. 4 – The Wildflower meadow becoming established and encouraging fauna to visit the park.

Fig. 5 – Integrating water management features into the public realm provided educational opportunities for the local primary school.

Fig. 6 – The upper basin reducing storm water runoff during storm Angus.

Fig. 7 – The lower basin reducing storm water runoff during storm Angus.

Fig. 8 – The scheme has enhanced Fonthill Park's appearance to become a more ecological diverse environment and deliver wellbeing benefits to local community users.