Counters Creek Flood Alleviation Scheme - SuDS

SuDS used

- *Permeable pavement (concrete block pavement with geocellular sub-base replacement)*
- *Rain gardens*
- *Tree pits*

Benefits

- *Reducing basement sewer flooding to properties*
- *Reducing the impact of the urban heat island effect*

- *Increasing green infrastructure on the public highway*
- *Creating capacity within the wider sewer network, increasing future resilience*
- *Wider improvements to the road network, such as traffic calming and footway renewals*
- *Community engagement events helped create a sense of ownership of the SuDS schemes by residents*

1. Location

Munster Road – SW6 - St Dionis Road to Fulham Road

Greenside Road – W12 – Whole Road

Godolphin Road – W12 – Thornfield Road to Goldhawk Road

Eddiscombe Road – SW6 – Whole Road

Wendell Road – W12 – Bassein Park Road to Rylett Road

Rostrevor Road – SW6 – Whole Road

2. Description

The wider Counters Creek Flood Alleviation Scheme was undertaken to protect over 1000 properties in West London by reducing the risk of basement sewer flooding to properties during a storm event in the catchment. The Counters Creek scheme involved the construction of new local sewer improvements, the installation of FLIP devices, and the installation of SuDS.

The SuDS element of the scheme involved retrofitting the existing Public Highway with SuDS on six roads in the highly urbanised London Borough of Hammersmith and Fulham. The SuDS element of the Counters Creek Flood Alleviation Scheme is the basis of this case study.

The SuDS schemes use permeable paving, rain gardens and tree pits to help slow the flow of surface water into the sewer. Due to the residential nature of the roads, it was a key requirement that once complete, the retrofit SuDS schemes fit aesthetically and functionally into the local environment.

3. Main SuDS components used

- Permeable paving (involving concrete block paving and a geocellular sub-base replacement)
- Rain gardens
- Tree pits

4. How it works

Before the main SuDS components were selected, consideration was given to other solutions. These consisted of SuDS solutions which aimed to address the four pillars: water quantity, water quality, biodiversity and amenity. The success of each depended largely on the engineering and local constraints of the streets, along with the potential storage capacity of each of the solutions considered.

Out of the four pillars of SuDS, water quantity was the key driver in the design of these SuDS. The first consideration was maximising the catchment areas feeding into the SuDS system. This was challenging due to the nature of the existing streets. The proximity of the SuDS to property basements and surrounding ground conditions reduced the ability to limit runoff volume through infiltration. There was the added challenge of the space available within the parking bay area, this limited the ability to provide green SuDS (e.g. bio-retention areas) within the parking bays due to the added pressure this would cause to on-street parking provision.

The system utilises the topography of the existing highway, by draining the carriageway and footway surface water into permeable parking bays. The parking bays on both sides of the road were excavated to an approximate depth of 700mm. Within the excavated parking bays, 300mm (in depth) geocellular units were installed on a capping layer of Type 1 material. The pervious concrete base was laid on top of the geocellular units, with a minimum thickness of 220mm. A permeable block layer was laid above the permeable concrete along with a 50mm layer of bedding. This construction provided a structurally solid carriageway, whilst giving the highway the permeability to allow water through. Where the sites were constrained by utilities at shallow depth, 4/20 coarse aggregate was used instead of geocellular units. This gave flexibility in the design but reduced the storage capacity available, so was used only where necessary. Where lateral utilities were encountered, the geocellular units were omitted and both ends were connected by piping through the laterals.

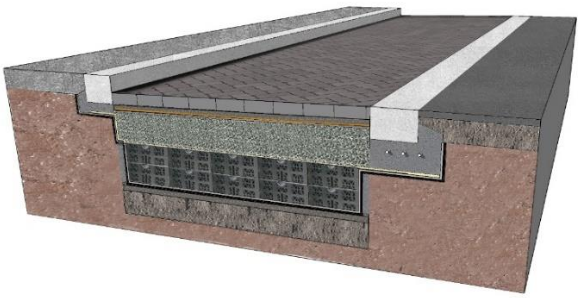

Figure 1: Cross section of permeable parking bay

Figure 2: Installation of geocellular units on site – Munster Road

Whilst guidance is available for the structural design of geocellular systems, testing material in systems with low cover is limited. As the parking bays were within the highway, it was considered that they should be designed for commercial vehicle overrun. Published guidance for geocellular storage structural design warns that they may be vulnerable to traffic damage when installed below paving at less than 1m cover. A proprietary permeable concrete base was provided below the permeable block paving to provide protection to the geocellular units. This was chosen because it has improved flexural strength, crack resistance and load-spreading ability under repetitive loading compared with permeable hydraulic bound material and traditional no-fines concrete. Moreover, its placement avoids the need for compaction plant to traffic over the geocellular units. To obtain a low cover pavement design, analysing the base thickness required customisation of the approach set out in CIRIA C737 which covers structural design using geocellular units.

Figure 3: Just laid pervious concrete – Eddiscombe Road

The permeable parking bays collect water at the surface, where it moves through the joints of the blocks, bedding and pervious concrete before entering the geocellular units. A filter geotextile is provided to capture silt and oils. Once the surface water is in the geocellular units, it flows through a series of flow control chambers which were provided with orifice and weir plates to minimise discharge rates and maximise the storage capacity. Orifice sizes were set to a minimum of 50mm diameter to minimise discharge rates while reducing the risk of blockage. These lead to terminal manholes connecting to the combined sewer system which were provided with flap valves and foul air traps to prevent back flows, odours or gases entering the SuDS system. The discharge rates for return periods up to the 1 in 20 year storm were dictated by the overall sewer hydraulic modelling to meet the target TWL at the sewer. The system was also designed to have controlled flooding for return periods up to the 1 in 100 year with a climate change allowance of 40%.

In addition to the permeable paving, rain gardens and tree pits were integrated into the design. These biodiversity pockets, generally 2m x 2m, could be located at dead spots or discreet locations in the longer streets without having significant impact on parking provision. These rain gardens are part of the hydraulic system of the permeable paving: geocellular units below the substrate are connected upstream and downstream to the sub-base storage of the permeable paving. These units include a gravel sump and rockwool material to provide passive irrigation to the substrata by capillary action, thus removing some runoff volume from the sewer. The system also intercepts runoff directly from the highways via kerb openings; a measure that, together with a filter geotextile installed in the permeable paving, provides pollution control should the system be connected to a surface water sewer in the future.

The approach of using permeable block paving parking bays provided an adaptable solution for the site-specific constraints of each road, specifically in terms of the depth of excavation and the existing highway use. This was a proven solution based off successful previous trials with SuDS working collaboratively with Thames Water. As the SuDS schemes are in highly urbanised areas, it was clear from initial consultation with residents that parking was at a premium. Although residents were open to green infrastructure, in general they were opposed to the idea if there was a risk of loss of parking. In three of the SuDS schemes, rain garden and tree pits could be installed.

Figure 4: Finished scheme – Eddiscombe Road

Figure 5: Finished scheme – Munster Road

5. Specific project details

This SuDS project is part of a wider drainage project called the Counters Creek Flood Alleviation Scheme, aiming to reduce the risk of basement sewer flooding within the catchment area.

The solution involved localised construction options; FLIP devices (pumped non-return valves), local sewer upgrades and SuDS. In March 2019 a final decision was made on which SuDS schemes were to go ahead, this left 3 months to complete detailed design and 9 months to deliver on site before the wider Counters Creek project ended in March 2020.

During design and delivery, there were multiple disciplines involved, from Hydraulic Modellers, Drainage, Civil and Highway Engineers to Landscape Designers. In addition there was a Thames Water communication team who worked closely with the engineers to ensure the right messages were delivered to the residents.

As all the SuDS schemes had to be delivered on-site in 9 months and the lead time for the design team was short, it was key that all partners worked together in the design and delivery to ensure the tight time scales were met. Both F M Conway and Cappagh Contractors were involved in the design of the SuDS schemes, helping to create designs that were deliverable. During the design phase, meetings were held with all parties (Thames Water, LBHF, Mott MacDonald, F M Conway and Cappagh Contractors) every 2-3 weeks to go through the designs and programme. At these meetings other areas of the project team would also be in attendance including; the commercial team, H&S leads and the communications team, this again ensured we remained on programme and prepared for construction. This project involved significant collaboration between Hammersmith & Fulham Council, Thames Water, Mott Macdonald and the different contractors involved.

The consultation with residents and Councillors was of great importance in these SuDS schemes, due to the amount of disruption caused whilst the roads were closed, and the short time frame for the consultation process. As such it was decided to do on-street consultation events for each road, along with letter drops to residents and businesses which had enclosed a leaflet of information about the project and the planned works.

The consultation events were held mid-week and in the early evening as most people were more likely to be at home. The on-street engagement involved having the plans for the street on view within a gazebo in the parking bay area for each road, this approach led to an increased engagement rate at the drop-in events. At each event there were at least 4 people from the project team present including a minimum of; a member of the Thames Water communication team, a designer from the Mott MacDonald, a representative from Thames Water integration team and LBHF. The events were well attended and feedback from residents at the events influenced the final design of some roads with the removal or repositioning of rain gardens, and changes in traffic management. The events also provided an opportunity to deal with concerns over access to off street parking, repositioning of disabled bays and electric charging from home.

6. Maintenance & operation

The SuDS are maintained by LBHF. Inspections of the block paving is part of the routine Highway inspection programme, and cleansing of the chambers part of the gully cleansing programme.

Maintenance of the green spaces is being undertaken by the Hammersmith Community Gardens Association, who were also involved with planting of the rain gardens and helped to organise community events for the planting of these spaces.

Figure 6: Community plantintg day – Godolphin Road

7. Monitoring and evaluation

The SuDS schemes have worked in current rainfall to date. Monitoring of flow will be taking place but is not in place at this time. This is due to be implemented later in 2020.

8. Benefits and achievements

- Benefits
  - Reducing surface water runoff entering the combined sewers resulting in reduced risk of basement sewer flooding.
  - Reducing risk of surface water flooding in the highways.
  - Reusing highways runoff in rain gardens and tree pits.
  - Reducing pollutant concentration from highways runoff at discharge points.

- Increasing green infrastructure on the public highway and reduce impact of the urban heat island effect through the removal of asphalt for permeable blocks.
- Creating capacity within the wider sewer network, increasing future resilience.
- Project delivered wider improvements to the road network, such as traffic calming and footway renewals.
- Community engagement events helped create a sense of ownership and involvement of the SuDS schemes by residents and residents' groups.
- Works were undertaken by the borough's contractors, meaning the maintenance of the spaces will be undertaken by contractors who have experience of SuDS. The work also built up knowledge of SuDS for the contractors.

- Achievements
    - The SuDS schemes were all delivered within 9 months, and when given the constraints of the road network in London and size of the project this was an achievement.
    - Consultation with residents was key, their input at consultation shaped the design at street level and built ownership in the community.
    - The project helped to build awareness of flood risk within the community and showed how we can alleviate flood risk sustainably.
    - Showing that SuDS can be installed in highly urbanised areas, and on roads that have high traffic flow.
    - The SuDS schemes designs are easily repeatable in other streets.
    - Collaborative working and trust between all partners involved was key to the susceess of the project. The relationship between the private utility company and a local authority showed how the two can work well together. This is supported by how the contractors on-site worked well together under tight site conditions.

9. Lessons learnt

All 6 SuDS schemes had to be designed and delivered on site within the 12 month period. If more time had been available further ground investigation would have been undertaken to gain further knowledge of ground conditions, which would have prevented making changes to the design on-site.

Communciation was key to the project's success, both internally between all the partners involved and externally with residents and Councillors. Early engagment with residents and Councillors allowed their ideas to be incorperated into the designs and any concerns to de addressed.

The Contractors were involved in the design of the project, enabling early feedback they had on the site management, programme and incorporating their suggestions of materials and working practices. This early engagement with F M Conway and Cappagh Contractors prepared them for the works, and made them an integral part of the project, helping to build that spirit and trust between all the partners involved.

During construction independent H&S inspections were undertaken every two weeks, assessing all the contractors on-site and wider traffic management. As the construction was all undertaken in a short time frame, and at points multiple SuDS schemes were in construction concurrently, it was key that Health and Safety standards did not drop, and if they did immediate action was taken to address this.

During construction, on-site weekly meetings were held with LBHF, the Contractors and the design team from Mott MacDonald. These meetings went through any issues with constrution and design, and enabled Mott MacDonald to make changes to the design quickly if needed.

When changes to the design occurred on-site, Hammersmith & Fulham Council were able to use their in-house survey team to undertake surveys when needed. This ensured that the design team had accurate information to undertake any change in design. An example from Godolphin Road being a utility service being shallower than anticipated, in this case it was not straight in the road, but moved from side to side. The in-house survey team were able to map the utility within a few hours and send it to the design team that day to work on a solution. This ability to adapt and make changes fast was cruitial to keep the construction to programme.

The project trialed new applications for some products, including a proprietary permeable concrete mix. Using these products in high traffic roads was a concern due to the risk of road failure, additionally there was little available on how to best install the product. With additional time, trials could have been undertaken before using the product more widely. However, in this case, after a few pours the best instalation method was identified with the supplier and through beam tests of the material that came to site, it provided confidence that the product will meet the design specifications.

Other lessons learnt include:

- Rethinking the traditional 'level of protection' has allowed for opportunities to be realised within the catchment, offering smaller-scale solutions bringing quantifiable benefits for the residents.
- Early coordination with Statutory Undertakers and surveys are essential to understand above and below ground constraints.
- Design needs flexibility and modular solutions that can adapt to specific constraints.
- Engagement with the community and the supply chain is important to identify opportunities and innovative products.

10. Interaction with local authority

Hammersmith & Fulham Council were involved throughout the process and tasked with the delivery side of the project. This ensured an innovative and collaborative approach with all partners throughout. All the SuDS schemes were within the public highway and after installation are maintained by the Local Authority. It was therefore decided that the Local Authority would use their highway contractors to undertake the work.

Thames Water Utilities Ltd were the project sponsors, Mott MacDonald were the designers, Hammersmith & Fulham Council were the client, and F M Conway and Cappagh Contractors were the contractors for the work, with support from SEL an installation company for Polypipe.

Figure 7: Project team and contractors on site at Munster Road

11. Project details

Construction completed: *9th March 2020*

Cost: TBC

Extent: 12851m^2

Project team

Funders	• Thames Water Utilities Ltd	
Clients	• Hammersmith & Fulham Council	
Designers	• Mott Macdonald • Hammersmith & Fulham Council	
Contractors	• F. M. Conway Ltd • Cappagh Contractors	
Other	• SEL Environmental Ltd • Hammersmith Community Gardens Association	