CASE STUDY

Alleviating flood risk in a new housing development

A sustainable approach in York

1. SUMMARY

Derwenthorpe is a new mixed tenure development in York which will include around 500 homes upon completion. The scheme is being developed by David Wilson Homes for the Joseph Rowntree Housing Trust and aims to be a socially and environmentally sustainable community. This case study explores some of the sustainability features of the scheme and, in particular, the role and importance of the sustainable drainage scheme (SuDS) put in place to alleviate flood risk.

2. SUSTAINABLE DESIGN FEATURES

A range of environmental and social features have been included to support sustainability:

- 40% of the scheme is affordable housing, with 25% social housing and 15% shared ownership
- a communal heating scheme, which saves residents money on heating bills compared to the national average
- the homes are designed with high levels of insulation and air tightness and feature ventilation systems
- the homes are built to *Lifetime Home* standards and a number have been adapted to support families with disabilities
- incentives are provided to reduce car use and encourage use of low-carbon transport, including a car club, travel passes and bike vouchers
- communal facilities include 18 acres of managed open land (35% of the total development), including a playground and ponds.

In addition to providing high quality homes across tenures, efforts have been made to minimise the environmental impact of the homes. Most homes are designed to 'Code 3' or 'Code 4' of the *Code for Sustainable Homes* (the former Government-defined benchmark for sustainable construction standards) and this energy efficiency has helped to significantly reduce CO_2 emissions compared to that from average homes (1.53 tonnes of carbon emissions per year per resident compared to the national average of 2.73 t/yr/resident).

A key feature of the scheme is a sustainable drainage system (SuDS) to reduce flood risk. The purpose of the drainage system is to avoid a large volume of surface water from the estate being channelled into the Osbaldwick Beck via a single discharge point during heavy rainfall. The drainage system needed to be designed in such a way that it would not channel water from the site into the beck when at full capacity. The use of impermeable surfaces within the estate (roofs, paths, roads, etc.) increased local flood risk and necessitated a flood alleviation solution.

To avoid overflow, the drainage system at Derwenthorpe uses two ponds to control the flow of water from the site into the beck. The drainage system allows for the slow release of water from a large storage pond, which has the capacity to store 5.2km^2 of surface water, into a small pond that channels water into the beck. To ensure water from the small pond is not channelled into the beck when it is at full capacity, the drainage system includes a mechanism to monitor the water level of the beck in order to identify times when it is unable to hold additional volume. When the beck is full, water is retained in the large pond. In addition, raised grass banks line the parklands and play areas, acting as a surface water storage mechanism.

The engineering design of the drainage system is relatively simple: two outlet pipes store and release water from the estate into the beck at a controlled rate. Water also drains from residents' gardens into the large storage pond to avert ground saturation. Pipes connecting the storage drain to the beck are monitored to ensure any blockages can be detected and rectified. Responding to blockages is the responsibility of Yorkshire Water. Entrances to pipes are covered by wire mesh to ensure debris does not block the flow of water into the beck. Monitoring of the Osbaldwick Beck is carried out by the Foss Internal Drainage Board. The drainage system is designed to withstand the combined impact of a 1 in 100 year flood and a 1 in 100 year storm.

3. PARTNERS

Joseph Rowntree Housing Trust manages the site and provides properties for social rent and part ownership; David Wilson Homes is doing the construction and provides properties for full ownership; Mansell carried out infrastructure works on the site; Yorkshire Water monitors drainage system pipes; the Foss Internal Drainage Board monitors and manages Osbaldwick Beck, although its role is outside of the management of Derwenthorpe.

4. GUIDING PRINCIPLES

The purpose of the sustainable drainage system at Derwenthorpe is three-fold:

1. its main function is to reduce the the flood risk posed to residents of the estate without increasing the risk posed to residents downstream
2. in addition to managing flood risk, the drainage system supports biodiversity
3. it also improves the appearance of the area as the ponds provide a natural amenity feature.

5. OUTCOMES

During December 2015, 120mm of rainfall fell on Yorkshire and Lancashire in 24 hours (the average rainfall for the whole of November is 150mm) and York, like other areas during this period, was particularly badly affected. Those involved in the management of Derwenthorpe report that the drainage system succeeded in managing the excess water that fell on the estate during this period. Research into resident satisfaction with the estate generally (Quilgars, et al, 2016) revealed nine out of ten residents were satisfied with their homes, and the estate won Best Large Development at the 2015 Yorkshire Residential Property Awards.

6. COSTS

Installation costs are hard to identify. The drainage system underpinning the SuDS is linked to local water networks and there is not a clear demarcation between developer-funded and local water board-funded infrastructure. Routine maintenance works are carried out to maintain the functionality of the SuDS and its presentation to the local community. Annual maintenance expenditure is attributable to: managing vegetation, dredging the drainage ponds, monitoring water quality and replacing timber that lines the pond. Maintenance relating to internal pipes – clearing blockages and monitoring the nearby beck – is carried out by local agencies.

7. CHALLENGES

Initial concerns were rightfully raised by local partners regarding the possibility that the drainage system at Derwenthorpe may increase flood risk downstream. To address this, developers increased the size of the storage pond such that it would be able to withhold excess water without releasing it into the beck when at full capacity.

In relation to the wider sustainability of the development, the Joseph Rowntree Housing Trust is carrying out longitudinal research to understand the barriers to, and support required for, residents adopting sustainable lifestyles in their homes and in the wider community.

8. LINKS

Quilgars, D., Dyke, A., Tunstall, R., and West, S. (2016). *A sustainable community? Life at Derwenthorpe, 2012-2015*. Centre for Housing Policy and Stockholm Environment Institute, University of York: York.

9. CONTACT

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