Counters Creek - Report of high level review

Our desk based review and challenge indicates that the further examination of root cause of flooding carried out by Thames Water to date shows that the previously proposed large-scale Counters Creek tunnel adds little additional benefit for its cost, given that local solutions would still be needed to alleviate the current causes of flooding.

In our view, the technical approach to such local solutions is appropriate and we are satisfied that these are being carefully designed and take into account the potential impacts of climate change. We note that future development and increases in rainfall intensity may still require a more strategic response in 20 or more years' time. However, it is unlikely that this would be an interceptor tunnel as proposed previously and more likely a strategic surface water management scheme. We are satisfied that the current approach will be compatible with any such future strategic scheme.

1 Background

The Counters Creek catchment of west London has suffered from significant basement flooding problems with notable incidents in 2004, 2005 and 2007. To resolve this, Thames Water had proposed at PR14 the construction of a major tunnelled storm relief sewer to reduce water levels in the combined sewerage system. Successfully reducing the flooding risk would also require improvements to the local sewers and installation of FLIP property level protection devices.

Recent more detailed assessment of the causes of the flooding has shown that most of the expected potential benefit of reduced flooding may be provided solely by carefully designed improvements to the local sewers and installation of FLIP devices; the tunnel itself does not provide significant additional benefit and so is not cost beneficial.

Thames Water is now proposing an alternative scheme that dispenses with the tunnel and makes full use of the other two components combined with more extensive use of sustainable surface water drainage systems.

1.1 Purpose and scope of review

Thames Water's Customer Challenge Group has asked for an independent review by an expert who has not been involved in the project, to provide confidence that the causes and impacts of flooding are sufficiently well understood and that the proposed scheme will provide the required level of protection after allowing for climate change and future development. The review is to be of the approach taken and the assumptions made; it is not to repeat the detailed audit of the modelling work that has already been done by others.

The review has been carried out by a desk study review and challenge of project method statements, reports and model results supported by discussions with key staff from Thames Water and the project design team to understand the thinking behind the decisions made and to expose and clarify any uncertainties or inconsistencies.

2 Solution strategy

2.1 Potential solutions

The problems of basement flooding are particularly difficult to solve, as in most cases the soffit level of the sewer is above basement level; so that flooding may occur even before the sewer is running full. Solutions that reduce the water level in the trunk sewers further downstream therefore do not provide much benefit, as local wet weather flows could still cause the sewer to have a significant depth of water.

The original proposal for a tunnelled trunk relief sewer was found to not provide enough benefit on its own and would also require local solutions to protect at-risk basements. As the

understanding of the catchment has developed and the number of properties identified as being at risk of flooding has reduced, the cost of the tunnel now significantly outweighs the benefits.

A strategy of local solutions is therefore considered more appropriate to provide property protection with a strategic solution only required if future conditions would mean that sewer flooding occurred at ground level. This is not currently the case.

2.1.1 Sewerage solutions

Three types of local solutions have been considered

- FLIPs
- Rider sewers with a pumped discharge
- Rider sewers with a gravity discharge

FLIPs

FLIP devices ('flooding local improvement projects') are small packaged pumping stations successfully installed on many individual properties to pump flows from the property to the sewer. They incorporate a non-return valve to prevent any reverse flow from the sewer. They are fitted with telemetry so that any faults are automatically reported to Thames Water. These are an excellent method of protecting basement properties and in some European countries they are required through Building Regulations in all properties with a sewer connection from the basement.

A programme to install FLIPs on all properties with a risk of basement flooding in the Counters Creek catchment would be a potential approach. However, FLIPs are expensive to install and there may be alternative solutions that are as effective but cheaper.

When a FLIP is installed this is normally on the current property drainage system, so that the FLIP takes all of the drainage from the property, both foul and rainwater. Consideration can be given to separating the foul and rain water flows where this is feasible, although the added complexity, increased time to install and extra cost usually rule out this option.

Pumped rider sewers

Where FLIPs are not feasible or where there is a cluster of properties needing protection then an alternative solution is a rider sewer running parallel to the main sewer with a single larger pumping station to pump the flow up to the main sewer. The rider sewer also provides some storage so that short duration peak flows greater than the pump capacity can be stored and pumped out after the peak.

As these involve a pumping station, they have a significant construction and operational cost, require significant space for the pumping station and the above ground control kiosk and require reliable power supplies and telemetry.

Thames Water's current proposal for this type of scheme is again to take all of the flow, foul and runoff, from the properties into the rider sewer. As with the FLIPs, consideration can be given to reducing the required storage by separating out the property drainage and only connecting the basement and basement area drainage into the rider sewer. However, this would be balanced by the additional complexity and costs for modifying the drainage and providing sustainable drainage for the runoff, which in most cases would rule out this option.

Gravity rider sewers

Where the sewer levels and the peak water levels are suitable then a rider sewer with a gravity discharge to the main sewer can be used. This discharges to the main sewer through a gravity connection fitted with a flap valve. When the water level in the main sewer is high, the flap valve closes and the rider sewer stores the water for later discharge as the water levels drop.

These are carefully designed to ensure that there is enough storage to cope with long duration storms that keep water levels in the main sewer high for a long period. This is done with checks against 12 hour duration storms.

Thames Water's proposal for this type of scheme is again to take all of the flow, foul and runoff, from the properties into the rider sewer. As before, consideration can be given to reducing the required storage by separating out the property drainage and only connecting the basement and basement area drainage into the rider sewer. However, this would be balanced by the additional complexity and costs for modifying the drainage and providing sustainable drainage for the runoff, which in most cases would rule out this option.

These solutions are in principle cheaper and easier to construct, operate and maintain than a pumped rider sewer but may require costly extra storage volume for long storms.

2.2 Target properties

The assessment of properties at risk of sewer flooding originally considered all properties potentially at risk of basement flooding from predicted high water levels in the sewerage system. This initial assessment understandably predicted far more properties at risk than had ever reported suffering from sewer flooding. This was believed to be due to a variety of causes including: properties not having a basement, not having a sewerage connection to the basement or being protected by an original flap valve. Customer surveys were carried out but did not provide sufficient responses to enable the real flood risk of all individual properties to be understood. However, the responses did allow the proportion of properties truly at risk to be estimated. This gave a number similar to the number of properties where flooding had been reported and so is realistic.

The strategy is therefore to target properties that are confirmed as having already suffered from basement flooding; these are the so-called "driver properties". All the properties where hydraulic sewer flooding is confirmed are to be provided with protection, either using a FLIP or as part of a local schemes. For the local schemes, intermediate properties within the cluster of driver properties, which have a currently unproven risk, are also provided with protection.

This approach makes it difficult to consider those properties that may become at risk due to climate change impacts, failure of flap valves or basement conversion. There will therefore continue to be a few properties that suffer from flooding for the first time and require additional schemes to resolve. However, as the location of these properties cannot be predicted and therefore protection cannot be provided until they have flooded, there is no cost-effective alternative to the approach being adopted by Thames Water.

2.3 Solution hierarchy

The solution hierarchy adopted by Thames Water originally considered a range of solutions depending on the root cause of the flooding. This has now been reduced to two or three solutions.

- Individual flooding properties will be fitted with FLIPs unless a FLIP is not feasible or if there is a cluster of 3 or more properties, where alternative solutions are cheaper.
- If FLIPs are not used, then a rider sewer will be constructed, if possible with a gravity outlet. If a gravity outlet is not feasible then a pumped outlet will be adopted. The rider sewer will also pick up intermediate properties within the cluster that have not been reported as suffering from flooding.

All three types of local solutions are acceptable and robust provided that they are correctly designed using sensible design criteria (see section 3 below).

There may be some situations where a proposed rider sewer solution would pick up some properties that are already fitted with FLIPs. In this case it may be better from a customer engagement perspective to use FLIPs throughout rather than constructing a rider sewer.

3 Design criteria

This review has not seen all of the details of the design criteria used for individual local schemes but we understand that good practice as set out below has been followed.

3.1 Rainfall

The standard design criteria for Thames Water is for no flooding in a 1:30 annual probability of exceedance. This standard has been used for the design of the local sewerage improvements. This has used the most recent FEH13 rainfall model, which is significantly improved over the earlier FEH99 model and gives slightly higher rainfall intensities.

Correct application of this model requires the consideration of a wide range of event durations to ensure that the critical duration has been identified. In particular when adding storage to a system it is necessary to consider longer duration events. The schemes have been assessed using a range of storms up to a long 12 hour duration. We believe that this is appropriate.

The rainfall depths are not reduced to represent the variation of rainfall over the catchment, providing a more conservative design approach (with a safety margin of about 5% on the rainfall depth) under current climate conditions, compared to the normal design approach.

3.2 Climate change

Local solutions, such as rider sewers, will be susceptible to increases in rainfall intensity in the local area and the schemes should be designed taking account of this.

Estimates of the increase in rainfall intensities depend on the climate change scenario and on the critical duration of the rainfall event. However, for the London area an increase of typically 20% by the 2030s is to be expected. An allowance of 20% increase is therefore being made for the design of local solutions.

The allowance for climate change for new schemes should be reviewed in future years to ensure they are appropriate as knowledge on the impact of climate change improves.

3.3 Downstream water levels

When the Thames Tideway scheme is commissioned in 2024, it will reduce water levels in the downstream area near to the Hammersmith pumping station, although this may not be reflected back up to the local sewers because of local restrictions of capacity. This future scenario has been considered in general but not in the design of the individual local schemes, as these will need to be effective before the Tideway scheme is commissioned. The reduced water levels in the future from the Tideway scheme may provide some mitigation for any increase in water levels caused by no longer “storing” flows in residential basements and additional mitigation for future climate change.

3.4 Sensitivity

Sewerage simulation models have an inherent error band of at least 10 percent of flows and water depths. It would therefore be sensible to check the performance of proposed designs in a rainfall event larger than the design conditions. This does not imply a requirement to design the sewerage system to a greater standard; but may indicate where other measures may be required to control excess flows in larger events to avoid a catastrophic failure.

Martin Osborne
Technical Director
Martin.Osborne@WSP.com
07736 362 944

13 Feb 2019