Final report

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Northampton Central Area drainage assessment

Northampton Borough Council

August 2012

Halcrow

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Northampton Central Area drainage assessment

Northampton Borough Council

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1 Introduction

1.1 Context

Northampton Borough Council, working in close co-operation with the Environment Agency and Anglian Water commissioned Halcrow Group Limited to undertake a drainage assessment to support the Northampton Central Area Action Plan. The purpose of this assessment is to provide an evidence base on the impact of development on the drainage system and options to mitigate the impact.

Northampton Borough Council (NBC) is progressing the Northampton Central Area Action Plan (CAAP) as part of the Local development Framework for West Northamptonshire. It will complement the West Northamptonshire Joint Core Strategy being progressed by the West Northamptonshire Joint Planning Unit.

The Vision for Central Area set out in the CAAP is 'By 2026 Northampton City Centre will be firmly established as the economic and cultural hub for Northamptonshire. It will be the destination of choice for people within the County and beyond to live, work and relax. The city centre will be using its strengths, in particular its architectural heritage, its riverside, a distinctive retail offer and its cultural offer as a key to success.'

In seeking to meet this vision the Plan identifies significant areas for regeneration. These will accommodate development of over 3500 dwellings, approximately 150,000 sq m of office space and 55,000 sq m of retail space. The major development areas have been identified in Figure 1-1[1]. The Pre-Submission Draft Central Area Action Plan was published on 4th November 2010 for consultation. The consultation period closed on 16th December 2010. The Pre-Submission draft document can be viewed at:

http://www.northampton.gov.uk/site/scripts/documents_info.php?documentID=216&pageNumber=6

In order to present a sound evidence base for the CAAP, it is necessary to show that there is sufficient drainage capacity within the surface, foul and combined drainage networks to accommodate the CAAP new and redevelopment proposals. Recently completed studies and ongoing studies have highlighted the issue of surface water flooding, and potential issues with capacity within the below ground drainage systems within Northampton and the Central Area. Some of these proposals involve only change of land use, or minor improvements to the site, and there will be little opportunity to alter or improve the drainage of these sites. In these locations there will not be any large scale change in demand for wastewater or surface water surfaces.

Proposed increased densities in other proposal areas could have significant impacts on both surface and foul drainage and there may be combined solutions, such as surface water separation

[1] During this study, there have been two changes that may affect the conclusions of this study. These are the designation of the Northampton Enterprise Zone, and changes to proposed use of the former Fish Market to a bus interchange. Although the drainage assessment is based on the previously advised land use, prior to these changes, we consider that a bus interchange offers significantly greater opportunities for drainage improvements in the public realm. The impact of the Enterprise Zone and changes in land use will need to be reviewed in any future work.

amongst others that need to be considered at a strategic planning stage. If there is not sufficient drainage capacity, then evidence needs to be presented that additional drainage capacity can be created sustainably, cost effectively and within the necessary timescales without damaging the viability of the CAAP.

Anglian Water Services (AWS) are responsible for the combined, foul and surface water sewer network, and have recently developed and verified a detailed model of the foul/combined sewer network using Infoworks CS™. This network also contains some surface water sewers where they interact with the foul and combined system, although the level of verification of the surface water system is less robust than the foul and combined sections. The Central Area also contains other surface water drainage (Highway Drains, private surface sewers and ordinary watercourses that are not modelled by the AWS Infoworks CS™ model, and that are not AWS responsibility). This additional asset data has been recently collated by the Lead Local Flood Authority, Northampton County Council, but was available for this project.

The Central Area is extensively drained by combined sewers, with only small areas being drained by foul only and surface water only sewers. With the exception of the Waterside proposals and Castle Station, Anglian Water Services modelling indicates that their combined and surface water system drains over 85% of the total area of the proposals. Because of the prevalence of combined sewers, there are a number of combined sewer overflows (CSOs) within the Central Area. These operate during wet weather conditions and may have an impact on water quality should development impact on drainage demand and routes.

The artificial drainage system ultimately discharges to a number of open watercourses in the River Nene catchment in the Northampton area.

Figure 1-2 shows the Anglian Water sewer network and combined sewer overflows, and Figure 1-3 details the system type (foul, combined or surface).

There are other systems of surface water conveyance that we have not been able to map, for example, highways drainage and private drainage systems. At the time of the commission of the study, there was no complete register of surface water assets within the Central Area. Northamptonshire County Council (NCC) have recently completed a Surface Water Management Plan which details all surface water assets. Any future surface water masterplanning or drainage strategy work should refer to the full register of surface water assets as held by NCC.

Northampton standards of protection

Following the significant flooding to Northampton town centre in Easter 1998 improvements were made to the defences along the River Nene. In order to secure the level of protection afforded by the new defence the Environment Agency have agreed with the West Northants Joint Planning Unit that the standards set for new development should also be improved, beyond that required by PPS25. Therefore all new development in the Upper Nene catchment should be designed for a flood with a 0.5% probability (1 in 200 chance) occurring in any year, including an appropriate allowance for climate change. This includes design of mitigation for main river flooding and any surface water attenuation. This applies across the whole of the Upper Nene catchment including all branches and arms of the Nene, upstream of Billing Aquadrome, and all tributaries such as Wootton Brook, Dallington Brook and Bugbrooke Brook. If the outfall of the attenuation facility is likely to be submerged in 0.5% (1 in 200 chance) rainfall event then within 24 hours of top water level being attained in a 0.5% (1 in 200) probability flood event the regulation facility must be capable of storing 80% of the additional run-off arising from a 10% (1 in 10) probability flood. The standards used in this study therefore include a requirement to achieve 1 in 200 standards.

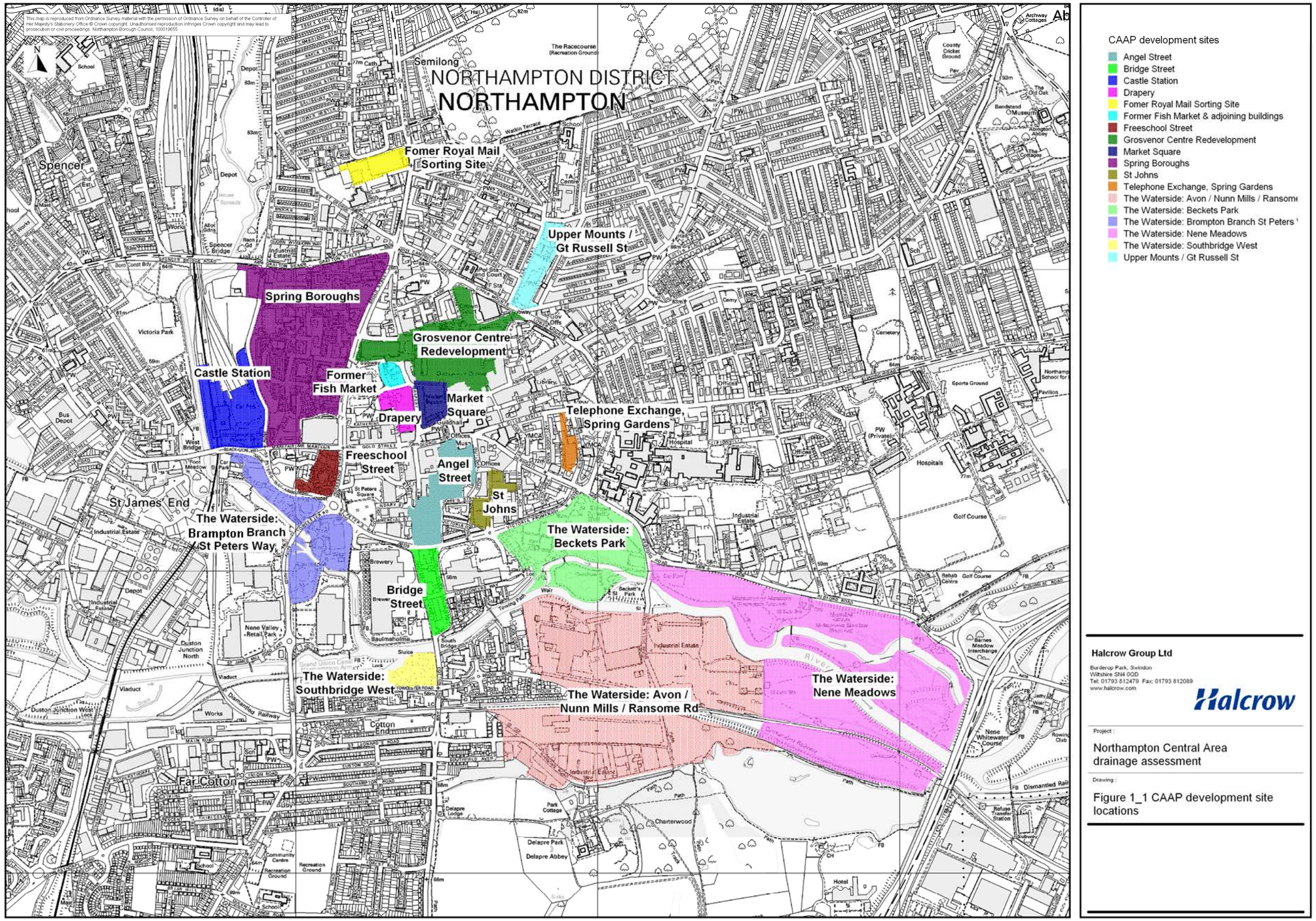

Figure 1-1 The extent of the CAAP and study area and the proposed development sites (some of which are open space enhancements)

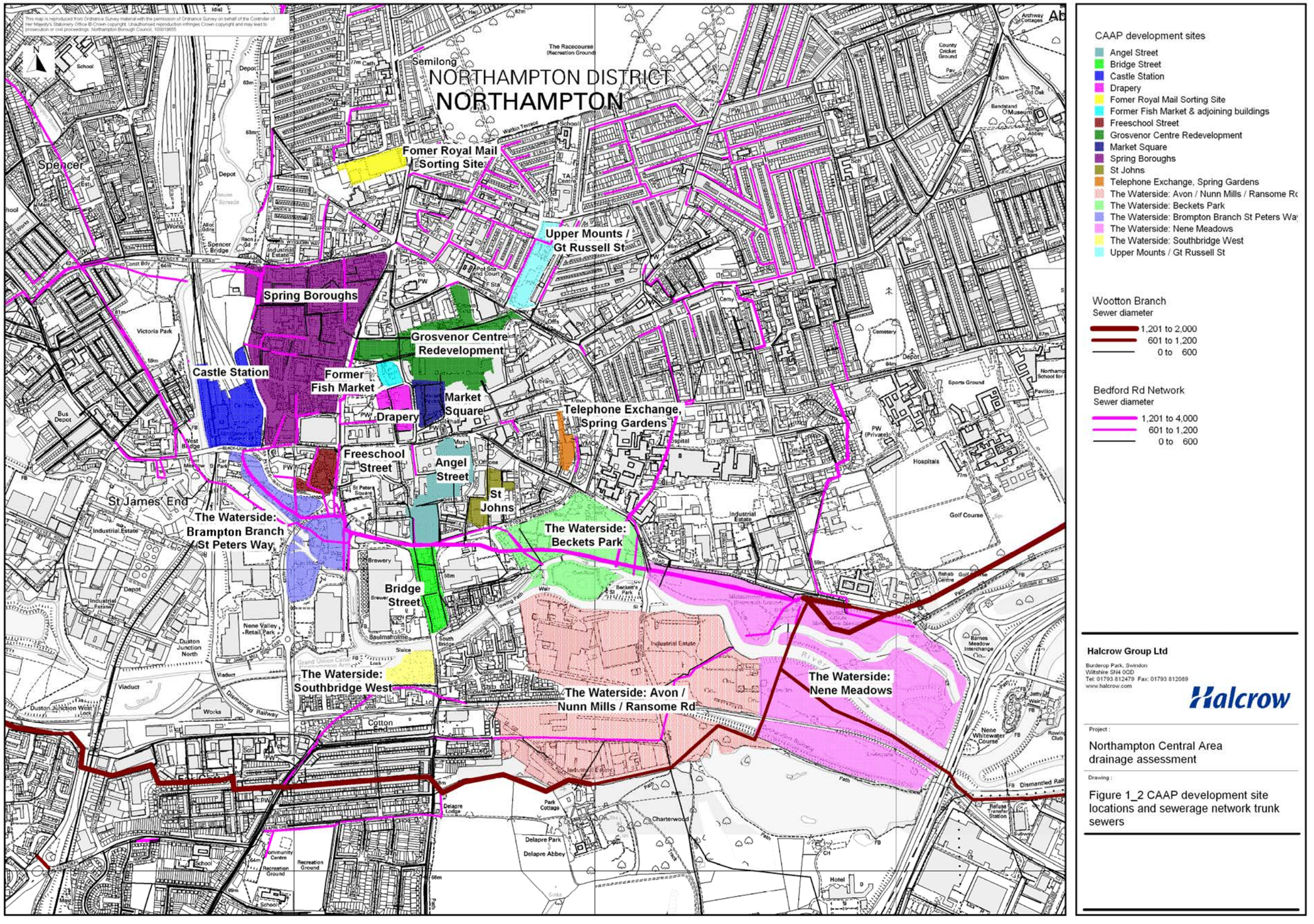

Figure 1-2 Northampton central area drainage network

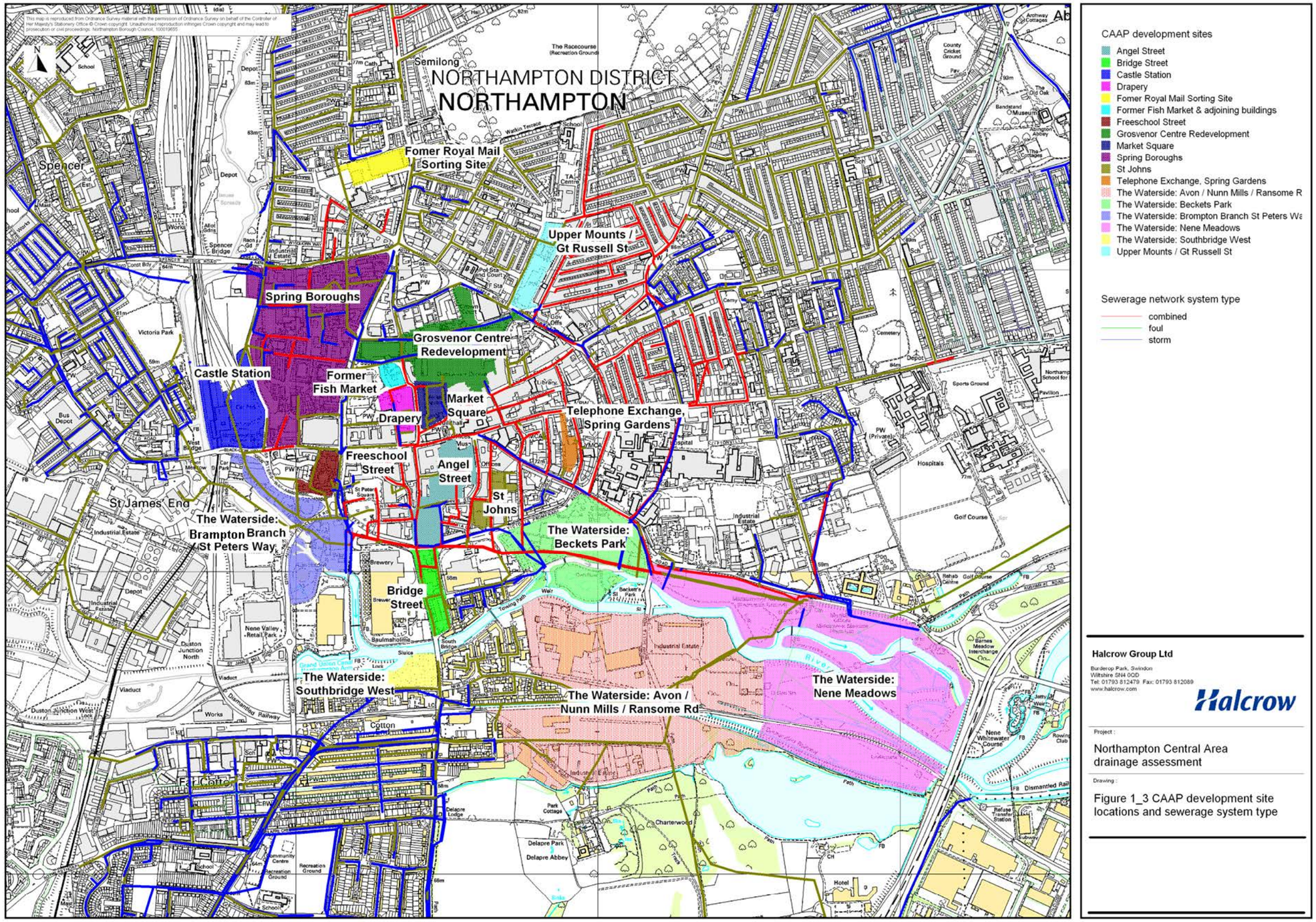

Figure 1-3 Northampton central area drainage network by system type

2 Existing drainage routes for CAAP proposals

In order to fully understand the impact of redevelopment on urban drainage, surface water management and flood risk, we have undertaken an assessment of the existing drainage system. For each proposal identified in Figure 1.1, using Anglian Water's drainage model, a terrain model derived from Environment Agency LIDAR data, and AWS asset records we have:

- confirmed the CAAP proposals and plans and identified conveyance routes and drainage responsibilities for the existing situation;
- identified the final drainage destination by river reach;
- quantified the wastewater and drainage demand of the pre-development situation for the CAAP[2].

The river network has been subdivided into reaches, and the results below are presented according to which river reach is the natural drainage destination for the proposal. This is displayed in Figure 2.1 below.

Spring Boroughs and **Castle Station** discharge to Brampton Branch 1 (River Nene Brampton Branch upstream of A4500 road bridge), and the results of the initial drainage assessment is covered in Section 2.1, Tables 2.1 and 2.2

Freeschool St, The Waterside Brampton Branch, the Grosvenor Centre and **the Former Fish Market** discharge to Brampton Branch 2 (River Nene Brampton Branch downstream of the A4500 road bridge, upstream of the confluence with River Nene at South Bridge), and the results are detailed in Section 2.2, Tables 2.3 to 2.6.

Upper Mounts/ Great Russell St, The Drapery, St Johns, Angel Street, Bridge St, Market Square, Telephone Exchange, Becket's Park, The Waterside: Avon Nunn Mills Ransome Road, The Waterside: Nene Meadows, and **The Waterside: Southbridge West** all discharge to the River Nene (River Nene, downstream of the confluence with the Grand Union Canal). The results for these proposals are detailed in Section 2.3, Tables 2.7 to 2.17.

[2] Full details and calculations can be found in Appendix A.

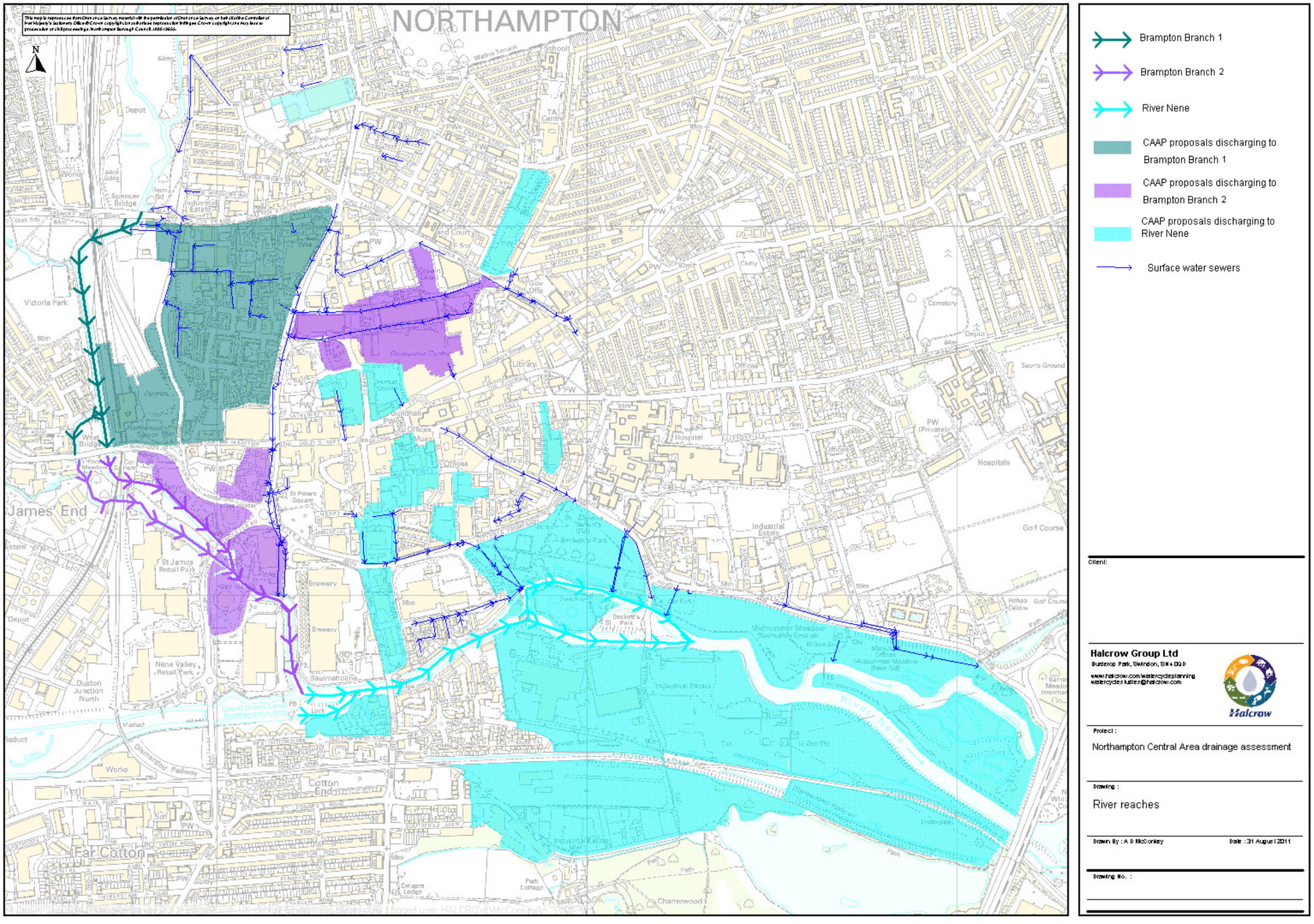

Figure 2-1 CAAP development proposals and river reaches

2.1 Proposals that drain to Brampton Branch 1 - Brampton Branch upstream of A4500 road bridge

The following proposals drain to this river reach:

- Spring Boroughs
- Castle Station

Figure 2.2 shows the location of these proposals and the river reach. Tables 2.1 and 2.2 contain the results of the drainage assessment for these two proposals.

The tables contain the following data:

Total site area (ha) – This is taken from the CAAP proposal boundary data provided by Northampton Borough Council.

Site area generating runoff (%) – This is the percentage of the total site area, based on the individual CAAP proposal boundary, that has been estimated using a visual assessment of satellite imagery, to consist of hard or impermeable surface

Impermeable runoff area (ha) – This is area of the proposal, estimated using a visual assessment of satellite imagery, to consist of hard or impermeable surface

Total modelled area generating runoff (ha) – this is the total runoff area within the proposal boundary that connects to the foul, combined or surface water drainage system. The value has been taken from the Anglian Water Services drainage model

Area connected to foul/combined (ha) – this is the runoff area within the proposal boundary that connects to the foul or combined drainage system. The value has been taken from the Anglian Water Services drainage model.

Area connected to storm (ha) – this is the runoff area within the proposal boundary that connects to the foul or combined drainage system. The value has been taken from the Anglian Water Services drainage model

% total area connected to AWS system – this is the percentage of the total site area that is connected to AWS drainage model. There are some values greater than 100% which indicates that the area connected to the AWS model is greater than the actual area of the proposal.

Proposals that drain to Brampton Branch 1 - Brampton Branch upstream of A4500 road bridge

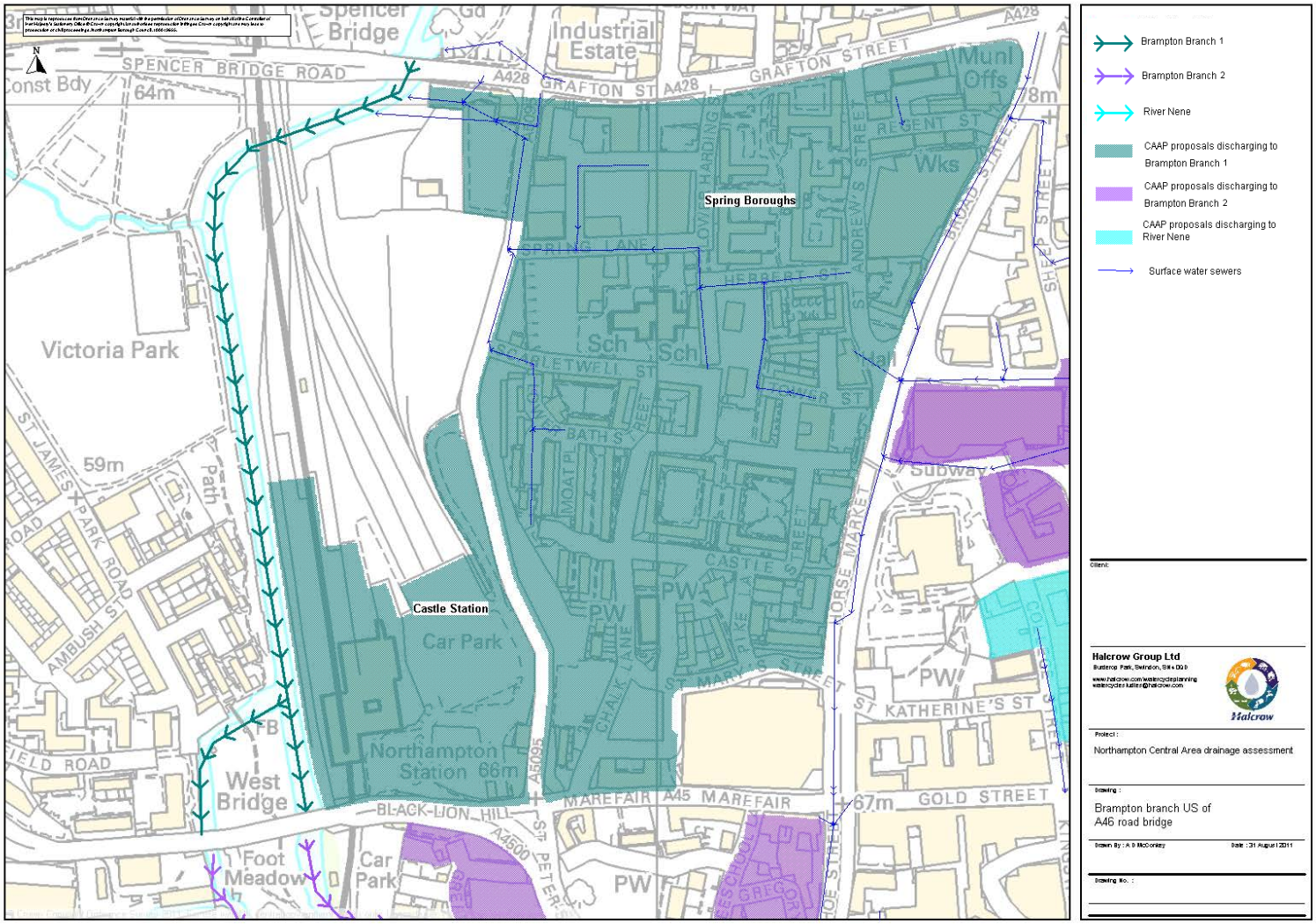

Figure 2-2 Proposals drainage to Brampton Branch 1

Table 2-1 Spring Boroughs existing drainage assessment

Spring Boroughs

Spring Boroughs is currently the largest single residential area within the Central Area. The area contains a mixture of employment uses, a primary school, municipal car parks, a small amount of community facilities and local retailing. It also has one listed building and the Castle Mound, a remnant of the original Northampton Castle with associated archaeological remains which is a Scheduled Ancient Monument.

The existing site is approximately 18ha, of which approximately 93% is drained by AWS sewers (see Table 2.1a below for full details). Of this, about 25% of the site drainage connects to the foul or combined sewer, with the remainder connecting to surface water sewers that discharge into the Brampton Branch reach 1 (Brampton Branch upstream of A4500 road bridge) of the River Nene (see Figure 2.2 for a map of the existing drainage system).

The remaining 7% of the site area not connected to AWS drainage system is likely to be open space and private gardens that do not to have any positive drainage system.

Table 2.1a Current site drainage characteristics

Total Site Area (ha)	From Visual inspection (initial assessment)		From Anglian Water model	
18.17	% site area generating runoff	0.7	Area generating runoff (ha)	16.82
	Impermeable area (ha)	12.72	Area connected to foul/combined (ha)	4.17
			Area connected to storm (ha)	12.65
			% total area connected to AWS system	92.58

Table 2-2 Castle Station existing drainage assessment

Castle station

The Castle Station site and car parks, and to the east, land and buildings associated with the railway social club is predominantly owned by Network Rail. There is a low intensity of use on the site that is not reflective of the opportunities that it brings in its role as a major transport facility.

The existing site is approximately 4.5ha, of which approximately 0.5% is drained by AWS sewers (see Table 2.2a below for full details). Of this, about 25% of the site drainage connects to the foul or combined sewer, with the remainder connecting to surface water sewers that discharge into the Brampton Branch reach 1 of the River Nene (see Figure 2.2 for a map of the existing drainage system).

Therefore it is likely that current drainage of hardstanding areas and the station drain direct to the Brampton Branch of the River Nene upstream of the A4500 Road Bridge via a private surface water connection, likely to be in Network Rail ownership.

Table 2.2a Current site drainage characteristics

Total Site Area (ha)	From Visual inspection (initial assessment)		From Anglian Water model	
4.381	% site area generating runoff	0.95	Area generating runoff (ha)	0.02
	Impermeable area (ha)	4.16	Area connected to foul/combined (ha)	0.02
			Area connected to storm (ha)	0
			% total area connected to AWS system	0.43

2.2 Proposals that drain to Brampton Branch 2 (downstream of the A4500 road bridge, upstream of the confluence with River Nene at South Bridge)

The following proposals drain to this river reach:

- Freeschool St
- Former Fish Market
- Grosvenor Centre
- The Waterside Brampton Branch

Figure 2.3 shows the location of these proposals and the river reach. Tables 2.3 to 2.6 contain the results of the drainage assessment for these four proposals.

Proposals that drain to Brampton Branch 2 (downstream of the A4500 road bridge, upstream of the confluence with River Nene at South Bridge)

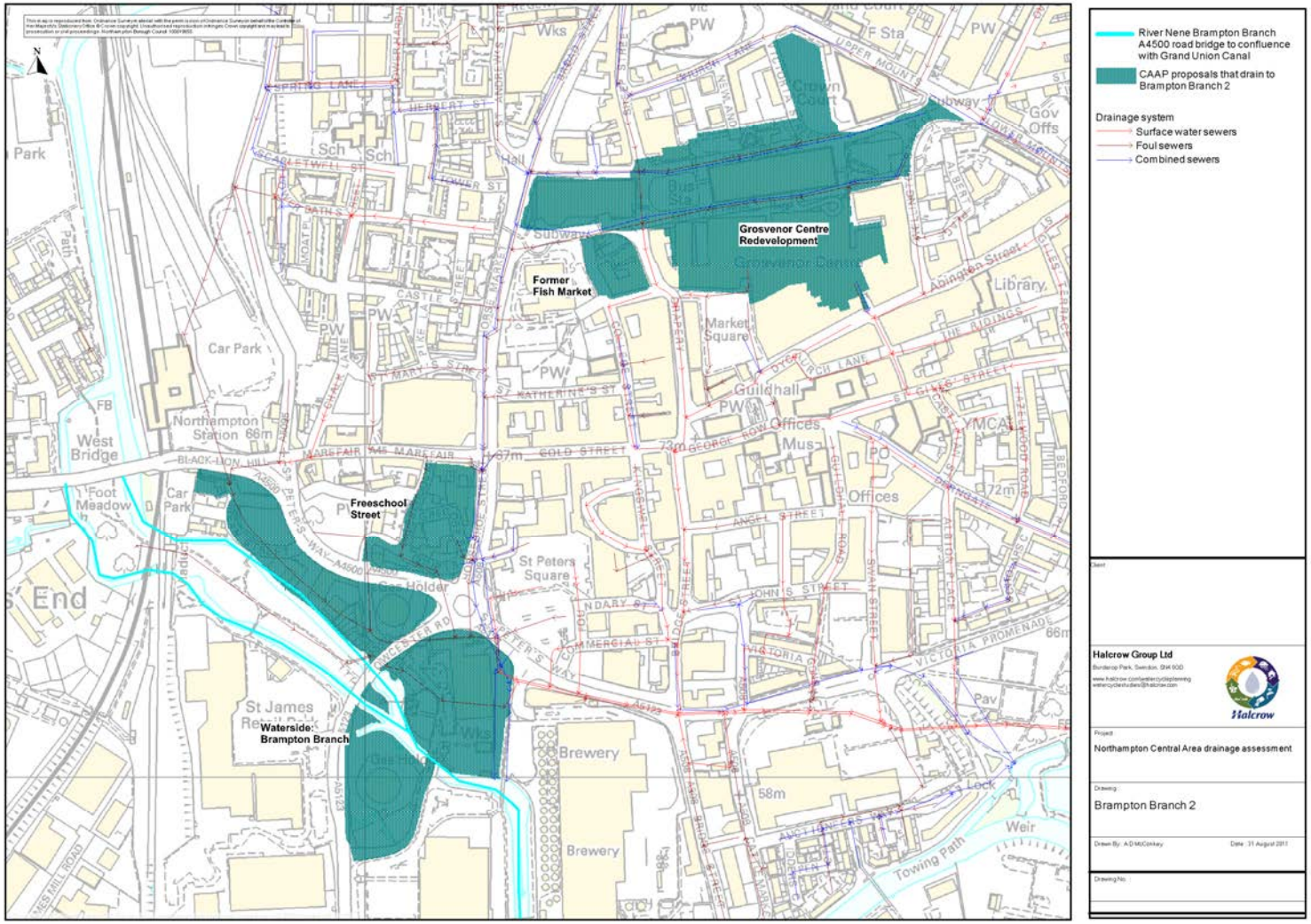

Figure 2-3 Brampton Branch 2

Table 2-3 Freeschool Street existing drainage assessment

Freeschool Street

The Freeschool Street development site is situated between Castle Station and the town centre boundary. The northern part fronting Marefair is predominately Victorian in character whereas the southern part comprises a mixture of car repair workshops, car sales, business space, derelict land and highway. The land is also fragmented under several different landowners part of which is owned by the Borough Council and is currently used as surface level parking.

The surrounding environs of the site is characterised by a mix of uses. To the north Sol Central dominates the Victorian three storey terraces and to the west residential development forms a partial barrier to pedestrian movement between the site and St Peter's Green.

The majority of the site currently comprises low grade industrial and surface parking.

The site area is approximately 1.3ha, which is entirely drained by public sewers (see Table 2.3a below for full details). Of this, about 60% of the site drainage connects to the foul or combined sewer, with the remainder connecting to surface water sewers that discharge into the Brampton Branch (see Figure 2.4 for a map of the existing drainage system).

Table 2.3a Current site drainage characteristics

Total Site Area (ha)	From Visual inspection (initial assessment)		From Anglian Water model	
1.287	% site area generating runoff	0.8	Area generating runoff (ha)	1.33
	Impermeable area (ha)	1.03	Area connected to foul/combined (ha)	0.73
			Area connected to storm (ha)	0.6
			% total area connected to AWS system	103.42

Proposals that drain to Brampton Branch 2 (downstream of the A4500 road bridge, upstream of the confluence with River Nene at South Bridge)

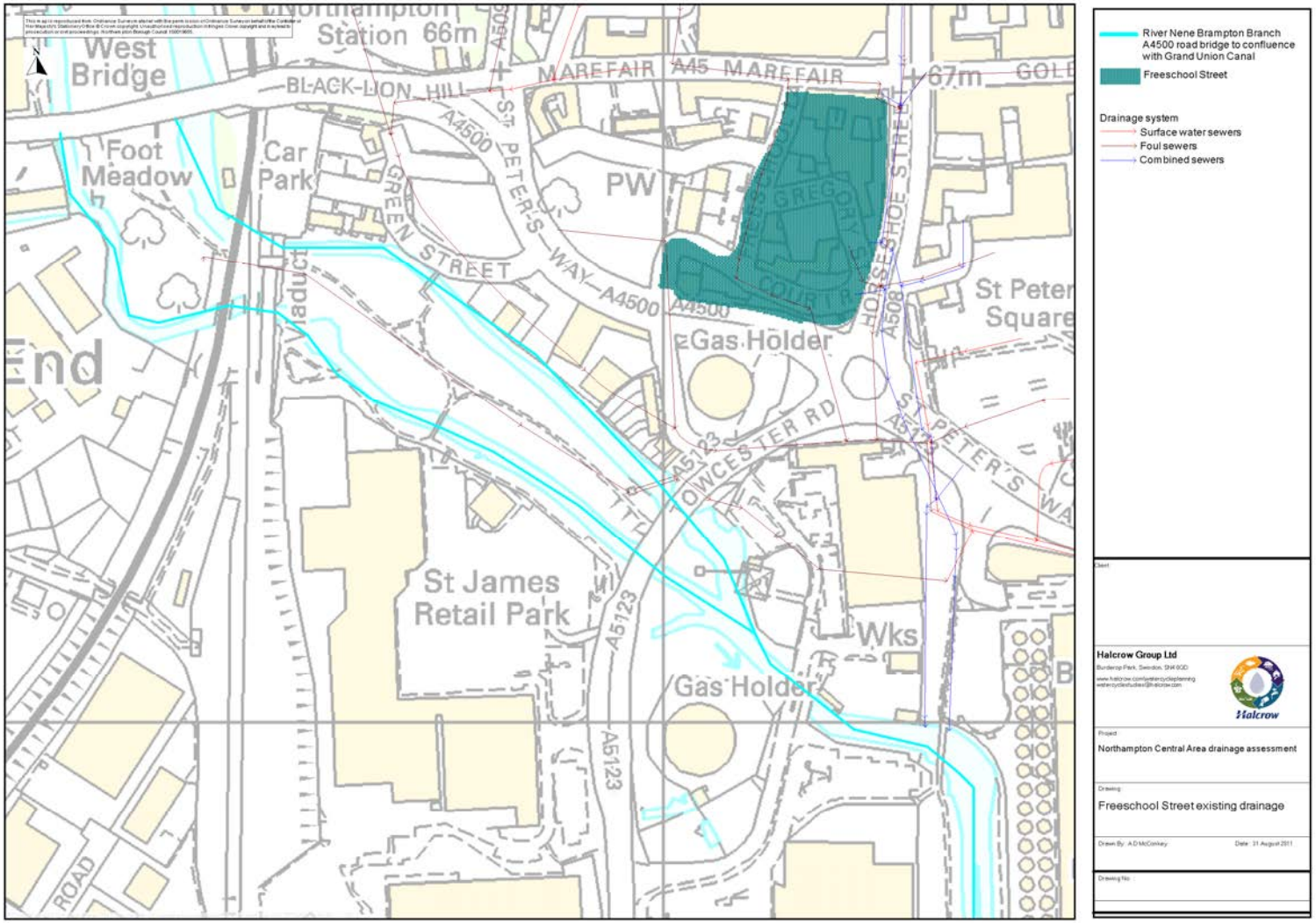

Figure 2-4 Boundary and drainage arrangements for Freeschool Street

Table 2-4 Former Fish Market existing drainage assessment

Former Fish Market

The former Fish Market and adjoining buildings site is bounded by Silver Street to the east, Bradshaw Street to the South, Greyfriars to the north and Sheep Street to the west. It is currently occupied by a range of uses including some lower order retailing and leisure uses fronting Sheep Street, and also the former Fish Market hall on Bradshaw Street occupied by the Fish Market Gallery and café. The proximity of the Greyfriars Bus Station and Mayorhold car park provides high levels of pedestrian activity. There is very limited natural drainage or greenspace within the existing site boundary.

The existing site is approximately 0.5ha, which is entirely drained by public sewers (see Table 2.4a below for full details). Of this, about 65% of the site drainage connects to the foul or combined sewer, with the remainder connecting to surface water sewers (see Figure 2.5 for a map of the existing drainage system).

Table 2.4a Current site drainage characteristics

Total Site Area (ha)	From Visual inspection (initial assessment)		From Anglian Water model	
0.5143	% site area generating runoff	1	Area generating runoff (ha)	0.56
	Impermeable area (ha)	0.51	Area connected to foul/combined (ha)	0.33
			Area connected to storm (ha)	0.22
			% total area connected to AWS system	107.91

Proposals that drain to Brampton Branch 2 (downstream of the A4500 road bridge, upstream of the confluence with River Nene at South Bridge)

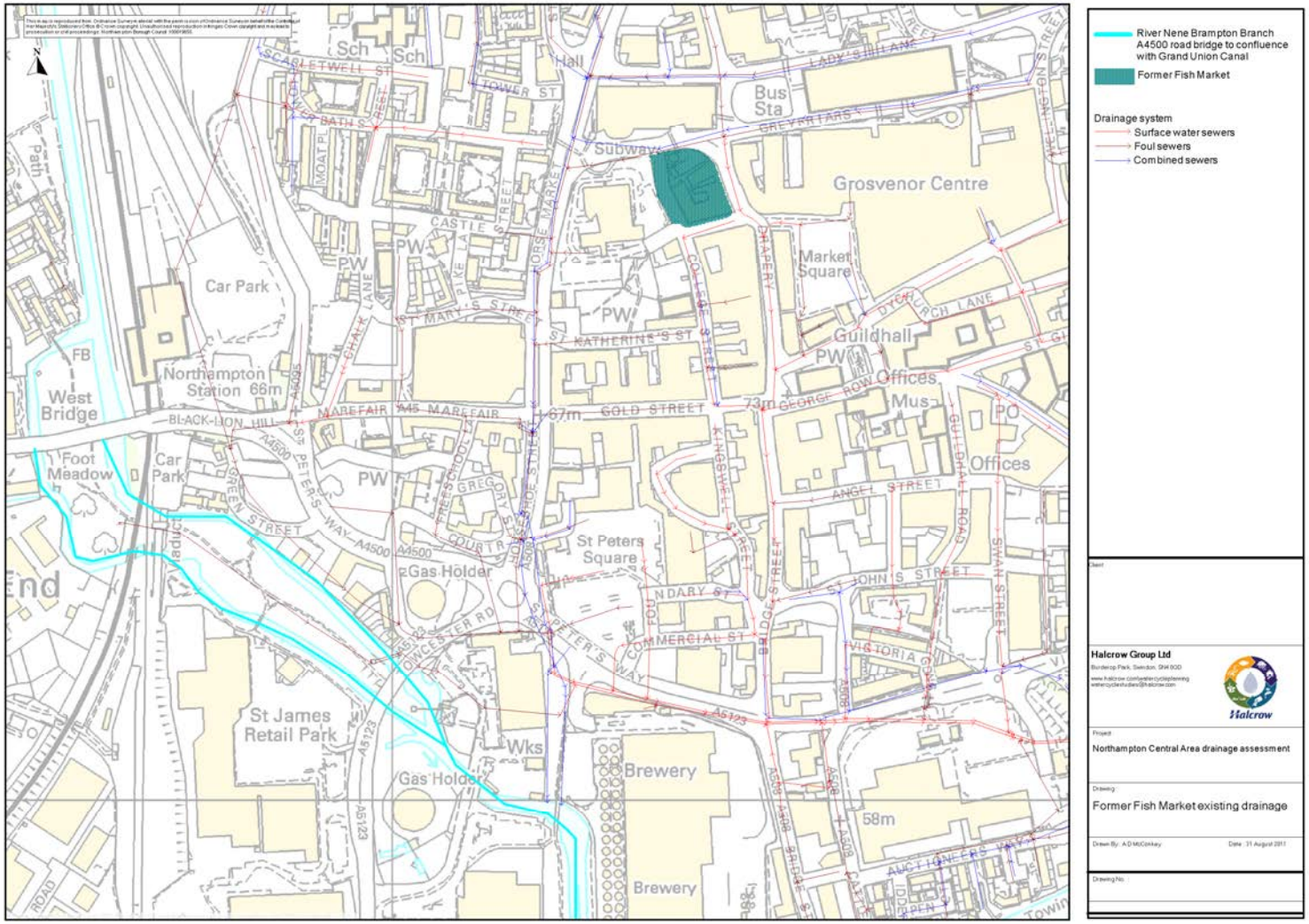

Figure 2-5 Boundary and drainage arrangements for the former Fish Market

Table 2-5 Grosvenor Centre existing drainage assessment

The Grosvenor Centre

The Grosvenor Centre constitutes a significant part of the retail frontage within the Central Area. The site includes a purpose built shopping centre, the Greyfriars bus station with offices above, the vacant land to the west and east, the Mayorhold multi-storey car park together with associated land including subways and the Upper Mounts surface level car park on Victoria Street. It is one of the biggest and most important development sites within and adjacent to the Primary Shopping Area of the Central Area.

There is very limited greenspace and no evidence of natural drainage within the site boundary.

The existing site is approximately 7.6ha, of which approximately 72% is drained by AWS sewers (see Table 2.5a below for full details). Of this, about 11% of the site drainage (from the South of the site) connects to the foul or combined sewer, with the remainder connecting to surface water sewers which discharge into Brampton Branch South of St Peter's way and North of the confluence with the Nene. (See Figure 2.6 for a map of the existing drainage system).

Table 2.5a Current site drainage characteristics

Total Site Area (ha)	From Visual inspection (initial assessment)		From Anglian Water model	
7.591	% site area generating runoff	0.91	Area generating runoff (ha)	5.45
	Impermeable area (ha)	6.91	Area connected to foul/combined (ha)	0.8
			Area connected to storm (ha)	4.65
			% total area connected to AWS system	71.85

Proposals that drain to Brampton Branch 2 (downstream of the A4500 road bridge, upstream of the confluence with River Nene at South Bridge)

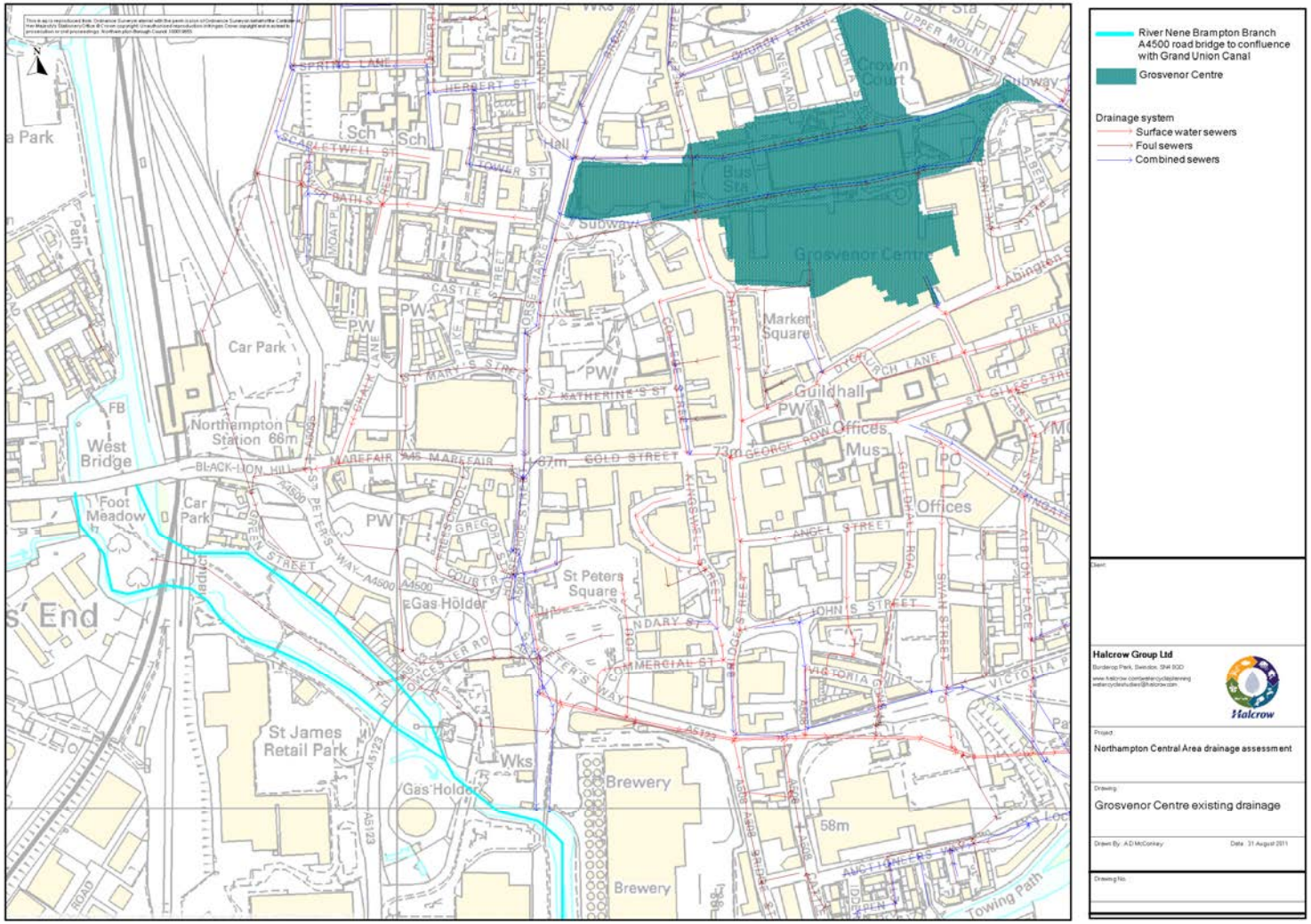

Figure 2-6 Boundary and drainage arrangements for the Grosvenor Centre

Table 2-6 Waterside Development: Brampton Branch and St Peter's Way existing drainage assessment

Waterside development Brampton Branch and St Peter's Way

The existing site comprises vacant cleared sites (some used for surface parking), low grade industrial, and small scale commercial.

The northern part of The Waterside running south of Castle Station contains a mixture of vacant cleared sites, small scale commercial, residential properties on Tanner Street, two substantial gas holders with associated plant and storage areas and part of a B&Q retail warehouse car park. West Northamptonshire Development Corporation owns much of the freehold interests in this area, apart from the gasholder site which are owned by National Grid and a site owned by Capital and Provincial.

The area between Castle Station and B&Q has substantial constraints that currently limit the range of development possibilities. The current, most significant, constraints are the two operational gasholders which have extensive development exclusion zones.

The existing site is approximately 5.8ha, of which approximately 22% is drained by AWS sewers (see Table 2.6a below for full details).Approximately 23% of the total site area is drained by the foul/combined system and approximately 12% by surface water sewers. The northwest and southern sections of the proposal have no surface water sewers and are presumed to discharge directly into the river system. The Eastern section, south of Towcester Road is drained by a surface water sewer that discharges to the Nene Brampton Branch. A map of the site and drainage arrangements is shown in Figure 2.7.

There may be contamination issues associated with the gasholder site and with the low grade industrial uses.

Table 2.6a Current site drainage characteristics

Total Site Area (ha)	From Visual inspection (initial assessment)		From Anglian Water model	
5.803	% site area generating runoff	0.9	Area generating runoff (ha)	1.27
	Impermeable area (ha)	5.22	Area connected to foul/combined (ha)	0.06
			Area connected to storm (ha)	1.22
			% total area connected to AWS system	21.92

Proposals that drain to Brampton Branch 2 (downstream of the A4500 road bridge, upstream of the confluence with River Nene at South Bridge)

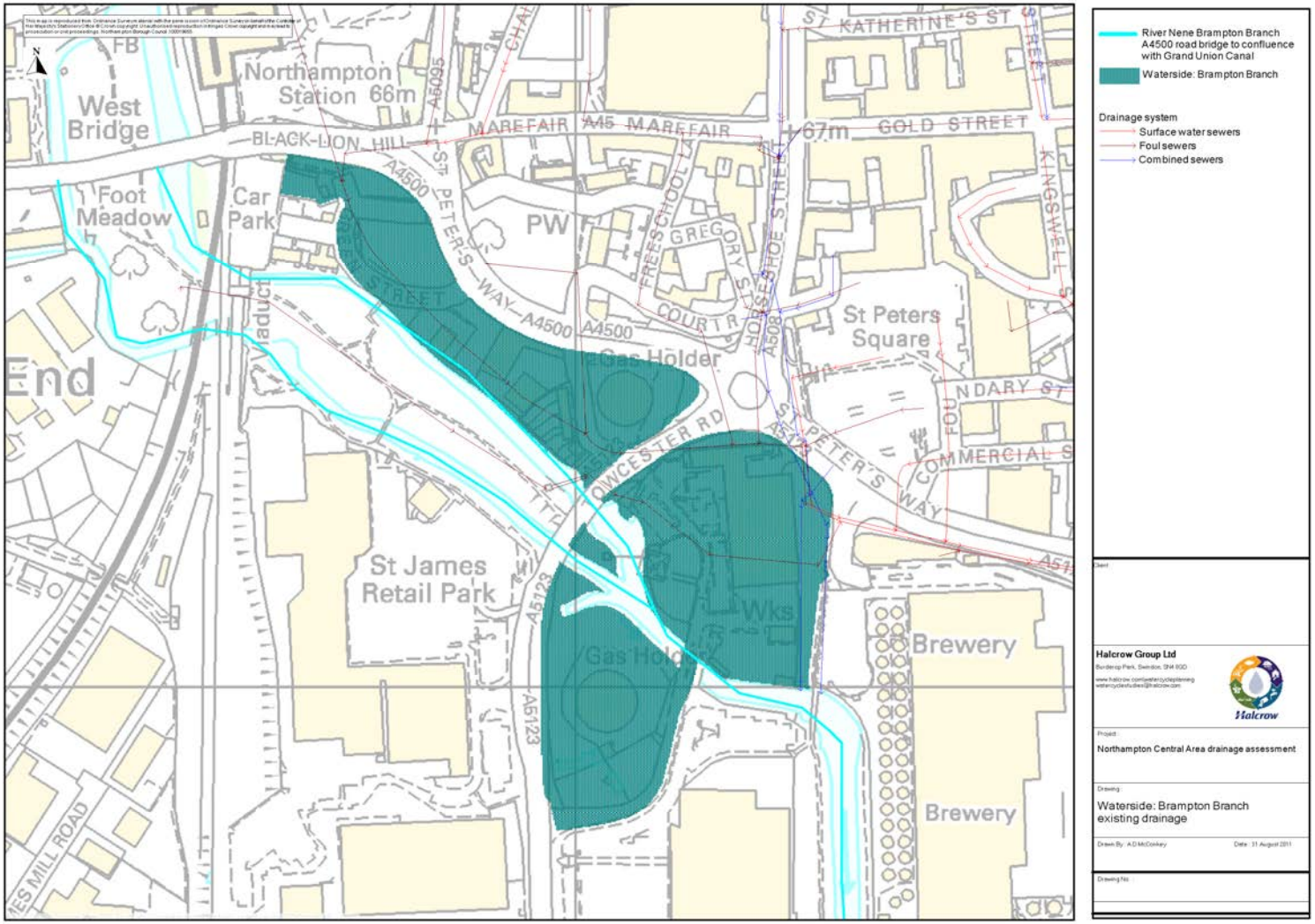

Figure 2-7 Site boundary and drainage characteristics of The Waterside: Brampton Branch and St Peter's Way

2.3 Proposals that drain to the River Nene, downstream of the confluence with the Grand Union Canal (Nene 1)

The following proposals drain to this river reach:

- Upper Mounts/ Great Russell St
- The Drapery
- Angel Street
- St Johns
- Bridge St
- Market Square
- Telephone Exchange
- Becket's Park
- The Waterside: Avon Nunn Mills Ransome Road
- The Waterside: Southbridge West
- The Waterside: Nene Meadows

Figure 2.8 shows the location of these proposals and the river reach. Tables 2.7 to 2.17 contain the results of the drainage assessment for these 11 proposals.

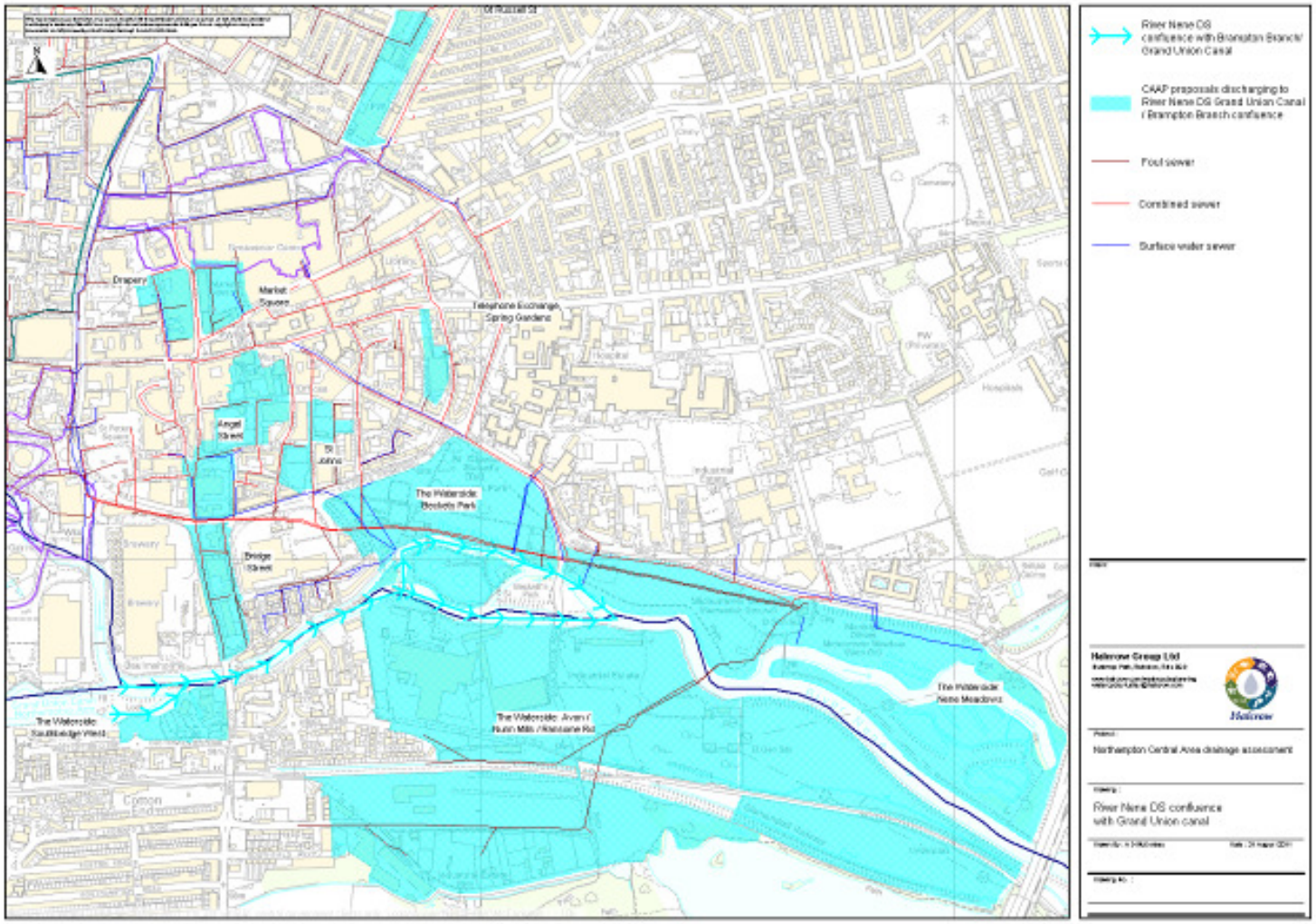

Figure 2-8 CAAP proposals that drain to Nene downstream confluence with Brampton Branch

Table 2-7 Upper Mounts/Great Russell St existing drainage assessment

Upper Mounts/Great Russell Street

The site is currently 100% hardstanding. It is a former printing press and comprises some low grade industrial/commercial units. There are several surface water sewers that drain areas close to the proposal boundary, although the current site drainage is connected to the foul / combined system. One of the surface water sewers (which drains south eastwards along Lower Mounts Street) drains back into the foul / combined system, therefore is not a true surface water sewer. The remaining surface water sewers that drain along Church lane, Lady's Lane and Greyfriars discharge the surface water to the Brampton Branch downstream of the Towcester Road bridge.

The existing site is approximately 2.03 ha, of which 97% is drained by public sewers (see Table 2.7a below for full details). All of this connected site drainage currently connects to the foul or combined sewer (see Figure 2.9 for a map of the existing drainage system).

Table 2.7a Current site drainage characteristics

From Visual inspection (initial assessment)		From Anglian Water model	
% site area generating runoff	100	Area generating runoff (ha)	1.97
Impermeable area (ha)	2.03	Area connected to foul/combined (ha)	1.97
		Area connected to storm (ha)	0
		% total area connected to AWS system	97.04

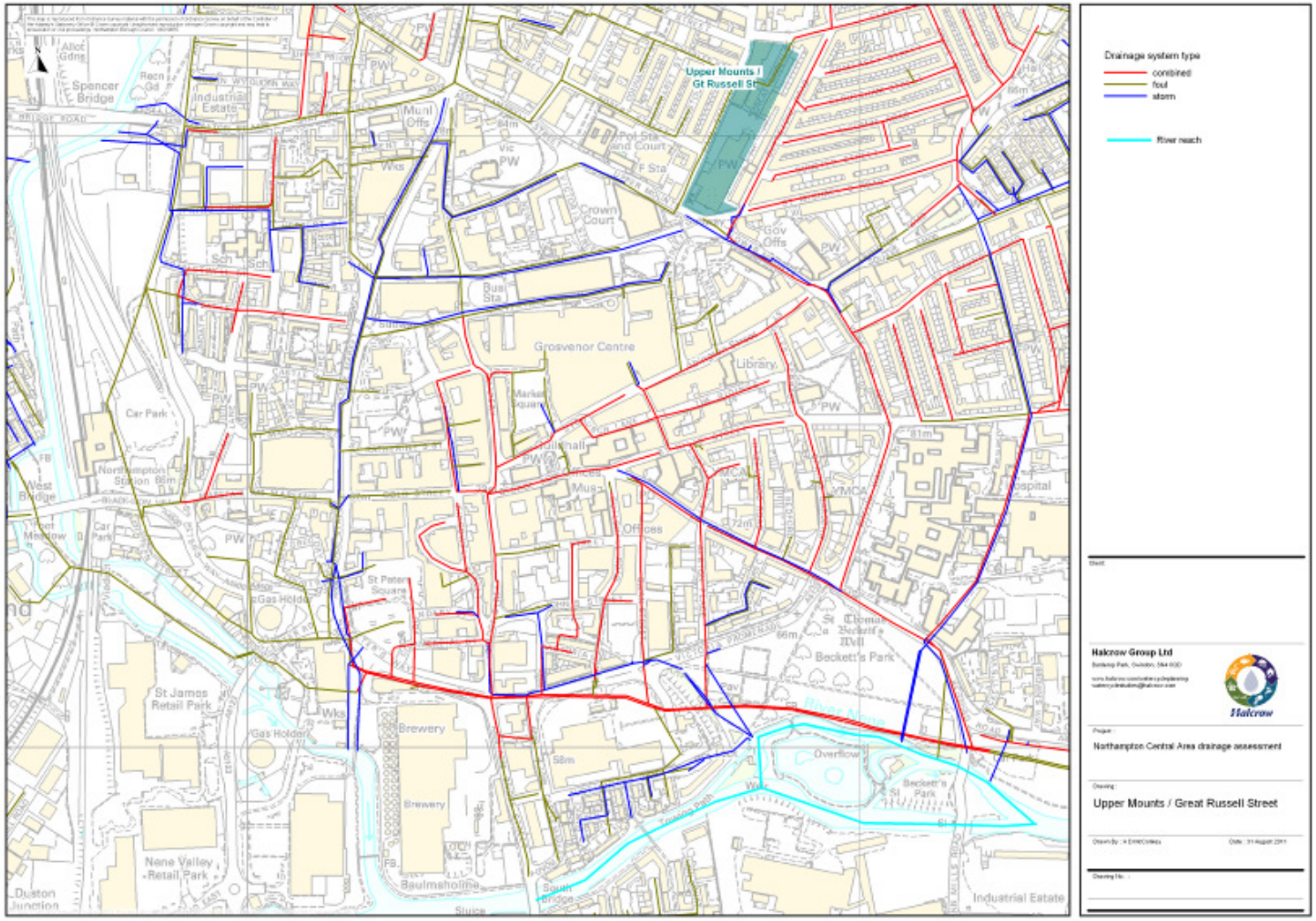

Figure 2-9 Upper Mounts / Great Russell Street existing drainage arrangements

Table 2-8 The Drapery existing drainage assessment

The Drapery

This site is bounded by Bradshaw Street and King Street on the north, St. Katherine's gardens on the west, Drapery on the east and Jeyes Jetty on the south. It is bisected by College Street.

This site currently accommodates the Debenhams department store, associated car parking/ service area and other smaller retail, service, public house and eating and drinking establishments.

The existing site is approximately 1.1ha, which is entirely drained by AWS sewers (see Table 2.8a below for full details).

100% of the current surface drainage drains to the foul or combined system. Although there is a SWS sewer that drains part of the site, it reconnects to the combined system downstream of the site. Figure 2.10 maps the existing drainage system serving The Drapery.

Table 2.8a Current site drainage characteristics

Total Site Area (ha)	From Visual inspection (initial assessment)		From Anglian Water model	
1.1	% site area generating runoff	1	Area generating runoff (ha)	1.19
	Impermeable area (ha)	1.1	Area connected to foul/combined (ha)	0.77
			Area connected to storm (ha)	0.42
			% total area connected to AWS system	108.27

Proposals that drain to the River Nene, downstream of the confluence with the Grand Union Canal (Nene 1)

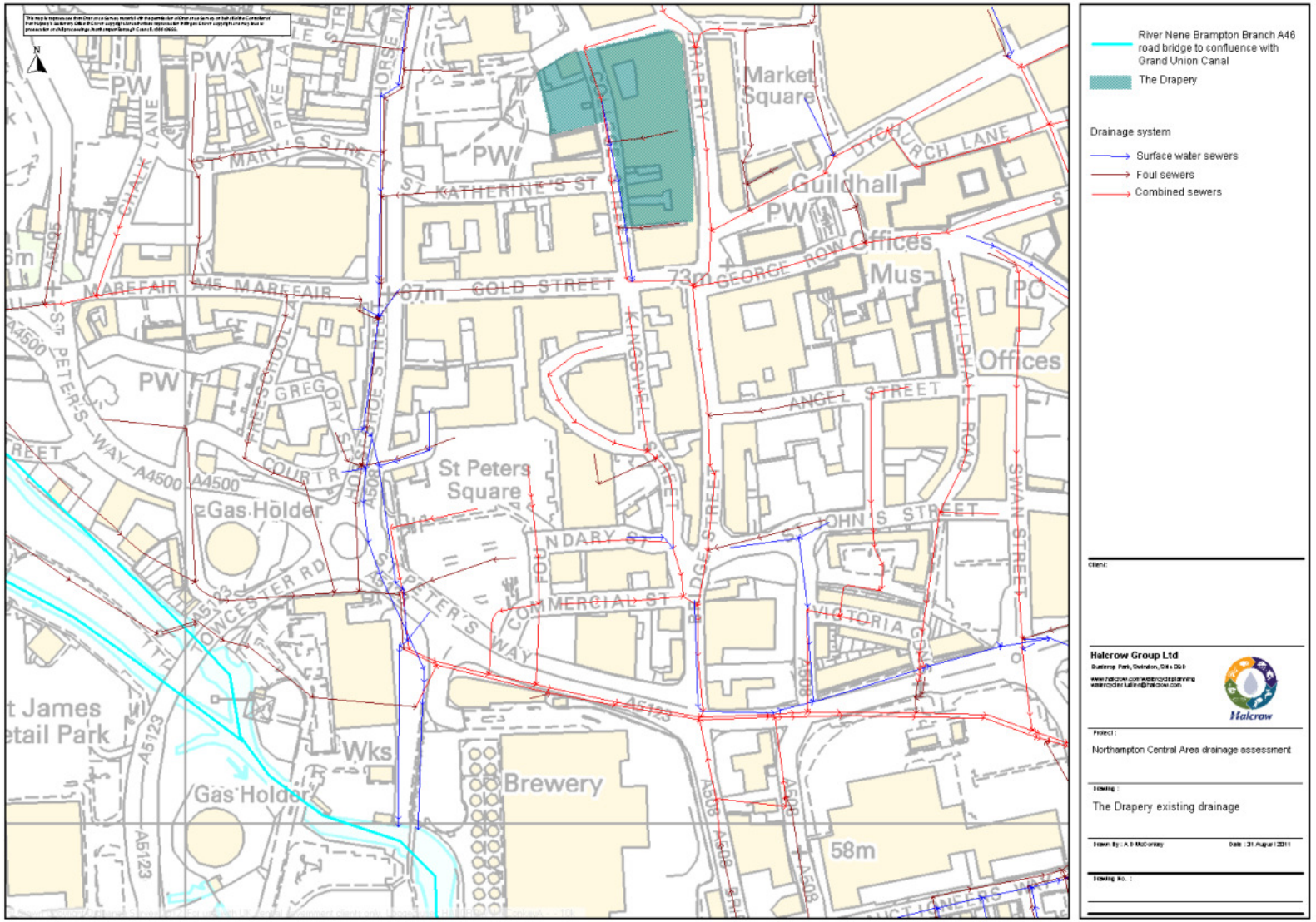

Figure 2-10 The Drapery existing drainage arrangements

Table 2-9 Angel Street existing drainage assessment

Angel Street

Angel Street is primarily owned by the County Council, incorporating their main town centre offices and a large vacant site used primarily for parking purposes. The Borough Council also owns a number of buildings on the Fetter Street frontage. Other buildings towards the south of the Angel Street area are in private ownership. In the southern part of the Angel Street area is a gyratory road system, a product of 1970s highways interventions.

The existing site comprises a large surface parking use on vacant lot, office space and a traffic gyratory system.

The existing site is approximately 3.7ha, of which approximately 84% is drained by AWS sewers (see Table 2.9a below for full details).

Approximately 60% of the surface drainage (from the north of the proposal) drains to the foul or combined system, with the remainder draining to a surface water sewer.

Table 2.9a Current site drainage characteristics

Total Site Area (ha)	From Visual inspection (initial assessment)		From Anglian Water model	
3.71	% site area generating runoff	1	Area generating runoff (ha)	3.1
	Impermeable area (ha)	3.71	Area connected to foul/combined (ha)	1.78
			Area connected to storm (ha)	1.32
			% total area connected to AWS system	83.54

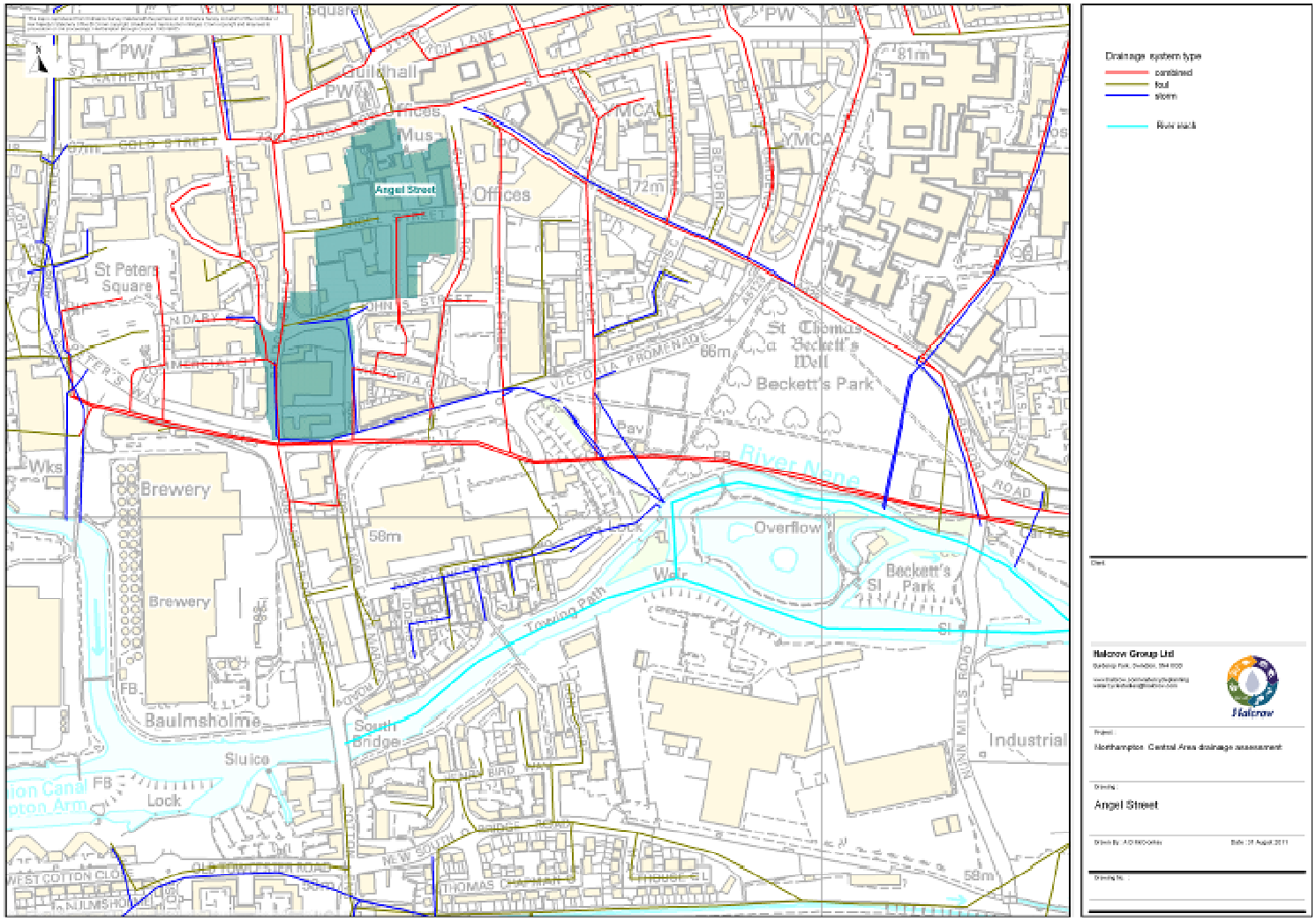

Figure 2-11 Angel Street existing drainage arrangements

Table 2-10 St John's existing drainage assessment

St John's

St John's is owned in its entirety, by the Borough Council and is currently predominantly used as surface level car parking.

The existing site is approximately 1.2ha, of which approximately 91% is drained by AWS sewers (see Table 2.10a below for full details).

Approximately 43% of the current site area drains to the foul or combined sewer, with 49% draining to a surface water sewer that discharges into the River Nene. This section of SWS is shared with drainage from Angel St and Beckett's Park.

Table 2.10a Current site drainage characteristics

Total Site Area (ha)	From Visual inspection (initial assessment)		From Anglian Water model	
1.19	% site area generating runoff	1	Area generating runoff (ha)	1.09
	Impermeable area (ha)	1.19	Area connected to foul/combined (ha)	0.51
			Area connected to storm (ha)	0.58
			% total area connected to AWS system	91.26

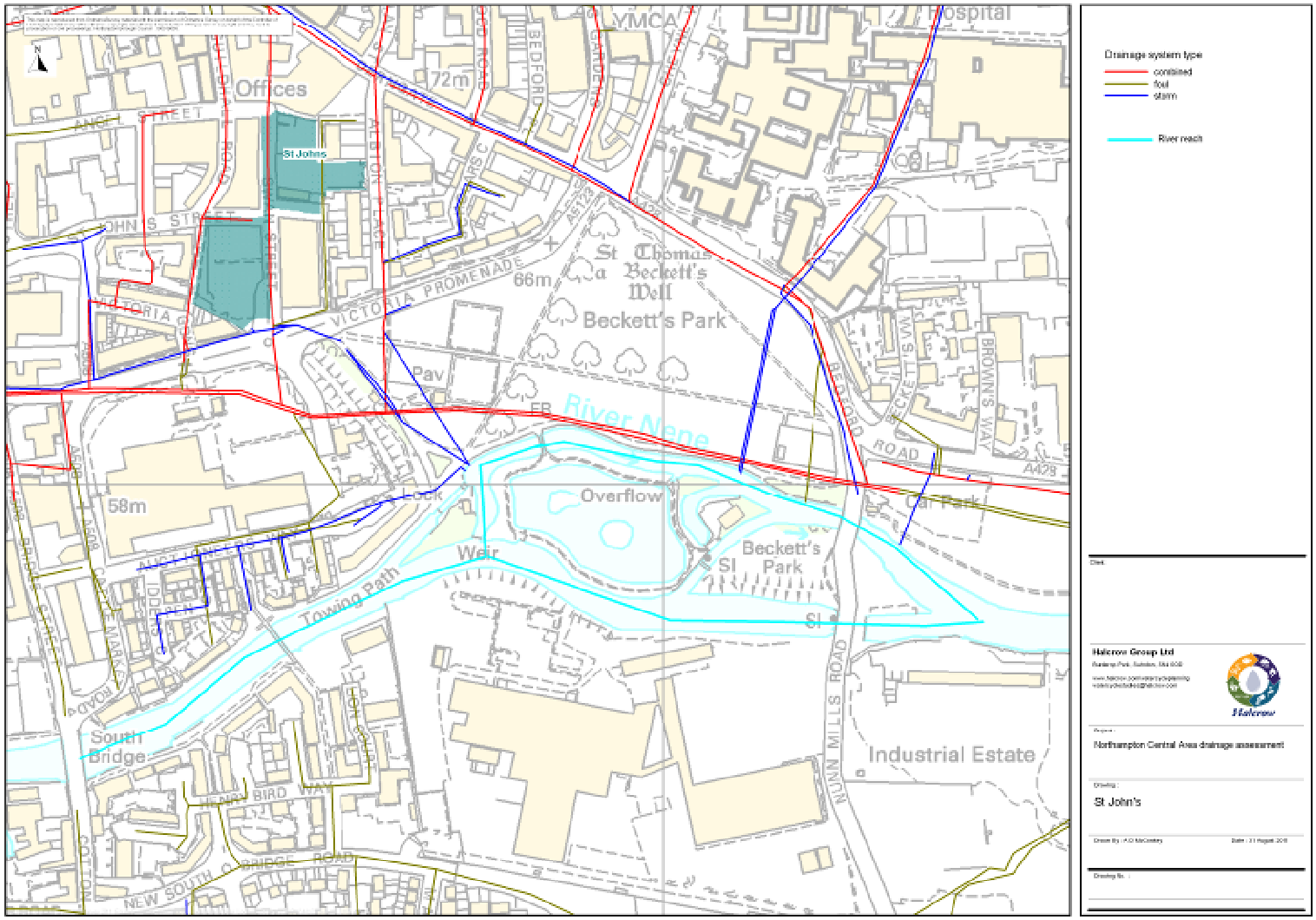

Figure 2-12 St John's existing drainage arrangements

Table 2-11 Bridge Street existing drainage assessment

Bridge Street

The existing land use is low grade industrial and some leisure and restaurants serving the low grade industrial uses. There is also extensive surface parking on hardstanding. There is no greenspace and the whole boundary is currently hardstanding.

The existing site is approximately 2ha, of which approximately 95% is drained by AWS sewers (see Table 2.11a below for full details). Of this 93% of the existing surface drainage drains to foul or combined system, with the remainder draining to a surface water sewer.

Table 2.11a Current site drainage characteristics

Total Site Area (ha)	From Visual inspection (initial assessment)		From Anglian Water model	
1.971	% site area generating runoff	1	Area generating runoff (ha)	1.86
	Impermeable area (ha)	1.97	Area connected to foul/combined (ha)	1.72
			Area connected to storm (ha)	0.14
			% total area connected to AWS system	94.47

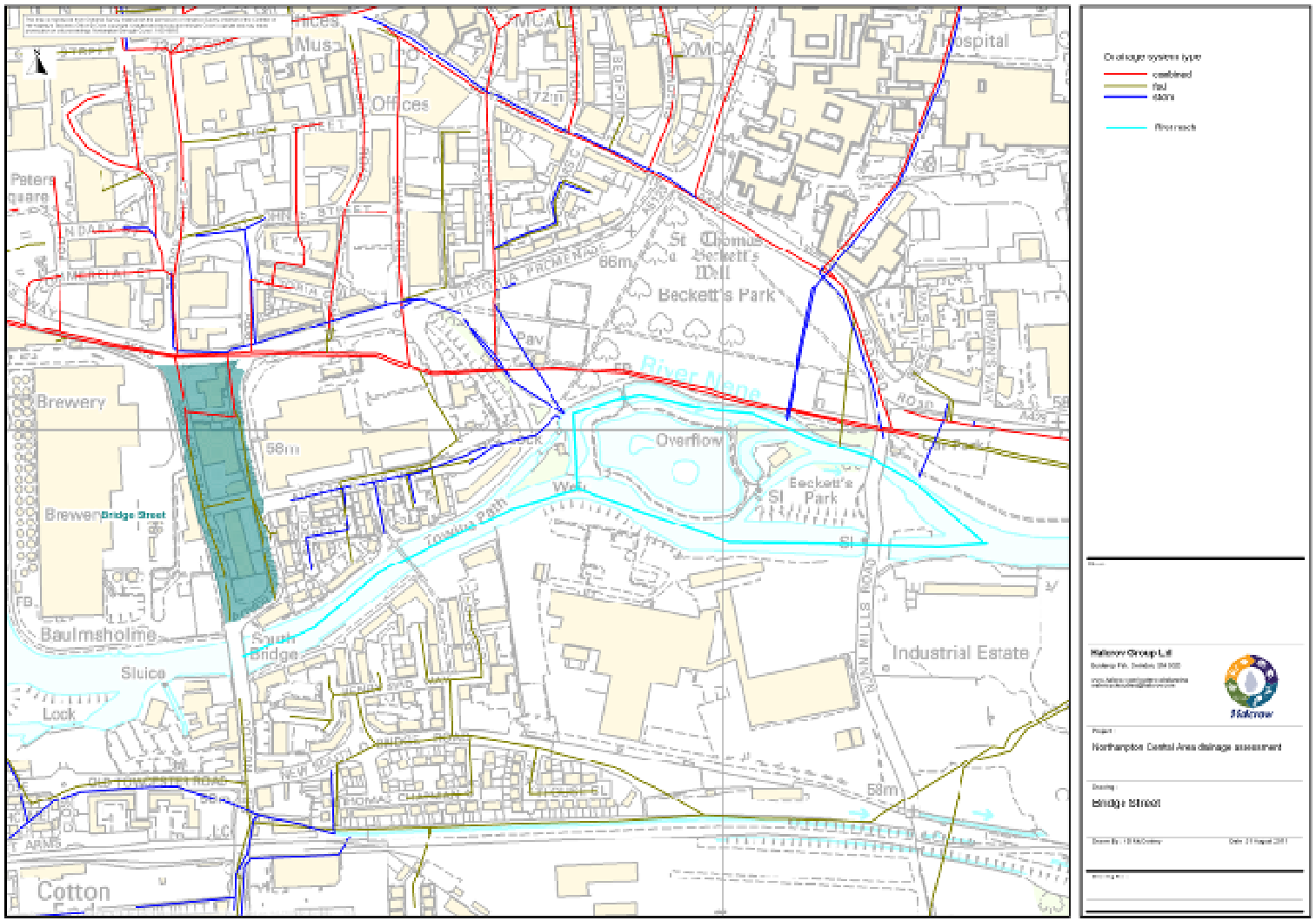

Figure 2-13 Bridge Street existing drainage arrangements

Table 2-12 Market Square existing drainage assessment

Market Square

The Market Square is a destination in its own right through its function as a market and event space. It is a major historical landmark and area of public space.

The existing site is approximately 1.4ha, of which 92% is hardstanding drained by AWS sewers (see Table 2.12a below for full details). Although a large portion of the site appears to drain to surface water sewer, this drains in to the foul/combined therefore it is considered that the majority of the site drains to foul/combined.

Table 2.12a Current site drainage characteristics

Total Site Area (ha)	From Visual inspection (initial assessment)		From Anglian Water model	
1.357	% site area generating runoff	1	Area generating runoff (ha)	1.25
	Impermeable area (ha)	1.36	Area connected to foul/combined (ha)	0.6
			Area connected to storm (ha)	0.66
			% total area connected to AWS system	92.41

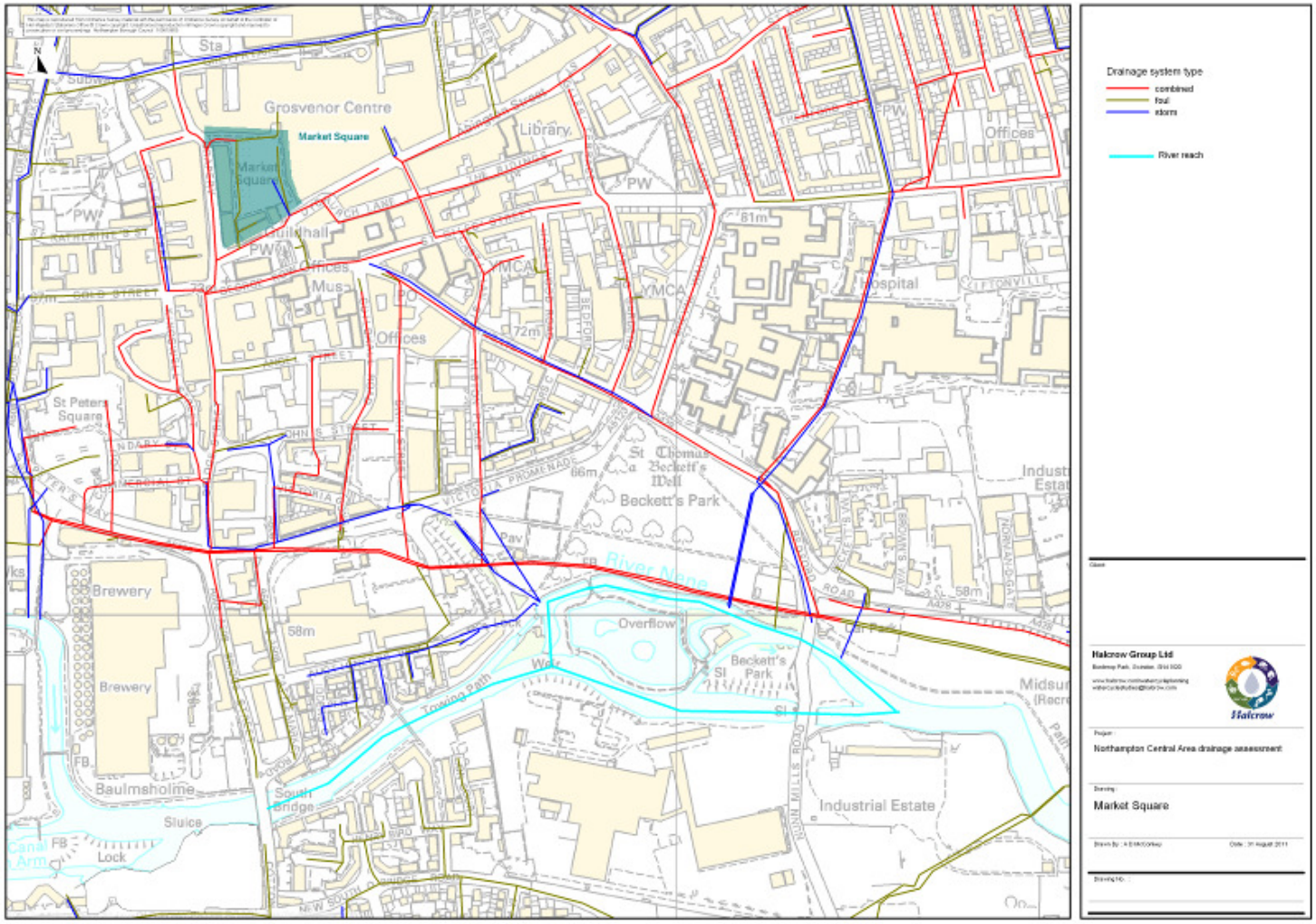

Figure 2-14 Market Square existing drainage arrangements

Table 2-13 Telephone Exchange existing drainage assessment

Telephone exchange

The site is located in the eastern part of the town centre and is currently occupied by a telephone exchange, offices and the former Citizens Advice Bureau. The surrounding area is predominately Victorian in character with a mixture of commercial and residential occupiers. The site is within the St Giles Conservation Area and is adjacent to a number of Grade II and locally listed buildings along St. Giles Street, Spring Gardens and Derngate.

The existing site is approximately 0.7ha, of which approximately 26% is drained by AWS sewers (see Table 2.13a below for full details). There is no open green space within the site, and there is no natural drainage apparent. The site appears to be 100% hardstanding. Therefore approximately 75% of the drainage of the site is unaccounted for.

Table 2.13a Current site drainage characteristics

Total Site Area (ha)	From Visual inspection (initial assessment)		From Anglian Water model	
0.68	% site area generating runoff	1	Area generating runoff (ha)	0.17
	Impermeable area (ha)	0.68	Area connected to foul/combined (ha)	0.16
			Area connected to storm (ha)	0.02
			% total area connected to AWS system	25.13

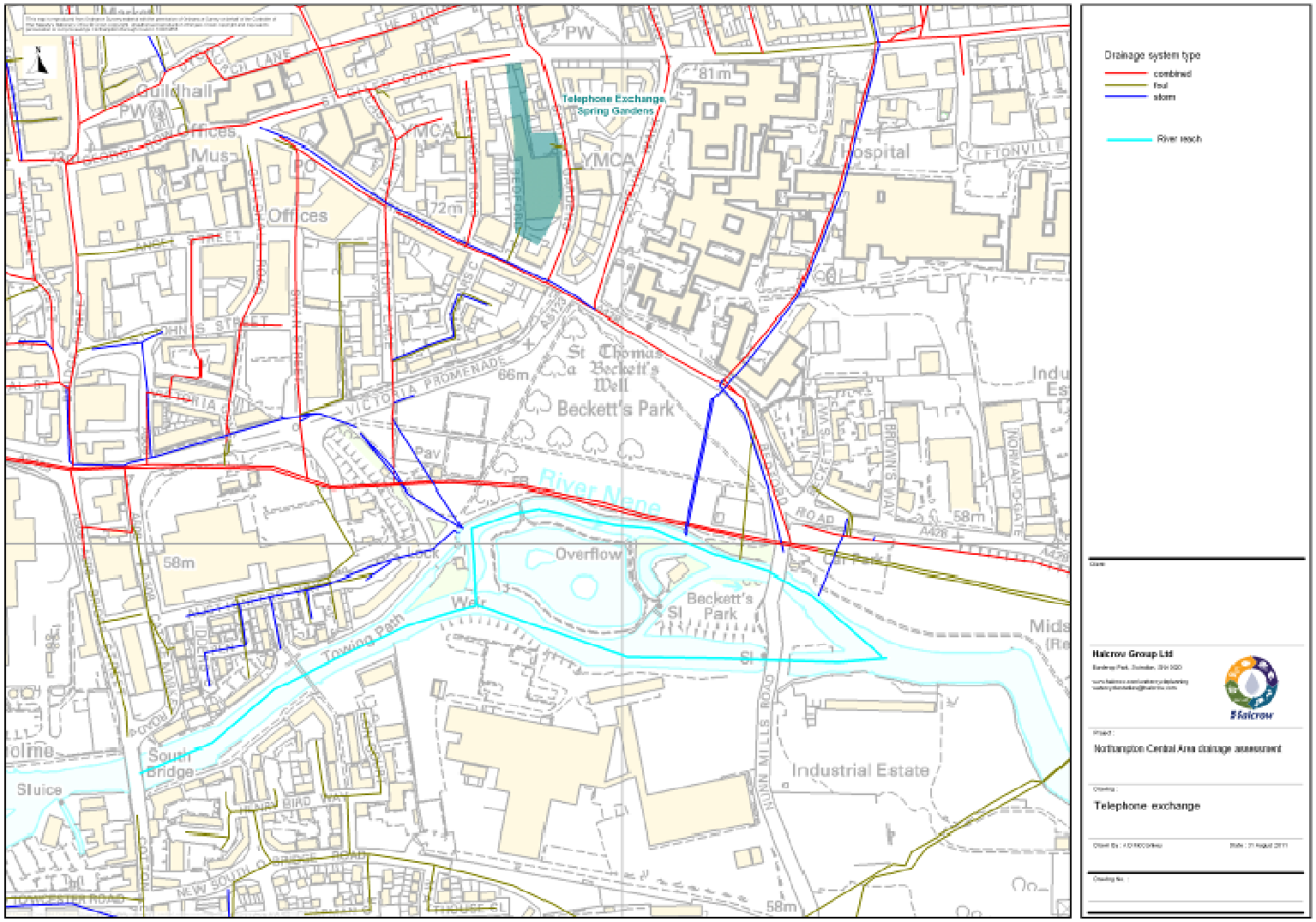

Figure 2-15 Telephone exchange existing drainage arrangements

Table 2-14 Becket's Park existing drainage assessment

Becket's Park

Becket's Park is a traditional park adjacent to the River Nene that was initially designed for promenading in 1783. It is bounded and crossed by formal tree lined avenues and contains some formal children's play facilities, tennis courts and a small pavilion. The only existing demand for wastewater and rainfall runoff surfaces stem from the sports pavilion on site.

The existing site is approximately 10ha, of which approximately 7.5% is drained by AWS sewers (see Table 2.14a below for full details). It is believed that natural drainage provides for the remaining 92% of the drainage need from this formal park.

Table 2.14a Current site drainage characteristics

Total Site Area (ha)	From Visual inspection (initial assessment)		From Anglian Water model	
9.804	% site area generating runoff	0.04	Area generating runoff (ha)	0.72
	Impermeable area (ha)	0.39	Area connected to foul/combined (ha)	0
			Area connected to storm (ha)	0.72
			% total area connected to AWS system	7.3

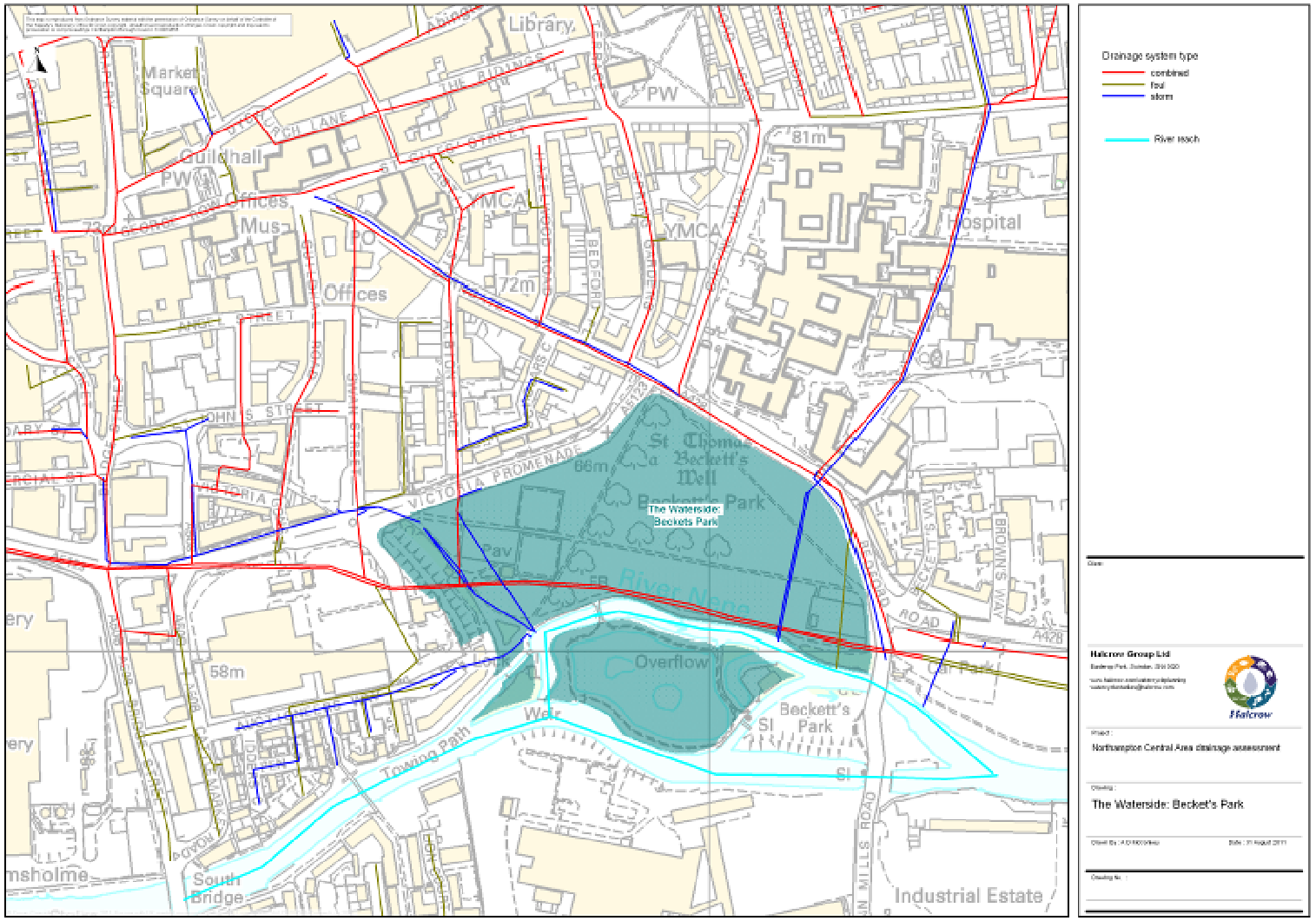

Figure 2-16 Becket's park existing drainage arrangements

Table 2-15 Avon Nunn Mills Ransome Road existing drainage assessment

The Waterside: Avon Nunn Mills Ransome Road

Avon Nunn Mills Ransome Road is an extensive area of vacant, derelict under-used and previously developed land.

The entire site area is 42ha, and currently less than 0.5ha (less than 1%) of this area connects to the foul / combined drainage system, with the remainder draining directly to the Nene through natural, unidentified or unmodelled pathways. See Table 2.15a below for further details.

Foul drainage and industrial effluent from the former and existing industrial uses drain to the foul system, with less than 0.02ha site area draining to the surface water sewer system.

Table 2.15a Current site drainage characteristics

Total Site Area (ha)	From Visual inspection (initial assessment)		From Anglian Water model	
41.39	% site area generating runoff	0.8	Area generating runoff (ha)	0.38
	Impermeable area (ha)	33.11	Area connected to foul/combined (ha)	0.37
			Area connected to storm (ha)	0.02
			% total area connected to AWS system	0.93

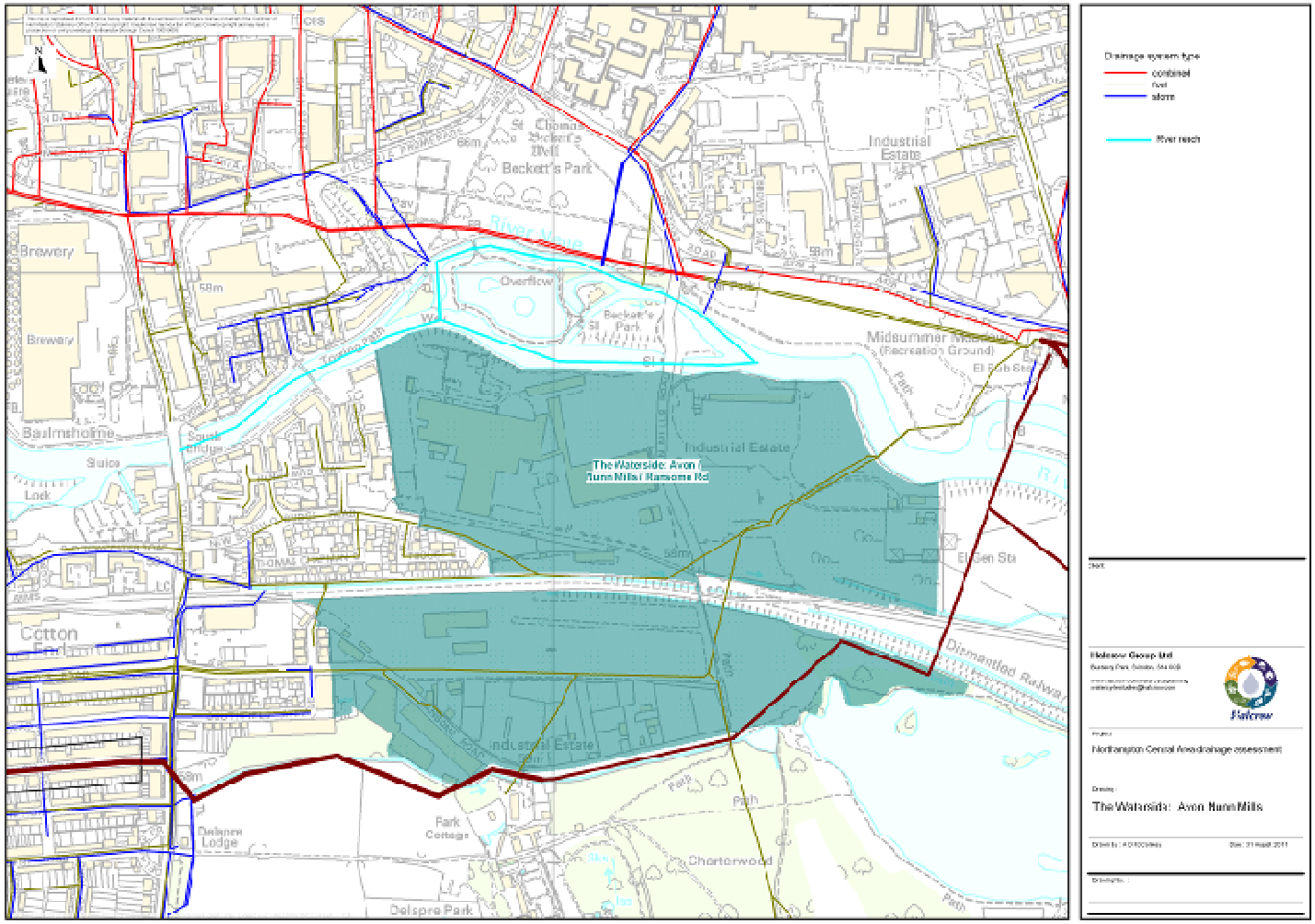

Figure 2-17 Avon Nunn Mills Ransome Road existing drainage arrangements

Table 2-16 Waterside Southbridge West existing drainage assessment

The Waterside: Southbridge West

Southbridge west currently predominantly comprises vacant plots, and small scale commercial operations. The entire site area is 1.72ha, and currently approximately 0.5ha (c30%) of this drainage area connects to the foul / combined / storm water drainage systems, with the remainder draining directly to the Nene through natural, unidentified or unmodelled pathways (see Table 2.16a below for full details).

Table 2.16a Current site drainage characteristics

Total Site Area (ha)	From Visual inspection (initial assessment)		From Anglian Water model	
1.72	% site area generating runoff	0.95	Area generating runoff (ha)	1.34
	Impermeable area (ha)	1.63	Area connected to foul/combined (ha)	0.2
			Area connected to storm (ha)	0.33
			% total area connected to AWS system	30.58

Table 2-17 Waterside Nene Meadows existing drainage assessment

The Waterside: Nene Meadows

There are two Meadows located in the South West corner of Central Area known as Midsummer and Barnes Meadows. Midsummer Meadow is a mixture of parking partly mowed grass and natural/semi natural space

This area is generally open space comprising river meadows.

Water services infrastructure that is of strategic importance to Northampton is located within and under this proposal. There is negligible drainage area connected to the foul or surface water drainage system, therefore any runoff area drains directly to the Nene through natural, unidentified or unmodelled pathways.

The existing site is approximately 32ha, of which approximately 0.2% is drained by AWS sewers (see Table 2.17a below for full details).

Table 2.17a Current site drainage characteristics

Total Site Area (ha)	From Visual inspection (initial assessment)		From Anglian Water model	
31.44	% site area generating runoff	0.03	Area generating runoff (ha)	0.82
	Impermeable area (ha)	0.94	Area connected to foul/combined (ha)	0
			Area connected to storm (ha)	0.05
			% total area connected to AWS system	0.17

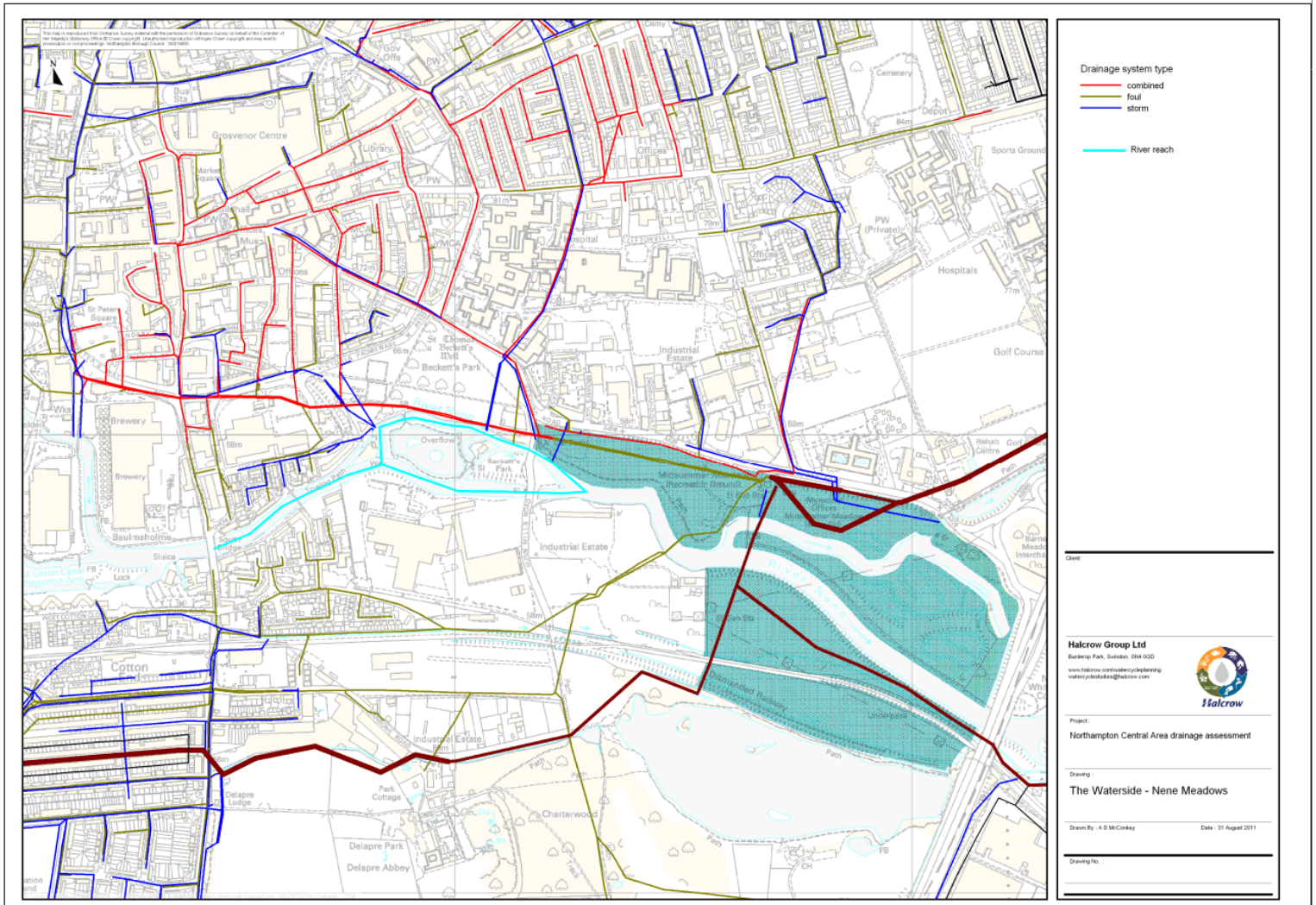

Figure 2-18 Waterside Nene Meadows existing drainage arrangements

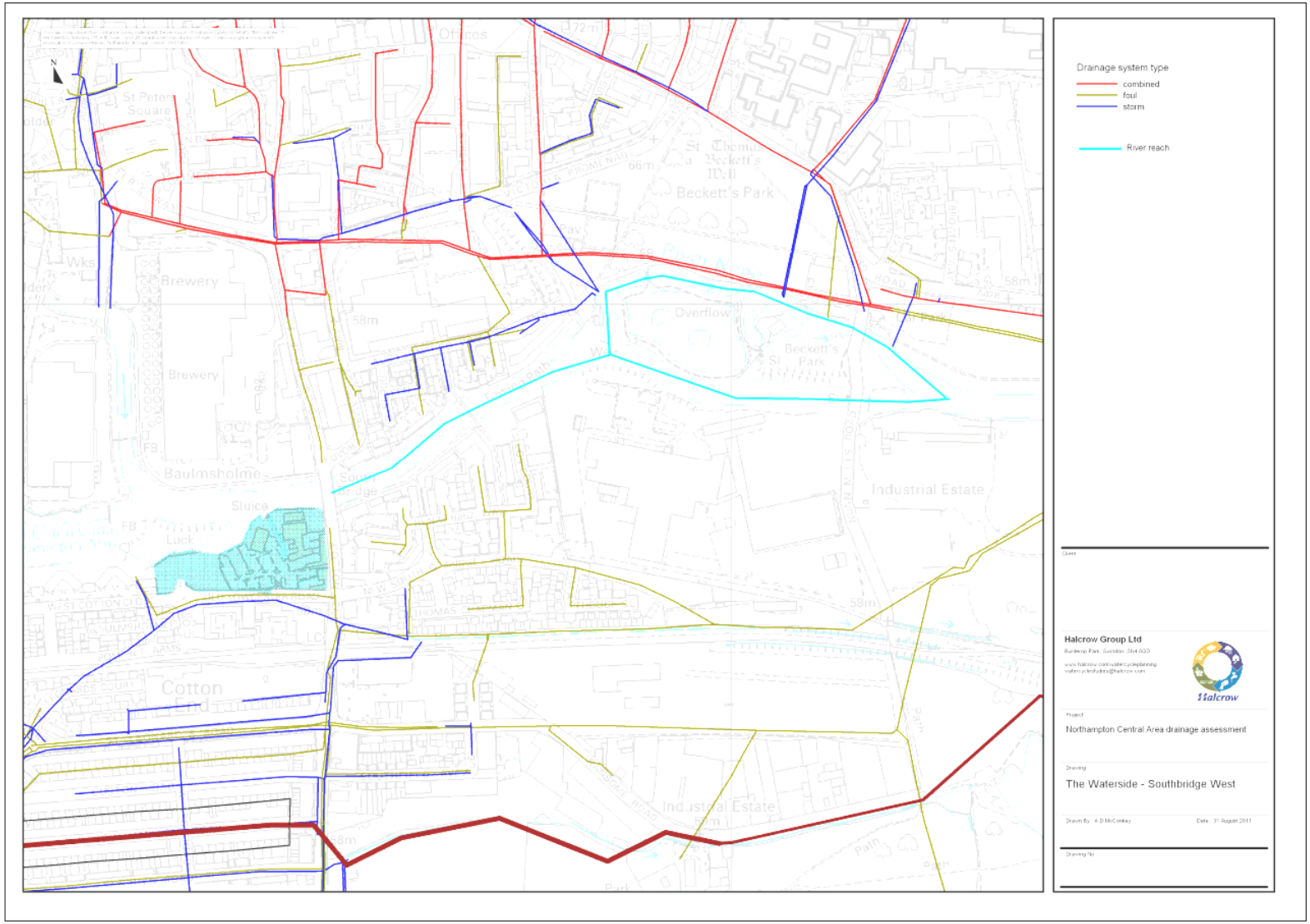

Figure 2-19 Waterside Southbridge West existing drainage arrangement

3 Future CAAP proposals drainage requirements and impact assessment

All new and redevelopment will be required to follow the National SUDS Standards[3] and are required to follow the SUDS management train as defined by the SUDS manual (see the West Northamptonshire Water Cycle Study[4] for further information). The application of the SUDS management train and the assessment of compliance with standards can only be undertaken during a masterplanning stage; there is not enough information about the likely shape of development before this stage to provide a robust assessment. However, as part of this study we have identified what we consider to be the worst case solution that might result from development based on very simplified and pessimistic assessment of what could be achieved on each proposal.

In order to assess the impact of the CAAP proposals on the drainage system we have scrutinised the CAAP proposals, and in partnership with Northampton Borough Council and Anglian Water, have:

- quantified the expected 'net additional' foul flows and change in effective runoff area;
- identified approximate locations where foul and surface water flows from the new and redevelopment proposals could connect to the existing drainage network; and
- identified whether development would result in a net increase of population equivalent upstream of key combined sewer overflows.

The aim of this assessment was to determine the maximum negative impact if no additional surface or foul sewer infrastructure was provided alongside redevelopment. The assessment has also assumed that no SUDS source control measures have been applied on site, and no water demand management measures have been implemented in any proposals. This assessment therefore is a 'worst case' scenario, and allows us to target key problem areas where new infrastructure or management approaches will be required to manage or reduce impacts. Section 3.1 provides details of the forecast change in drainage area and population based on the CAAP proposals. Section 3.2 details the results of the impact assessment

The following assumptions have been used when undertaking this assessment:

- 100% of the proposal developed area will generate runoff (no sustainable drainage source control has been applied). Any proposed green space has been omitted from this calculation.
- Water consumption and hence demand for wastewater service in the redeveloped proposals follow Anglian Water's typical land use/population projections assuming no additional demand management.
- Drainage for redevelopment will follow the draft National SUDS Standards destination of drainage philosophy (see Section 5.2 and text box below).
- The CAAP development proposals fall primarily in an area underlain by impermeable bedrock[4]. Although superficial deposits are largely permeable, where proposals are on

[3] http://www.defra.gov.uk/consult/files/suds-consult-annexa-national-standards-111221.pdf

[4] West Northamptonshire Water cycle study November 2011, Chapter 6.

previously developed land, development will have compacted these deposits and rendered them less permeable. Therefore we have assumed that large scale infiltration features will not be suitable on previously developed land.

The following receptors must be considered for surface runoff in order of preference:

1. Discharge by infiltration into the ground
2. Discharge to an open surface water body
3. Discharge to a surface water sewer
4. Discharge to a combined sewer

Discharge to a foul sewer will not be permitted, and discharge to combined sewer will only be permitted if

- there are no other practicable options for discharge of surface water runoff

AND

- it can be demonstrated that there will be no increase in the frequency or volume of discharge from intermittent storm discharges, or any increase in foul flooding downstream of the development site

3.1 Post-redevelopment drainage requirements

3.1.1 Brampton Branch 1 - Brampton Branch upstream of A4500 road bridge

The following proposals drain to this river reach:

- Spring Boroughs

Castle StationFigure 2-2Figure 2.2 in Chapter 2 maps the location of these proposals and the river reach. The Tables 3.1 and 3.2 contain the results of the post-redevelopment drainage assessment for these two proposals.

The tables contain the following data:

Total site area (ha) – This is taken from the CAAP proposal boundary data provided by Northampton Borough Council.

Site area generating runoff (%) – This is the percentage of the total site area, based on the individual CAAP proposal boundary, that has been estimated using a visual assessment of satellite imagery, to consist of hard or impermeable surface.

Impermeable runoff area (ha) – This is area of the proposal, estimated using a visual assessment of satellite imagery, to consist of hard or impermeable surface.

Total modelled area generating runoff (ha) – this is the total runoff area within the proposal boundary that connects to the foul, combined or surface water drainage system. The value has been taken from the Anglian Water Services drainage model.

Area connected to foul/combined (ha) – this is the runoff area within the proposal boundary that connects to the foul or combined drainage system. The value has been taken from the Anglian Water Services drainage model.

Area connected to storm (ha) – this is the runoff area within the proposal boundary that connects to the foul or combined drainage system. The value has been taken from the Anglian Water Services drainage model.

% total area connected to AWS system – this is the percentage of the total site area that is connected to AWS drainage model. There are some values greater than 100% which indicates that the area connected to the AWS model is greater than the actual area of the proposal.

Existing modelled land use

Total proposal developed area (ha)

This is taken from the CAAP proposal boundary data provided by Northampton Borough Council.

Runoff area connect to SWS (ha)

This is the runoff area within the proposal boundary that connects to the foul or combined drainage system. The value has been taken from the Anglian Water Services drainage model.

Runoff area connected to foul/combined (ha)

This is the runoff area within the proposal boundary that connects to the foul or combined drainage system. The value has been taken from the Anglian Water Services drainage model.

Runoff area connected to other drainage / SUDS system (ha)

If the sum of runoff area connected to SWS and runoff area connected to foul combined is less than the total site area, we have assumed that the remainder must be connected to another, unidentified drainage system. This assumes that 100% of the proposal site area generates runoff which is likely to be a very conservative assumption.

Current population

This is the population that the Anglian Water model currently indicates is connected to the foul system within the proposal area.

Future modelled use

Total proposal developed area (ha)

This is taken from the CAAP proposal boundary data provided by Northampton Borough Council.

Runoff area requiring surface water drainage (ha)

Where our initial assessment has indicated that drainage by a surface water sewer is feasible, this is the area post-redevelopment that we have modelled as being connected to surface water sewer.

Runoff area connected to foul (ha)

Where our initial assessment has indicated that drainage by a surface water sewer is not feasible, this is the area post-redevelopment that we have modelled as remaining connected to the foul sewer.

Runoff connected to other drainage system / SUDS system (ha)

If the sum of runoff area connected to SWS and runoff area connected to foul combined is less than the total site area, we have assumed that the remainder must be connected to another, unidentified drainage system. This assumes that 100% of the proposal site area generates runoff which is likely to be a very conservative assumption.

Future population

This is the population forecast based on the proposal data provided by NBC.

Table 3-1 Post-redevelopment drainage assessment for Spring Boroughs

Spring Boroughs

Spring Boroughs is proposed to be a mixed use redevelopment of council housing stock to provide modern social and market housing that meets future needs. It will be primarily residential redevelopment with mixed uses appropriate for residential areas.

Mixed use redevelopment or a high density residential area should not increase the overall area requiring surface water drainage, and it is likely that there will be opportunities to significantly reduce the total drainage area that requires positive drainage. However, for the purposes of this assessment, we have assumed that the total impermeable area will remain the same, and that all runoff area will drain via the existing conventional surface water drainage system to the nearest watercourse.

There may be small amounts of additional wastewater demand from changes in the residential population associated with the redevelopment, and from associated retail and commerce, but there is not enough certainty to model these changes. Therefore we have assumed that foul demand will remain the same as the current demand.

The removal of more than 4 hectares of runoff area from the foul system will reduce the demand on the foul system and create capacity for minor increases in population or commercial foul effluent.

Table 3.1a below shows the change in modelled drainage area and population.

Table 3.1a Modelled future drainage needs

Existing modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area connected to SWS (ha)	Runoff area connected to foul/combined (ha)	Current population
18.17	1.35	12.65	4.17	2664
Future modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Future population
18.17	1.35	16.82	0.00	2664
Change				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Change in runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Population difference
0.00	0.00	4.17	-4.17	0

Table 3-2 Post-redevelopment drainage assessment for Castle Station

Castle station

Castle Station is proposed to be a redevelopment of the confines of the Railway Station. This redevelopment will include improvements to the railway station, a new multi storey car park, offices, retail ancillaries which include restaurants, cafes, bars and new residential houses.

There is no proposed change in total drainage area, although there may be additional wastewater demand from additional food and drink outlets supporting the station, and from associated hotel, office and small scale residential developments.

It has been assumed that the existing, unidentified drainage routes for this proposal will remain the same. The total proposal site area, or the percentage of runoff area will not change through the proposal, therefore, other than the increase in population, there should be no change in impact caused by this proposal.

Table 3.2a below shows the change in modelled drainage area and population.

Table 3.2a Modelled future drainage needs

Total site area				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area connected to SWS (ha)	Runoff area connected to foul/combined (ha)	Current population
4.38	4.36	0	0.02	5
Future modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Future population
4.38	4.38	0	0	672
Change				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Change in runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Population difference
0	0.02	0.00	-0.02	667

3.1.2 Brampton Branch 2 - Sites that drain to Brampton Branch downstream of the A4500 road bridge, upstream of the confluence with River Nene at South Bridge

The following proposals drain to this river reach:

- Freeschool St
- Former Fish Market
- Grosvenor Centre
- The Waterside Brampton Branch

Figure 2.3 in Chapter 2 shows the location of these proposals and the river reach. Tables 3.3 to 3.6 contain the results of the drainage assessment for these four proposals.

Table 3-3 Post-redevelopment drainage assessment for Freeschool Street

Freeschool Street

The site is to be redeveloped to provide mixed use predominantly office development supported by restaurants etc. The total post-redevelopment site area is 1.287ha, but existing modelling assumes runoff from an area of 1.331ha for this site. The total post development site drainage area does not increase from the current modelled area, and there is no predicted increase in foul drainage volumes.

For the purposes of this modelling assessment, the higher value of 1.331ha has been used. To be consistent with the destination of drainage hierarchy which presumes against discharge to combined sewer, it has been assumed that all site drainage will be removed from the foul/combined system, and discharged in the existing surface water sewer system. Table 3.3a below shows the change in modelled drainage area and population.

Table 3.3a modelled future drainage needs

Existing modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area connected to SWS (ha)	Runoff area connected to foul/combined (ha)	Current population
1.29	0.00	0.60	0.73	16
Future modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Future population
1.29	0.00	1.33	0.00	0
Change				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Change in runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Population difference
0.00	0.00	0.73	-0.73	-16

Table 3-4 Post-redevelopment drainage assessment for the Former Fish Market

Former Fish Market

The proposals are to provide extension to retail space (for the adjacent Grosvenor Centre), and to move the existing art gallery to the St Johns/Angel St cultural quarter.

The total drainage area of the proposal is slightly (0.2ha) less than the current modelled drainage surface connected to surface water sewer. For the purposes of this assessment, and to be consistent with the destination of drainage hierarchy which presumes against discharge to combined sewer, it has been assumed that all site drainage will be removed from the foul/combined system, and discharged in the existing surface water sewer system. However, the removal of some hardstanding areas from draining into the combined system, and the proposed connection of these to the surface water system will exert new demand on the local surface water system and receiving watercourse.

There is unlikely to be additional wastewater demand from changes in the retail and commerce.

Table 3.4a below shows the change in modelled drainage area and population

Table 3.4a Modelled future drainage needs

Existing modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area connected to SWS (ha)	Runoff area connected to foul/combined (ha)	Current population
0.51	-0.04	0.22	0.33	37
Future modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Future population
0.51	0.00	0.51	0.00	0
Change				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Change in runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Population difference
0.00	0.04	0.29	-0.33	-37

Table 3-5 Post-redevelopment drainage assessment for the Grosvenor Centre

The Grosvenor Centre

The proposals are for the remodelling of the existing retail space. There should therefore be no change of hardstanding or runoff area. There should be marginal change in the foul demand, although there is a slight modelled decrease in demand for foul wastewater from the proposals. The site is primarily a large retail centre, with associated delivery space and some surface car parking on hardstanding. There is very limited greenspace and no evidence of natural drainage within the site boundary.

For the purposes of this assessment, and to be consistent with the destination of drainage hierarchy which presumes against discharge to combined sewer, it has been assumed that all site drainage will be removed from the foul/combined system, and discharged in the existing surface water sewer system. However, the removal of some hardstanding areas from draining into the combined system, and the proposed connection of these to the surface water system will exert new demand on the local surface water system and receiving watercourse.

Table 3.5a below shows the change in modelled drainage area and population

Table 3.5a Modelled future drainage needs

Existing modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area connected to SWS (ha)	Runoff area connected to foul/combined (ha)	Current population
7.59	1.72	4.88	1.00	328
Future modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Future population
7.59	0.00	7.59	0.00	0
Change				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Change in runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Population difference
0.00	-1.72	2.71	-1.00	-328

Table 3-6 Post-redevelopment drainage assessment for the Waterside Development: Brampton Branch and St Peter's Way

Waterside development Brampton Branch and St Peter's Way

The area between Castle Station and B&Q has substantial constraints that currently limit the range of development possibilities. The current, most significant, constraints are the two operational gasholders which have extensive development exclusion zones.

The proposal is for office development with ancillary retail and leisure. There are possible contamination issues from the Gasholder site and drainage of low grade industrials areas that will require further consideration.

The total post development area is 5.803ha, of which 1.93ha (approx 33%) is proposed to be greenspace, meaning that 3.873ha will be developed.

There is little change in proposed hardstanding areas between the existing area and following the proposed redevelopment.

The site is adjacent to open watercourse, therefore the destination of drainage hierarchy would dictate that surface water should be discharged directly to the watercourse, with appropriate SUDS features and controls. For the purposes of this 'worst case' it has been assumed that all site drainage will be removed from the foul/combined system, and discharged in to the river system without any SUDS controls.

Table 3.6a below shows the change in modelled drainage area and population.

Table 3.6a Modelled future drainage needs

Existing modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area connected to SWS (ha)	Runoff area connected to foul/combined (ha)	Current population
3.87	2.60	1.216	0.06	60
Future modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Future population
3.87	0.19	3.68	0.00	830
Change				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Change in runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Population difference
0.00	-2.40	2.46	-0.06	770

3.1.3 Proposals that drain to the River Nene, downstream of the confluence with the Grand Union Canal (Nene 1)

The following proposals drain to this river reach:

- Upper Mounts/ Great Russell St
- The Drapery
- Angel Street
- St Johns
- Bridge St
- Market Square
- Telephone Exchange
- Becket's Park
- The Waterside: Avon Nunn Mills Ransome Road
- The Waterside: Southbridge West
- The Waterside: Nene Meadows

Figure 2.8 in Chapter 2 shows the location of these proposals and the river reach. Tables 3.7 to 3.17 contain the results of the future drainage assessment for these 11 proposals.

Table 3-7 Post-redevelopment drainage assessment for Upper Mounts/Great Russell St

Upper Mounts/Great Russell Street

The proposal will be developed in a comprehensive manner to deliver a mixed use but predominantly residential development with ancillary optional uses for community, leisure, educational and office use. There will be no actual increase in drainage area as the site is currently 100% hardstanding. There is a small increase in modelled site drainage area, which can be attributed to a slight underestimate of site area in AWS modelling. There is no forecast change in wastewater demand.

For the purposes of this assessment, and to be consistent with the destination of drainage hierarchy which presumes against discharge to combined sewer, it has been assumed that all site drainage will be removed from the foul/combined system, and discharged through the existing surface water sewer system. However, the removal of some hardstanding areas from draining into the combined system, and the proposed connection of these to the surface water system will exert new demand on the local surface water system and receiving watercourse.

Table 3.7a below shows the change in modelled drainage area and population

Table 3.7a Modelled future drainage needs

Existing modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area connected to SWS (ha)	Runoff area connected to foul/combined (ha)	Current population
2.03	0.06	0	1.97	0
Future modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Future population
2.03	0	2.03	0	0
Change				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Change in runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Population difference
0.00	-0.06	2.03	-1.97	0

Table 3-8 Post-redevelopment drainage assessment for The Drapery

The Drapery

This proposal is predicated on the remodelling of retail space, including the provision of space of approximately 17,000 square metres after the opening of the Grosvenor Centre extension. This floorspace will be more suited to retailers' requirements, provide an extension to the primary shopping area and enhance the role of the Drapery as a primary shopping frontage.

There will be no actual increase in runoff area following redevelopment as the site already has a high density of hard standing. The future proposal effective area is actually 0.09ha lower than the current, although the higher value has been retained for the purposes of this assessment.

There is no surface water sewer available without construction of between 250m and 800m of surface water sewer along Kingswell St and Bridge St. It is not certain at this stage that there is a practicable option to discharge to a surface water sewer. For the purposes of this assessment we have therefore assumed that 100% of the developed area will discharge to the existing combined /foul sewer.

There is unlikely to be additional wastewater demand from changes in the retail and commerce.

Table 3.8a below shows the change in modelled drainage area and population

Table 3-8a Modelled future drainage needs

Existing modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area connected to SWS (ha)	Runoff area connected to foul/combined (ha)	Current population
1.20	0.01	0.42	0.77	19
Future modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Future population
1.10	0.00	0.00	1.20	0
Change				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Change in runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Population difference
-0.10	-0.01	-0.42*	0.43	-19

* Although there is drainage area modelled connecting to a surface water sewer, this SWS connects back into the foul system directly downstream of the proposal site.

Table 3-9 Post-redevelopment drainage assessment for Angel Street

Angel Street

The proposal is for remodelling of the gyratory system to ease pedestrian access, provision of office space and associated retail/leisure. There are also plans for a public square to be provided as part of the redevelopment. Therefore there are significant opportunities to remodel the drainage of this area. For the purposes of this assessment, the whole site area has been used as the area generating runoff, and increased from 3.1ha to 3.7ha.

For the purposes of this assessment, and to be consistent with the destination of drainage hierarchy which presumes against discharge to combined sewer, it has been assumed that all site drainage will be removed from the foul/combined system, and discharged through the existing surface water sewer system. However, the removal of some hardstanding areas from draining into the combined system, and the proposed connection of these to the surface water system will exert new demand on the local surface water system and receiving watercourse.

There is a forecast small increase in wastewater demand.

Table 3.9a below shows the change in modelled drainage area and population

Table 3-9a Modelled future drainage needs

Existing modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area connected to SWS (ha)	Runoff area connected to foul/combined (ha)	Current population
3.713	-0.61	2.54	1.78	113
Future modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Future population
3.713	0	3.713	0	155
Change				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Change in runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Population difference
0.00	0.61	1.17	-1.78	42

Table 3-10 Post-redevelopment drainage assessment for St John's

St John's

The proposals comprise office development (up to 10,000 square metres) a hotel, small scale retail (up to 250 square metre units), restaurants, cafés and living accommodation including student accommodation. The proposals aim to deliver a public square to the north of the Albion Street car park adjacent to the Royal and Derngate Theatre entrance, fronted by restaurants, cafés and bars, public houses or drinking establishments at ground floor level. These development proposals offer significant opportunities to remodel the drainage of this area.

For the purposes of this assessment, the whole site area has been used as the area generating runoff, an increase from 1.086ha to 1.19ha. As the site is currently 100% hardstanding, there will be no increase in actual overall runoff area. The small increase in modelled site runoff area can be attributed to a slight underestimate of site area in AWS modelling.

For the purposes of this assessment, and to be consistent with the destination of drainage hierarchy which presumes against discharge to combined sewer, it has been assumed that all site drainage will be removed from the foul/combined system, and discharged through the existing surface water sewer system. However, the removal of some hardstanding areas from draining into the combined system, and the modelled connection of these to the surface water system will exert new demand on the local surface water system and receiving watercourse.

There is a forecast small increase in wastewater demand.

Table 3.10a below shows the change in modelled drainage area and population

Table 3-10a Modelled future drainage needs

Existing modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area connected to SWS (ha)	Runoff area connected to foul/combined (ha)	Current population
1.09	0.00	0.58	0.51	36
Future modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Future population
1.19	0	1.19	0	50
Change				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Change in runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Population difference
0.10	0.00	0.62	-0.51	14

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Table 3-11 Post-redevelopment drainage assessment for Bridge Street

Bridge Street

The proposed land use is small scale retail and financial, with some leisure and restaurant use. Retail and leisure are proposed at ground level, with office use above this.

For the purposes of this assessment, the whole site area has been used as the area generating runoff, an increase from 1.86ha to 1.97ha. As the site is currently 100% hardstanding, there will be no increase in actual overall runoff area. The small increase in modelled site runoff area can be attributed to a slight underestimate of site area in AWS modelling.

There is no SWS within the proposal boundary, but there is a SWS within 50m of the site boundary. For the purposes of this assessment, and to be consistent with the destination of drainage hierarchy which presumes against discharge to combined sewer, it has been assumed that all site drainage will be removed from the foul/combined system, and discharged through the existing surface water sewer system. However, the removal of some hardstanding areas from draining into the combined system, and the proposed connection of these to the surface water system will exert new demand on the local surface water system and receiving watercourse.

There is a forecast small increase in wastewater demand.

Table 3.11a below shows the change in modelled drainage area and population

Table 3-11a Modelled future drainage needs

Existing modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area connected to SWS (ha)	Runoff area connected to foul/combined (ha)	Current population
1.86	-0.26	0.14	1.98	21
Future modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Future population
1.97	0.00	1.97	0.00	85
Change				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Change in runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Population difference
0.11	0.26	1.83	-1.98	64

Table 3-12 Post-redevelopment drainage assessment for Market Square

Market Square

The Market Square is a destination in its own right through its function as a market and event space. It is a major historical landmark and area of public space. It provides a unique opportunity for Northampton to differentiate its retail and leisure experience from competing out-of-town retail parks and other retail centres. In terms of role and function, the Borough Council intends to maximise the potential offered by this asset, by encouraging more restaurants and cafés to invest in the properties fronting the Square.

There is no surface water sewer available within 50m of the proposal. It is not certain at this stage that there is a practicable option to discharge to a surface water sewer. For the purposes of this assessment we have therefore assumed that 100% of the developed area will discharge to the existing combined /foul sewer.

There is no material change to the drainage of the site through the proposals. Therefore there should be no negative impact on surface water demand and no increase in foul demand.

Table 3.12a below shows the change in modelled drainage area and population

Table 3-12a Modelled future drainage needs

Existing modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area connected to SWS (ha)	Runoff area connected to foul/combined (ha)	Current population
1.36	0.10	0.66	0.60	30
Future modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Future population
1.36	0.00	0.00	1.36	0
Change				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Change in runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Population difference
0.00	-0.10	-0.66	0.76	-30

* Although approximately 50% of the site drainage is described as connecting to the surface water sewer, in reality it connects back into the foul/combined system immediately of the proposal area.

Table 3-13 Post-redevelopment drainage assessment for the Telephone Exchange

Telephone exchange

The telephone exchange building dominates the area and is regarded as having a negative impact on the skyline of Northampton due to its height and monolithic appearance. Development of a more appropriate scale and form would be advantageous to the area together with improvements along the Spring Gardens frontage. This one-way street linking St Giles Street and Derngate would be the primary access to the site.

The proposal is for the site to be a mixed use development comprising offices and other uses, including some residential. There appears to be no natural drainage 100% of the site area currently discharges into foul or combined sewer, therefore there can be no actual increase in effective runoff area

The existing site is approximately 0.7ha, of which approximately 26% is drained by AWS sewers (see Table 3.13a below for full details). Therefore about 75% of the runoff area of the site is unaccounted for. As there is no actual forecast increase in runoff area, it is currently believed that in reality the majority if not all of the runoff area is drained by AWS combined sewer.

Although there is a surface water sewer that runs within 50m of the southern extent of the proposal, this SWS connects back into the foul system upstream of a combined sewer overflow. There are no other identified SWS within the site boundary, therefore for the purposes of this modelling we have assumed that there is no practicable option other than to discharge to the combined system. Therefore we have modelled an increase in runoff area to the foul/combined system and an increase in population.

Table 3.13a below shows the change in modelled drainage area and population

Table 3-13a Modelled future drainage needs

Existing modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area connected to SWS (ha)	Runoff area connected to foul/combined (ha)	Current population
0.68	0.50	0.02	0.17	27
Future modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Future population
0.68	0.00	0.00	0.69	125
Change				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Change in runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Population difference
0.00	-0.50	-0.02	0.52	98

Table 3-14 Post-redevelopment drainage assessment for Becket's Park

Becket's Park

The park is to remain a formal park and waterfront area. The only part of the proposal that could affect the existing foul and surface runoff demand is the proposal for up to 500 square metres of development to allow for uses appropriate to the park. These will have a negligible impact on wastewater demand, and a marginal impact on surface water demand.

The total proposal area is 9.804, of which 8.684ha will remain as greenspace. Therefore the future proposal developed area is 1.12ha. We have assumed that any additional impermeable area created through development will connect to a SUDS system which will discharge direct to river, therefore there is no increase in impermeable area to surface water or foul/combined sewer.

Table 3.14a below shows the change in modelled drainage area and population

Table 3-14a Modelled future drainage needs

Existing modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area connected to SWS (ha)	Runoff area connected to foul/combined (ha)	Current population
9.80	9.09	0.72	0.00	1
Future modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Future population
9.80	9.09	0.72	0.00	50
Change				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Change in runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Population difference
0.00	0.00	0.00	0.00	49

Table 3-15 Post-redevelopment drainage assessment for Avon Nunn Mills Ransome Road

The Waterside: Avon Nunn Mills Ransome Road

The Avon Nunn Mills Ransome Road site will be redeveloped with offices/ retail/ restaurants/ hotel and about 1,250 dwellings. The developed area is proposed to be 24.61ha, a 20% increase on the current effective drainage area. Therefore the effective runoff area could increase by up to 20%. The development will be situated in extensive parkland, therefore there will be ample space within the parkland and open space for above ground SUDS systems ensuring that any changes to runoff surface area can be fully mitigated to pre development standards.

The entire site area is 42ha, and currently approximately 0.4ha of this drainage area connects to the foul / combined drainage system, with the remainder draining directly to the Nene through natural, unidentified or unmodelled pathways. Following the destination of drainage hierarchy, we can see no practicable reason why surface water drainage can not be managed to agreed SUDS standards on site and then discharged direct to watercourse. For the purposes of this modelling assessment, we have assumed that no site drainage will remain connected to the public sewer system, and have modelled the projected increase in population. It is possible that the existing runoff connected to the foul system is in fact contaminated runoff from industrial activities on the site. Where this is the case, it may be necessary to design on site SUDS to provide additional water quality treatment.

Table 3.15a below shows the change in modelled drainage area and population

Table 3-15a Modelled future drainage needs

Existing modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area connected to SWS (ha)	Runoff area connected to foul/combined (ha)	Current population
41.39	41.01	0.02	0.37	27
Future modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Future population
41.39	41.39	0	0	5000
Change				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Change in runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Population difference
0.00	0.38	-0.02	-0.37	4973

Table 3-16 Post-redevelopment drainage assessment for Waterside Southbridge West

The Waterside: Southbridge West

Proposals for Southbridge West are poorly developed; therefore it is difficult to forecast the demand for foul and surface water drainage services from the proposal. The CAAP identifies that a more detailed flood risk assessment will be required before any development can proceed behind the flood defences on this site. Subject to this flood risk assessment, it can be developed for leisure, residential or office use. For the purposes of this modelling assessment, and in line with the destination of drainage hierarchy, we have assumed that it is practicable that any surface water drainage can be managed to SUDS standards on the proposal itself, and then discharged direct to watercourse. Therefore there is a modelled reduction in area draining to public sewers, but an increase in population.

Table 3.16a below shows the change in modelled drainage area and population

Table 3-16a Modelled future drainage needs

Existing modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area connected to SWS (ha)	Runoff area connected to foul/combined (ha)	Current population
1.63	1.11	0.33	0.20	25
Future modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Future population
1.72	1.72	0	0	50
Change				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Change in runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Population difference
0.09	0.61	-0.33	-0.20	25

Table 3-17 Post-redevelopment drainage assessment for Waterside Nene Meadows

The Waterside: Nene Meadows

The proposal is generally for open space, with a central activity hub with provision for a visitor centre, café and licensed bar facilities, changing facilities, hire facilities e.g. cycle, retail (up to 250 square metres) and an indoor activity area to accommodate play/ parties/ meeting rooms. The total proposal area is 31.44ha of which 29.72 will remain as greenspace.

For the purposes of this modelling assessment, and in line with the destination of drainage hierarchy, we have assumed that it is practicable that any surface water drainage for any new development can be managed to SUDS standards on the proposal itself, and then discharged direct to watercourse. Therefore there is a modelled reduction in runoff area draining to public sewers.

Table 3.17a below shows the change in modelled drainage area and population

Table 3-17a Modelled future drainage needs

Existing modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area connected to SWS (ha)	Runoff area connected to foul/combined (ha)	Current population
0.94	0.84	0.05	0.05	1
Future modelled land use				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Future population
1.72	1.72	0	0	0
Change				
Total proposal developed area (ha)	Runoff area connected to other drainage / SUDS system (ha)	Change in runoff area requiring surface water drainage (ha)	Runoff area connected to foul/combined (ha)	Population difference
0.78	0.88	-0.05	-0.05	-1

4 CAAP proposals drainage impact assessment

4.1 Methodology

A modelling assessment was undertaken to determine the impact of the proposals, using the land use and drainage assessment values calculated in Chapter 3. The modelling was undertaken in two stages, with the first stage establishing the baseline flood risk and CSO discharge impact for the current modelled land use. The second stage modelled the impact of the land use changes and population changes identified in Chapter 3.

The modelling has been undertaken by AWS using their detailed drainage model of Northampton.

It was originally intended that additional analysis would be undertaken with climate change rainfall and climate change river stage data. However, the model was not stable with climate change rainfall or river stage data therefore these results have had to be omitted. However, the 200 year with high river levels can be considered as worse than, and a conservative indicator of, the 100 year with climate change.

Two rainfall return period events were used to simulate the performance of the drainage system:

- 30 year rainfall return period for the drainage system
- 200 year rainfall return period for the drainage system

The performance of the drainage system was measured with respect to the following indicators:

- Change in spill volume and frequency of combined sewer discharge by river reach
- Change in surface water discharge volume and peak rate by river reach
- Change in volume of foul flooding across the CAAP area
- Change in volume and extent of surface water flooding across the CAAP area

The performance of the drainage system is likely to be affected by river levels in the river system; when river levels are high, it is likely that some outfalls may be submerged and that these may not be able to operate during peak river events. In order to assess the performance of the drainage system under these conditions, two river scenarios were used:

- Low river level, unimpeded or free outfall for all discharges
- High river level, corresponding to the 200 year or 0.5% annual exceedance probability river level.

4.2 Impact assessment on combined sewer overflow operation

It is important to assess if there is capacity within the combined drainage system for the additional population proposed through the CAAP proposals. If there is no capacity, then the incidence of foul flooding and combined sewer overflow will increase, causing environmental and potential human health issues.

This assessment has used the land use and drainage characteristics identified in Chapter 3. Therefore, these results are highly dependant on the removal of surface water from the foul or combined network.

Using the AWS model, we have identified those combined sewer overflows that will be impacted by the CAAP proposals, and assessed how the CSO spill volume changes for a 30 year rainfall event by spills to each river reach. The assessment has used the land use and drainage characteristics for each proposal identified in Chapter 3. Therefore, these results are highly dependant on the removal of surface water from the foul or combined network.

Figures 4-1 to 4-3 show the location of the CSO discharges in relation to the CAAP proposals.

Table 4-1 below shows the outputs of the assessment.

Table 4-1 Combined sewer overflow discharge by river reach

CSO name	River reach	Upstream population change	Upstream Effective runoff area change (to foul or combined)	% Change in spill volume for 30 yr rainfall event free outfall	% Change in spill volume for 30 yr rainfall event with 200yr RP river levels
Bedford RD Pumping Station CSO	River Nene, Downstream Southbridge, Downstream Becket's park	+4,048	-13.09	+0.33%	-12%
Victoria Gardens overflow		-5	-0.51		
Bedford Rd Storm overflow		+154	+.499		
Swan St Overflow		-5	-0.512		
Bridge St overflow		-1,287	-20.89		

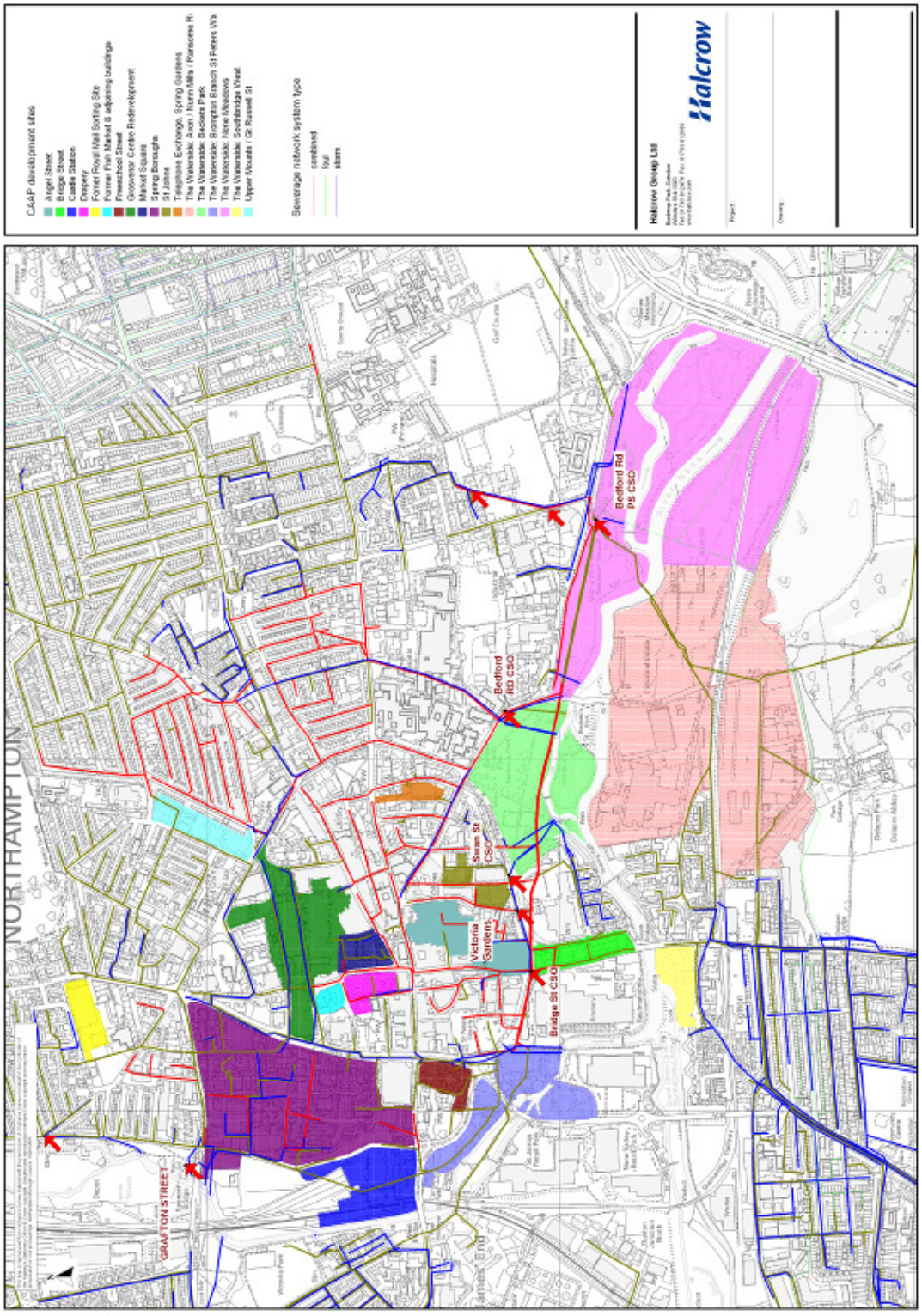

Figure 4-1 CAAP combined sewer overflow locations

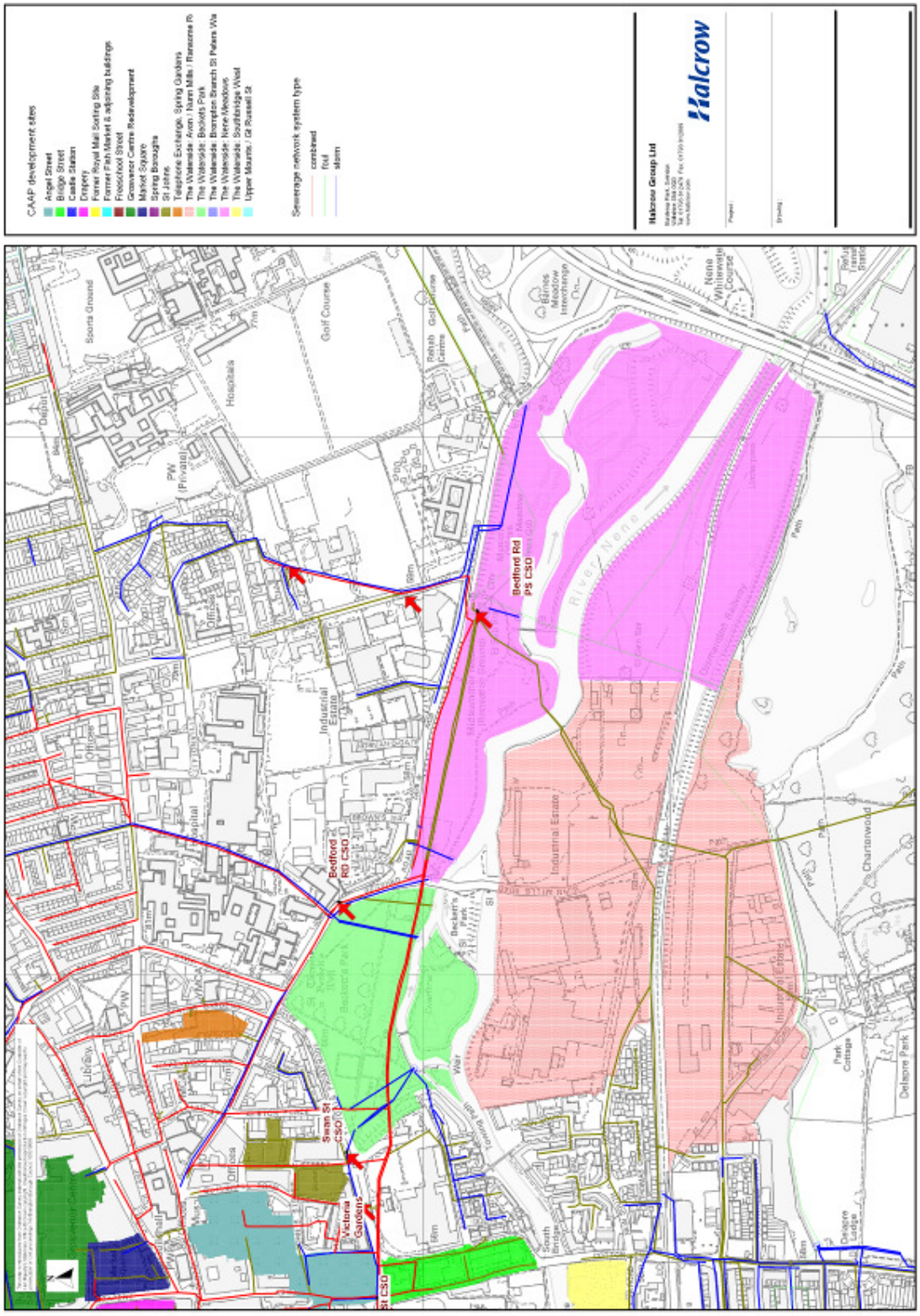

Figure 4-2 Bedford Rd combined sewer overflows

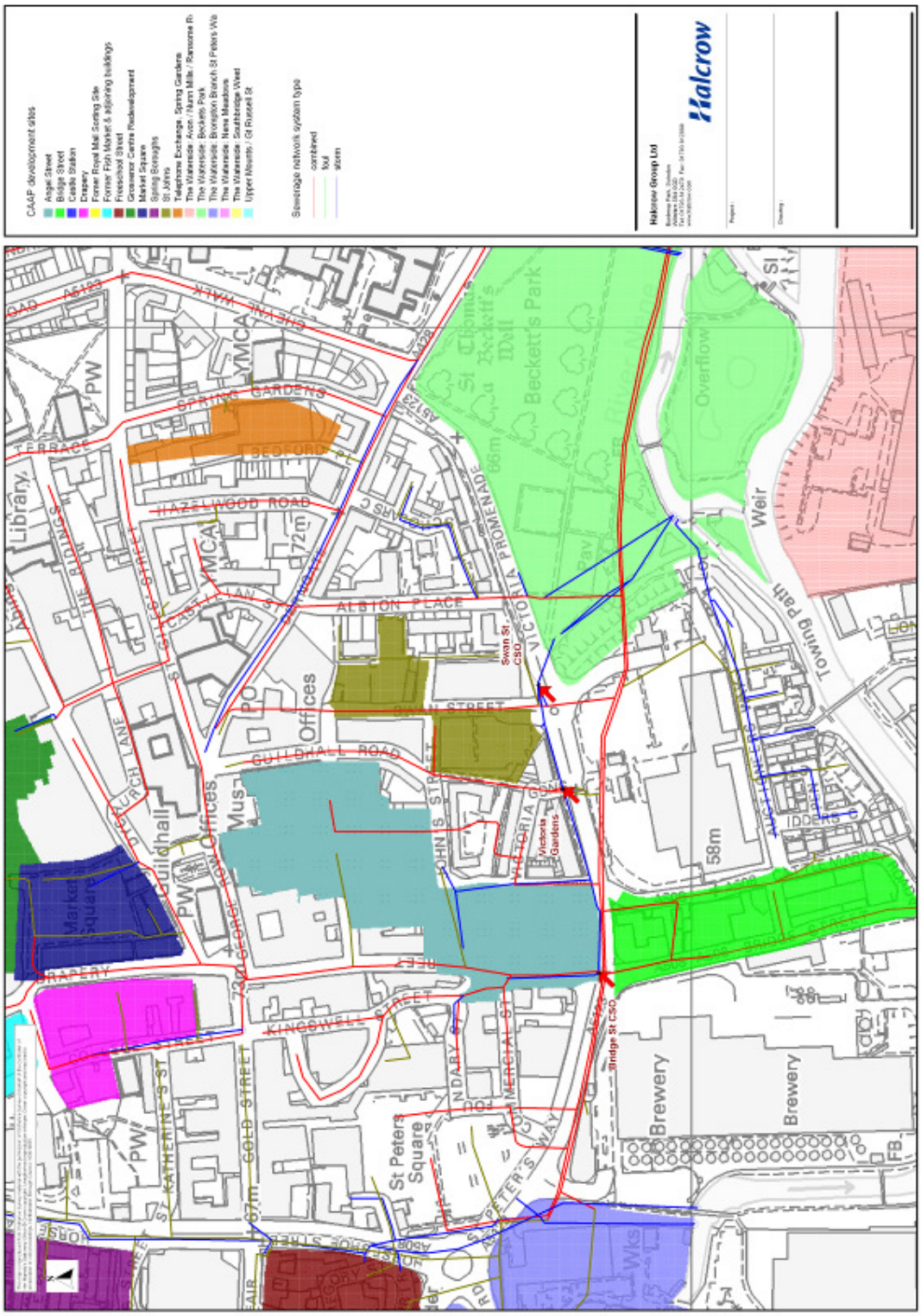

Figure 4-3 Victoria Gardens and Swan St combined sewer overflow locations

The analysis shows us that only one river reach, the River Nene downstream of Becket's Park is impacted by CSOs affected by the CAAP proposals.

It also indicates that the total volume of effluent discharged in a 30 year rainfall event does not change if we are assuming a free outfall. If the 30 year rainfall event occurs at a time when river levels are high, then the volume discharged actually decreases following the CAAP proposals.

It can be concluded that the removal of surface water from the combined system will create capacity for the forecast increase in wastewater demand through the CAAP proposals.

4.3 Surface water flood risk assessment

4.3.1 Impact on river flood risk

It is not within the scope of this assessment to model the impact of drainage changes on river flood extent. However, as an indicator of change in river flood risk, it is possible to determine the impact of the modelled drainage changes, particularly the impact of the removal of surface water discharge from the foul or combined system, on the volume of surface water discharged into each river reach. This has been undertaken using an Infoworks 2D model to determine the peak rate and total volume of surface water discharge to each river reach. Infoworks 2D is a fully dynamic above ground and below ground model. When the below ground sewer system is surcharged, the exceedance flow is routed on the ground model. The exceedance flow remains on the ground model either until there is a route and capacity for it flow back into the below ground sewer model, or until it reaches a river. The model nodes, (manholes and outfalls) are the point of interaction between the above ground and below ground system. The ground model as been built from the unfiltered Lidar data, therefore the buildings correctly act as barrier to exceedance flow. However, this methodology probably over estimates flood depth and velocity because some of the exceedance would in reality flow into and be stored in buildings. The infoworks 2D model results are shown in Tables 4-2 to 4-4. They compare the total volume of surface water discharged from all modelled surface water discharges, before and after development, for two different event scenarios:

- 100 year rainfall event, assuming low river level and free outfall of surface water into the river
- 200 year rainfall event, assuming high river levels (0.5% annual exceedance probability, or 200 year return period equivalent)

Table 4-2 Brampton Branch 1

	100 year RP rainfall, free outfall		200 year RP rainfall, 0.5% AEP river level	
	Volume of discharge (m3)	Peak rate of discharge (m3/s)	Volume of discharge (m3)	Peak rate of discharge (m3/s)
Pre-redevelopment	4,301	0.56	3,308	0.68
Post-redevelopment	9,708	0.87	7,403	0.74
Difference	5,407	0.31	1,095	0.06

Table 4-3 Brampton Branch 2

	100 year RP rainfall, free outfall		200 year RP rainfall, 0.5% AEP river level	
	Volume of discharge (m3)	Peak rate of discharge (m3/s)	Volume of discharge (m3)	Peak rate of discharge (m3/s)
Pre-redevelopment	6,590	0.56	-33,043	-1.45
Post-redevelopment	10,251	0.87	-29,322	-1.45
Difference	3,661	0.31	3,721	0.00

Table 4-4 River Nene

	100 year RP rainfall, free outfall		200 year RP rainfall, 0.5% AEP river level	
	Volume of discharge (m3)	Peak rate of discharge (m3/s)	Volume of discharge (m3)	Peak rate of discharge (m3/s)
Pre-redevelopment	17,093	1.32	13,637	0.93
Post-redevelopment	15,747	1.22	11,187	0.91
Difference	-1,346	-0.1	-2,450	-0.02

These results show that the modelled worst case change to land use and drainage strategy described in Chapter 3 will increase both the volume and rate of surface water being discharged into the Brampton Branch of the River Nene.

The modelling indicates that there is significant reverse flow from the river system into the surface water sewer system in the area of Brampton Branch 2, but it has not been possible to verify this conclusion with real historical or anecdotal evidence.

The increase in volume and rate of discharge into the Brampton Branch will result in an increase in fluvial flood risk both in, and downstream of, these river reaches.

Therefore source control or other surface water management mitigation measures will be needed to prevent this increase in risk.

4.3.2 Impact on surface water flood risk

During extreme rainfall events, not all of the rainfall will be able to enter the urban drainage system. During extreme rainfall events, the rain may pond on the surface, or may flow down

streets and roads until it either re-enters the river system, or until it finds it way into the drainage system as the rainfall subsides. This above ground flow is known as exceedance flow, and the fate of this exceedance flow can be modelled using Infoworks ™. In partnership with Anglian Water, we have used the AWS drainage model to map and evaluate the impact of exceedance flow.

In terms of damage to property and risk to life, both the depth of water, and the velocity at which it flows are important. In terms of overall risk to life, it is possible to combine the velocity and the depth using a methodology developed by Defra, and provide an overall hazard score.

The tables below detail the total flood volume on the surface during the rainfall event. The table identifies the total volume of predicted surface water flooding, presented by proposal name and by river reach. Taken proposal by proposal, these results give an indication of the amount of surface water storage that would be required to prevent surface water flooding if the surface water system remains unchanged. Alternatively, taken by river reach, and in combination with the results in 4.3.1 above, the results also indicate the additional volume of surface water that would be discharged to the river network if a surface water system was upgraded and designed to convey the flows generated in an extreme rainfall event.

Table 4-5 Total exceedance flood volume (100 year return period, low river levels)

River Reach	CAAP proposal name	Preredevelopment max flood volume (m3)	Post redevelopment max flood volume (m3)	Difference max flood volume (m3)
Brampton Branch 1	Castle Station	0	0	0
Brampton Branch 1	Spring Boroughs	0	549	549
Brampton Branch 1	Fomer Royal Mail Sorting Site	0	0	0
	Total flood volume	**0**	**549**	**549**
Brampton Branch 2	Freeschool Street	0	0	0
Brampton Branch 2	The Waterside: Brampton Branch St Peters Way	3	2	-1
Brampton Branch 2	Former Fish Market & adjoining buildings	0	0	0
Brampton Branch 2	Grosvenor Centre Redevelopment	0	0	0
	Total flood volume	**3**	**2**	**-1**
River Nene	Market Square	0	0	0
River Nene	Drapery	0	0	0
River Nene	Upper Mounts / Gt Russell St	0	0	0
River Nene	Bridge Street	86	130	44
River Nene	Angel Street	0	0	0
River Nene	St Johns	0	0	0
River Nene	Telephone Exchange, Spring Gardens	0	0	0
River Nene	The Waterside: Nene Meadows	4345	4224	-121
River Nene	The Waterside: Beckets Park	573	482	-91
River Nene	The Waterside: Avon / Nunn Mills / Ransome Rd	1491	1411	-80
River Nene	The Waterside: Southbridge West	0	0	0
	Total flood volume	**6495**	**6247**	**-248**

Table 4-6 Total exceedance flood volume (200 year return period, high river levels)

River Reach	CAAP proposal name	Pre redevelopment max flood volume (m3)	Post redevelopment max flood volume (m3)	Difference max flood volume (m3)
Brampton Branch 1	Castle Station	18	18	0
Brampton Branch 1	Spring Boroughs	0	752	752
Brampton Branch 1	Fomer Royal Mail Sorting Site	0	0	0
	Total flood volume	**18**	**769**	**752**
Brampton Branch 2	Freeschool Street	0	0	0
Brampton Branch 2	The Waterside: Brampton Branch St Peters Way	94	102	8
Brampton Branch 2	Former Fish Market & adjoining buildings	0	0	0
Brampton Branch 2	Grosvenor Centre Redevelopment	0	0	0
	Total flood volume	**94**	**102**	**8**
River Nene	Market Square	0	0	0
River Nene	Drapery	0	0	0
River Nene	Upper Mounts / Gt Russell St	0	0	0
River Nene	Bridge Street	228	237	9
River Nene	Angel Street	0	1	1
River Nene	St Johns	0	0	0
River Nene	Telephone Exchange, Spring Gardens	0	0	0
River Nene	The Waterside: Nene Meadows	8923	8625	-299
River Nene	The Waterside: Beckets Park	9375	9275	-100
River Nene	The Waterside: Avon / Nunn Mills / Ransome Rd	2248	2006	-241
River Nene	The Waterside: Southbridge West	30	30	0
	Total flood volume	**20804**	**20174**	**-630**

The figures below detail the velocity and depth of exceedance flow and Defra hazard score, before and after development, for two different event scenarios:

- 100 year rainfall event, assuming low river level and free outfall of surface water into the river
- 200 year rainfall event, assuming high river levels (0.5% annual exceedance probability, or 200 year return period equivalent)

100year return period free outfall results

The eight maps below all relate to the 100 year rainfall return period free outfall scenario, and are presented in the following order:

1. Maximum surface water depth, pre-redevelopment
2. Maximum surface water flood extent, pre-development
3. Maximum surface water depth, post-redevelopment
4. Maximum surface water flood extent, post-redevelopment
5. Maximum surface water velocity, pre-redevelopment
6. Maximum surface water velocity, post-redevelopment
7. Surface water flooding Defra hazard score, pre-redevelopment
8. Surface water flooding Defra hazard score, post-redevelopment

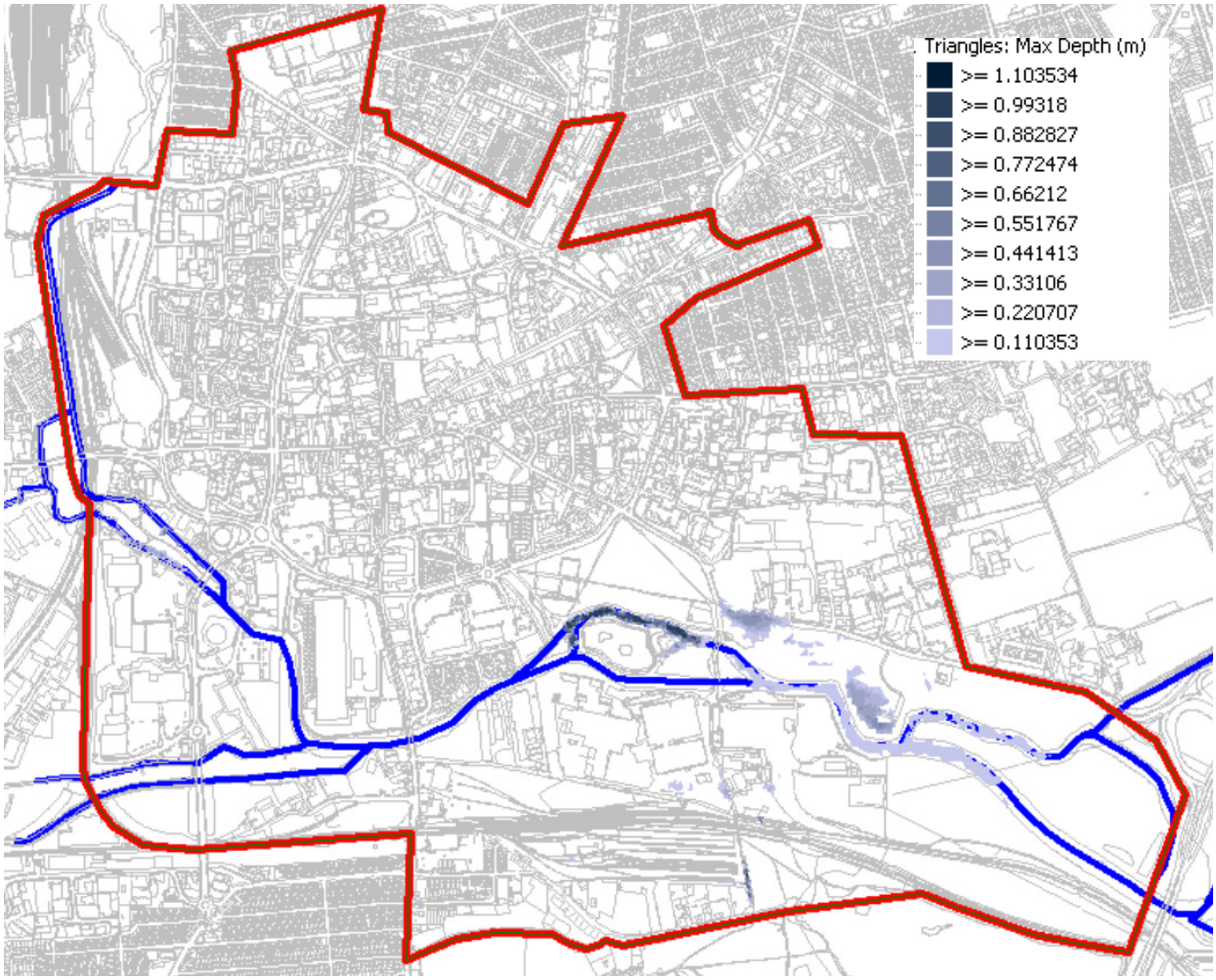

Figure 4-4 Surface water maximum depth: 100 year free outfall – pre-redevelopment

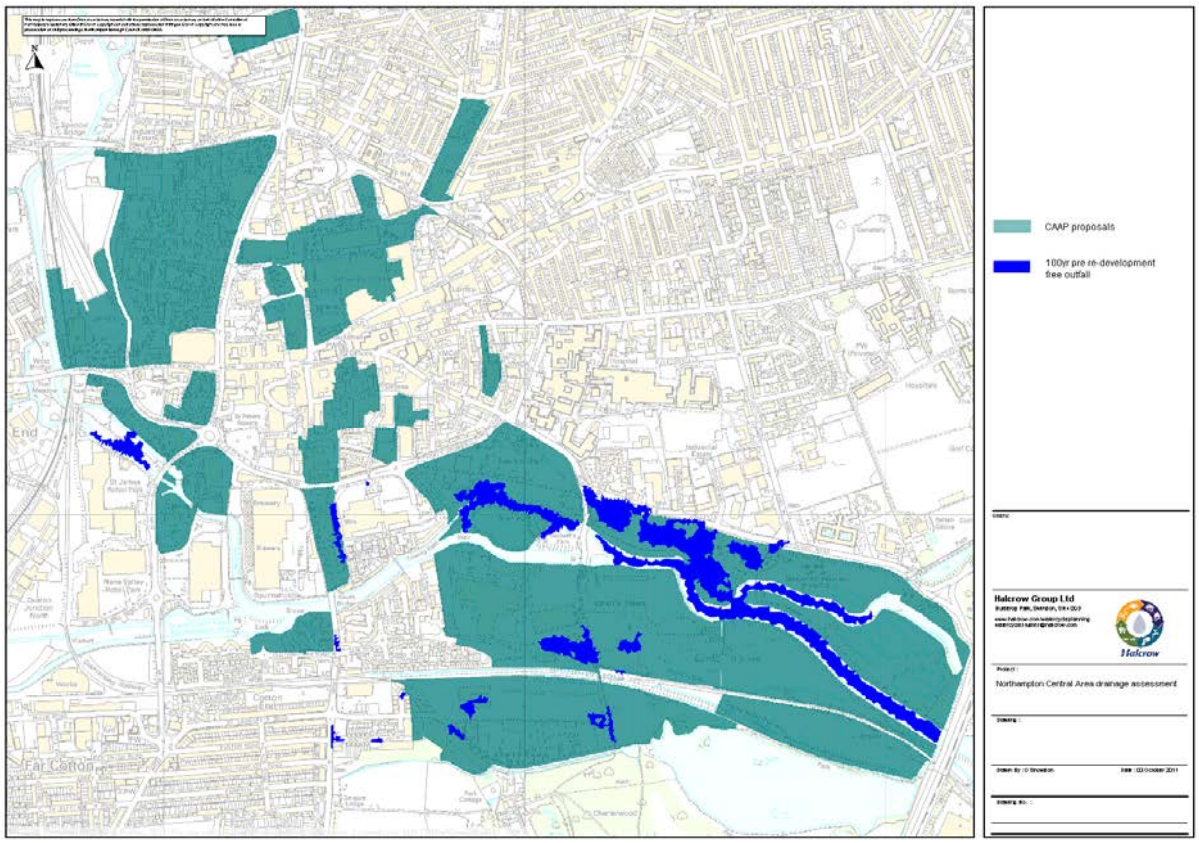

Figure 4-5 Surface water maximum flood extent: 100 year free outfall – pre-redevelopment

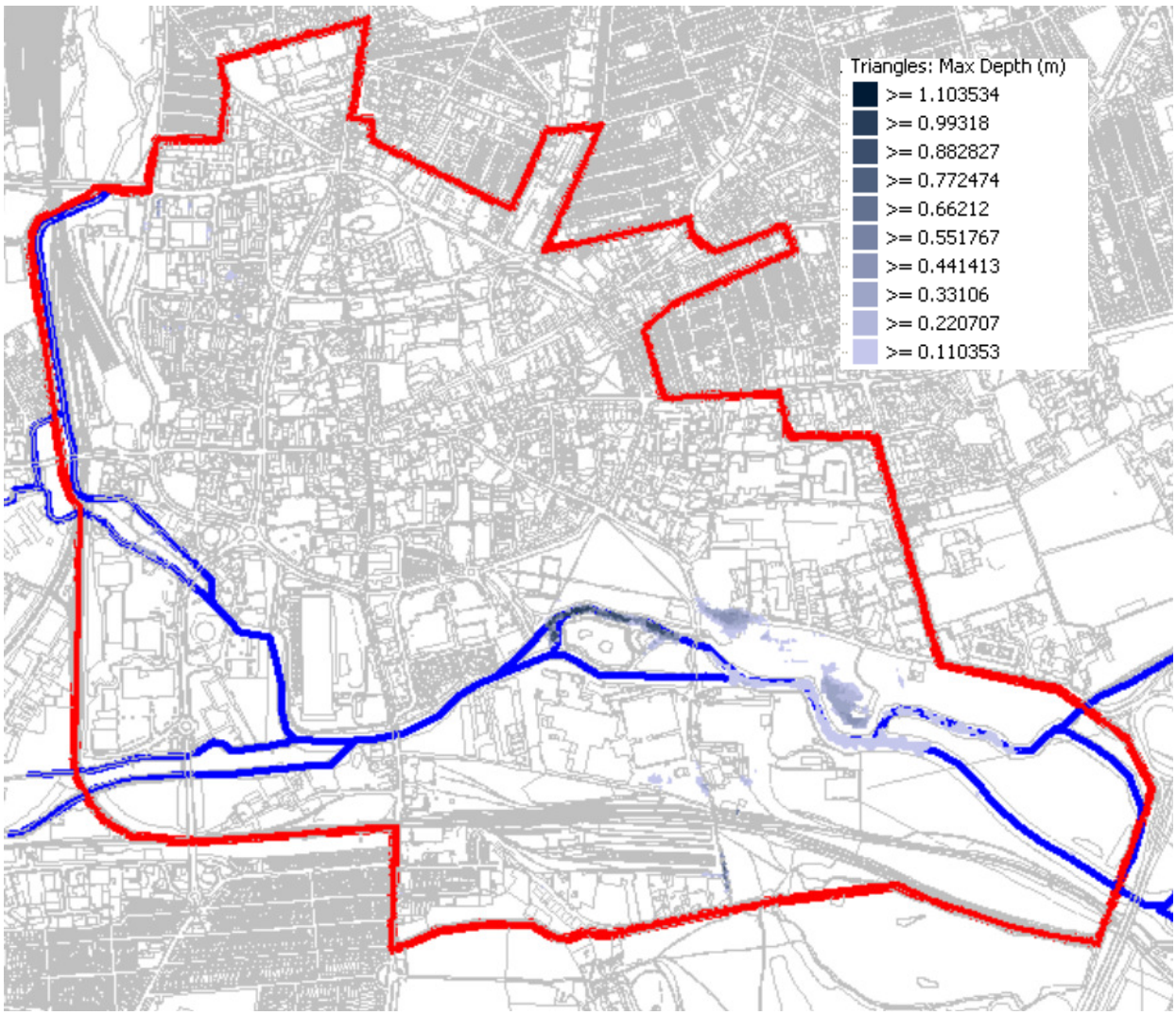

Figure 4-6 Surface water maximum depth: 100 year free outfall – post-redevelopment

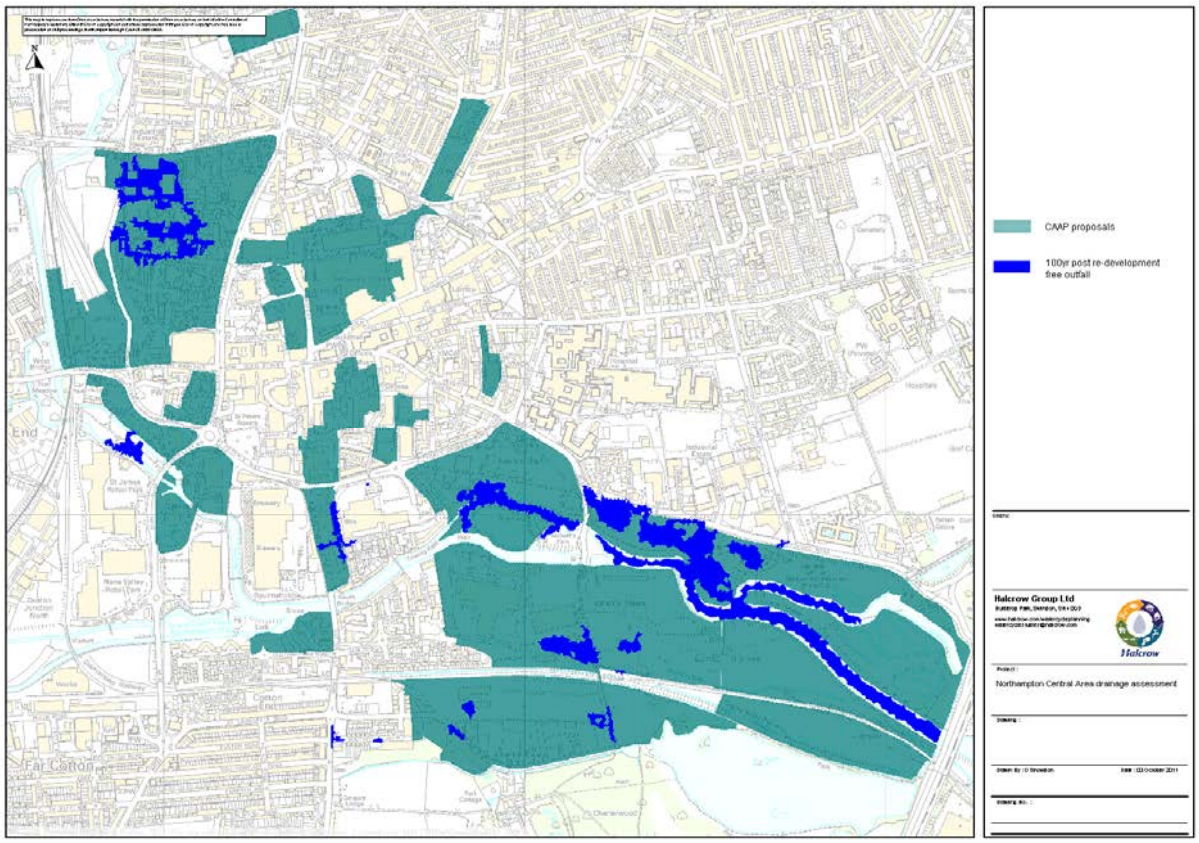

Figure 4-7 Surface water maximum flood extent: 100 year free outfall – post-redevelopment

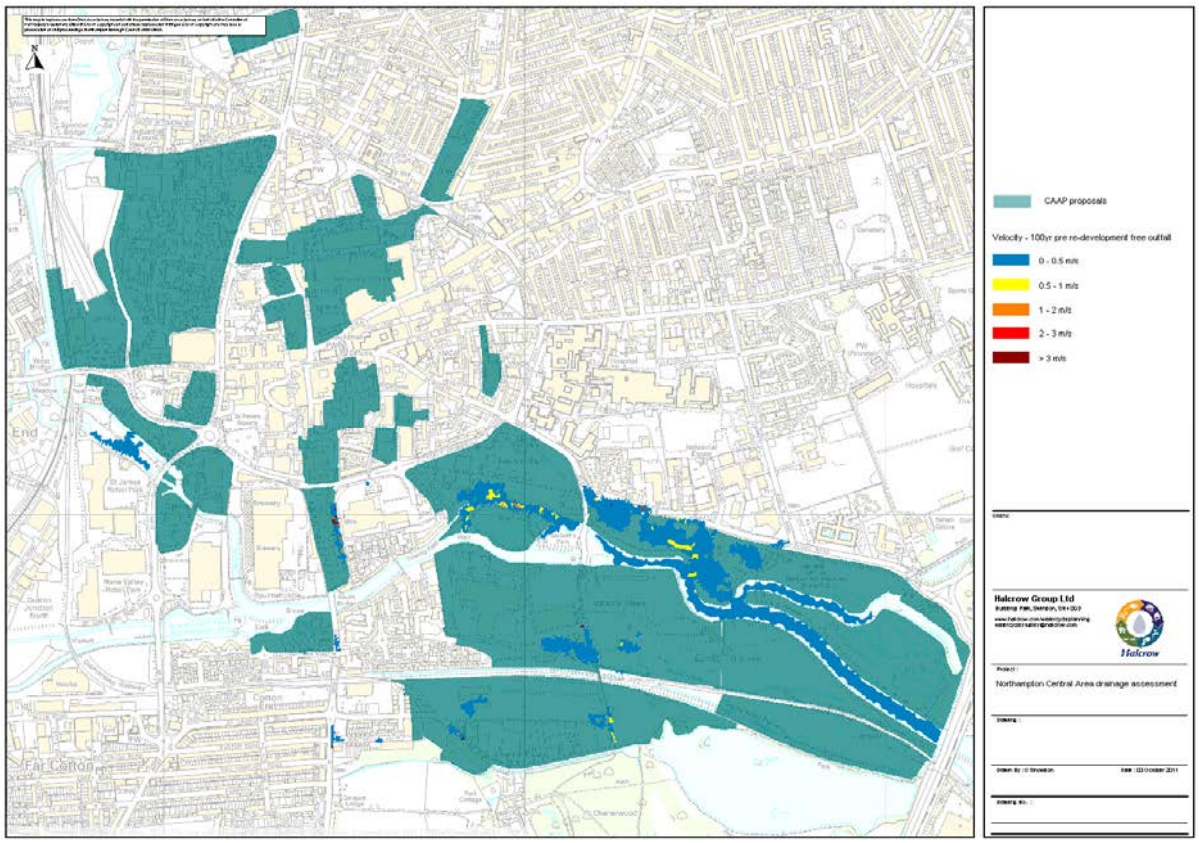

Figure 4-8 Surface water peak event velocity: 100 year free outfall – pre-redevelopment

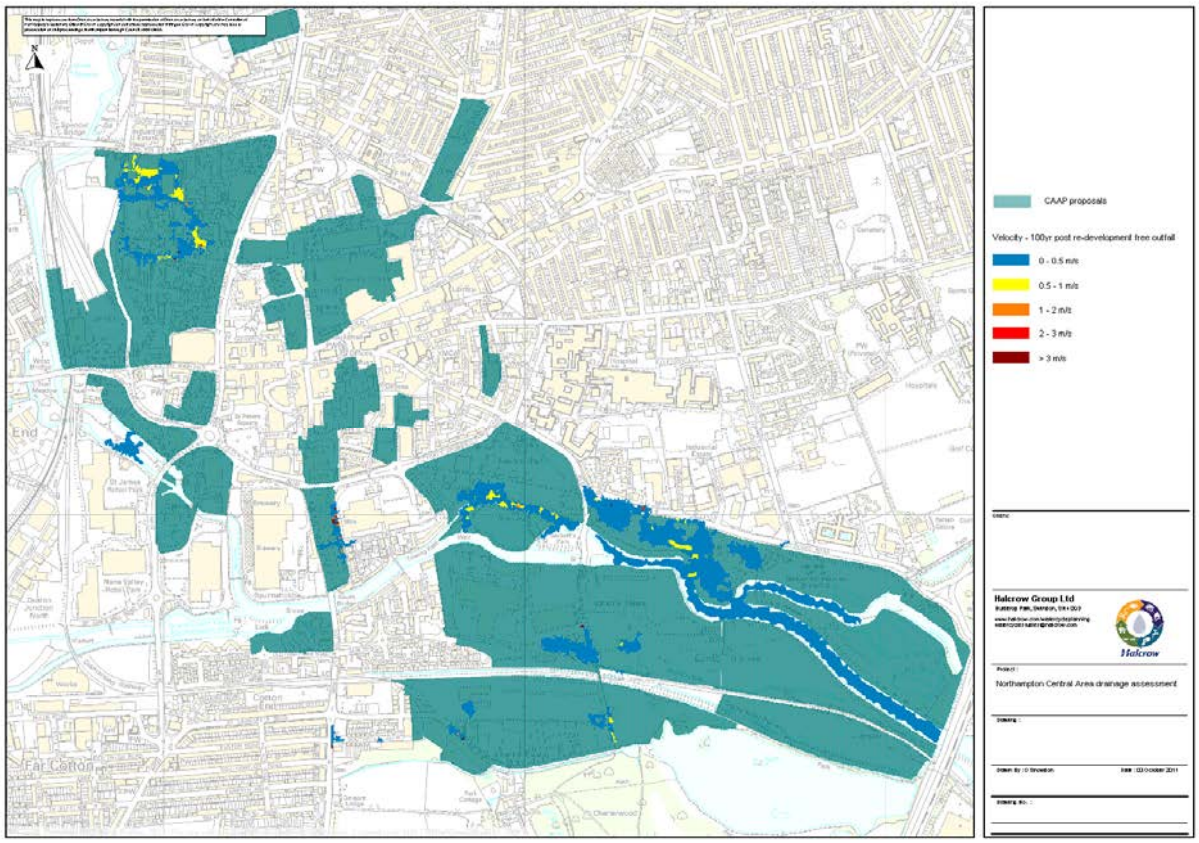

Figure 4-9 Surface water peak event velocity: 100 year free outfall – post-redevelopment

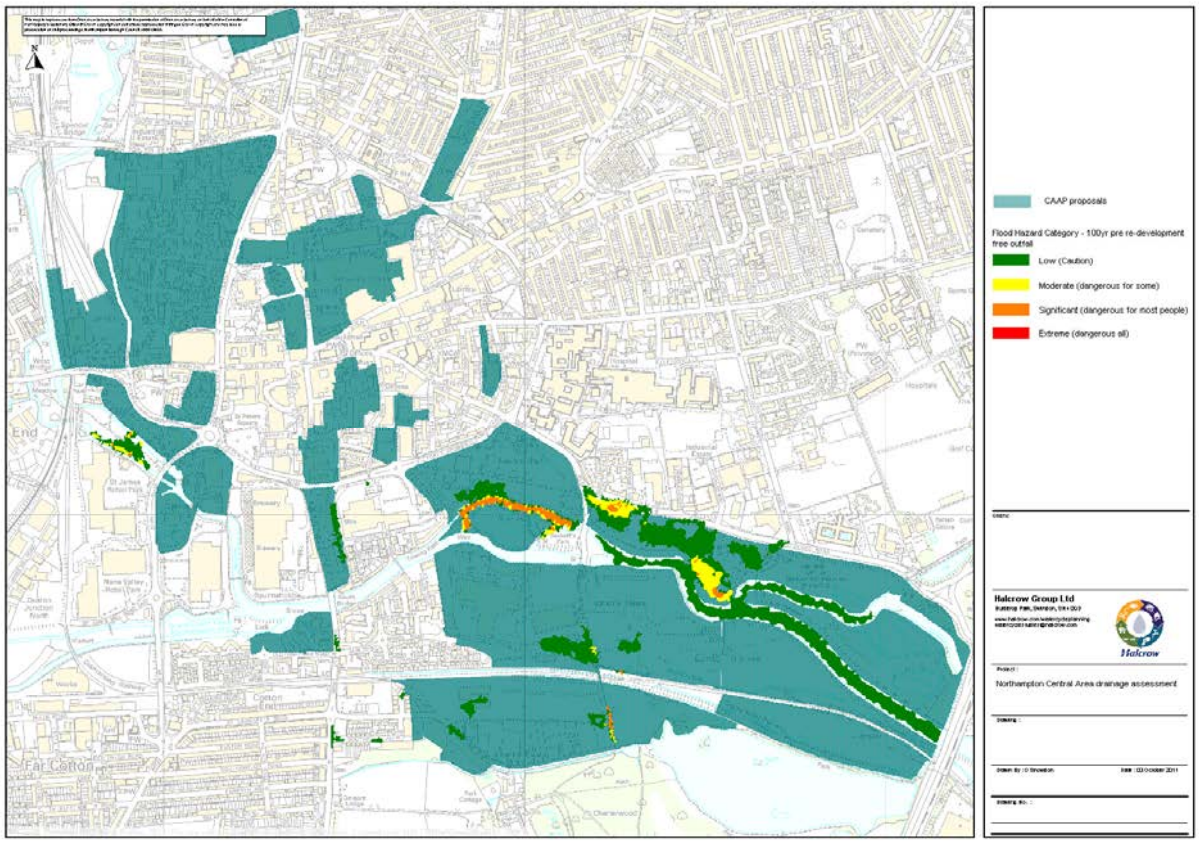

Figure 4-10 Surface water Defra flood hazard: 100 year free outfall – pre-redevelopment

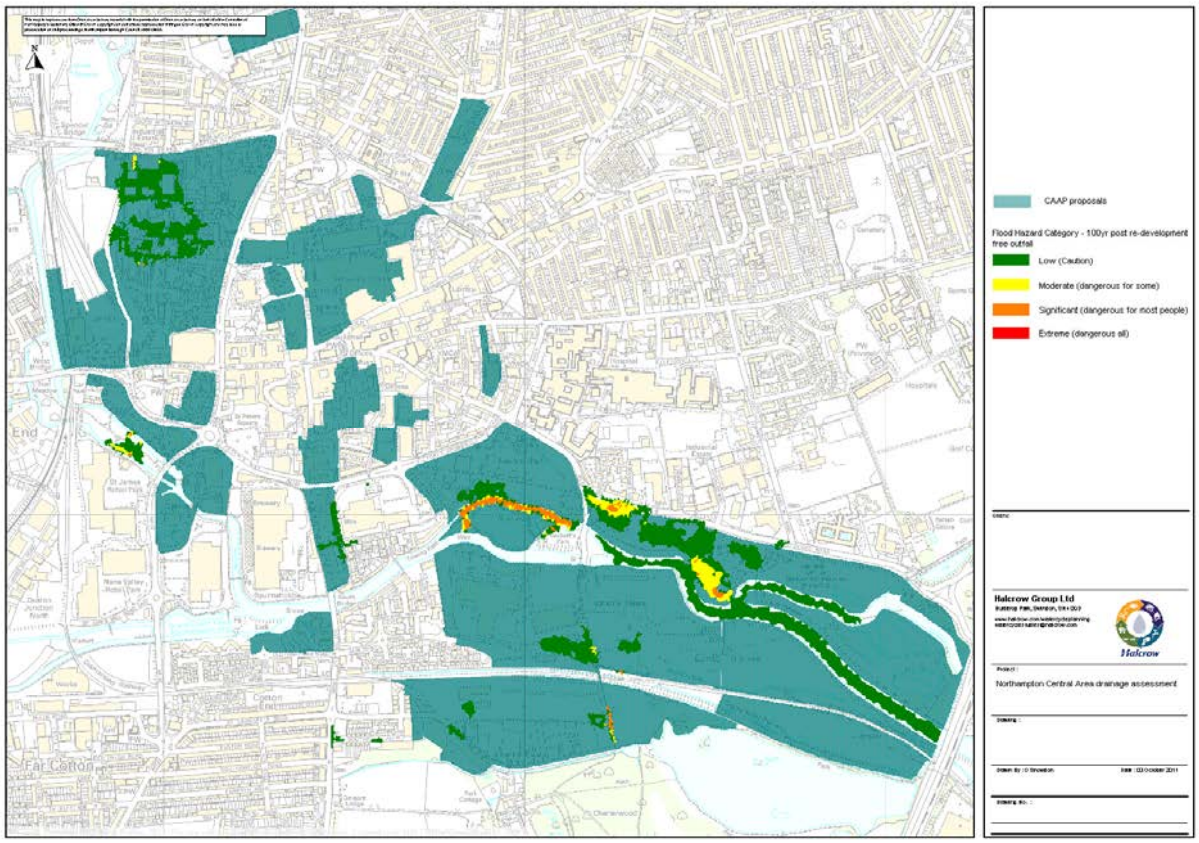

Figure 4-11 Surface water Defra flood hazard: 100 year free outfall – post-redevelopment

This analysis indicates that for the 100 year rainfall events, the existing surface water network is not capable of managing the rainfall that falls on the urban extent of the CAAP proposals.

The proposals particularly affected are Spring Boroughs, Bridge Street and the waterside proposals.

200 year rainfall return period, high river level (0.5% annual exceedance probability) results

The eight maps below all relate to the 200 year rainfall return period, high river scenario, and are presented in the following order:

1. Maximum surface water depth, pre-redevelopment
2. Maximum surface water flood extent, pre-development
3. Maximum surface water depth, post-redevelopment
4. Maximum surface water flood extent, post-redevelopment
5. Maximum surface water velocity, pre-redevelopment
6. Maximum surface water velocity, post-redevelopment
7. Surface water flooding Defra hazard score, pre-redevelopment
8. Surface water flooding Defra hazard score, post-redevelopment

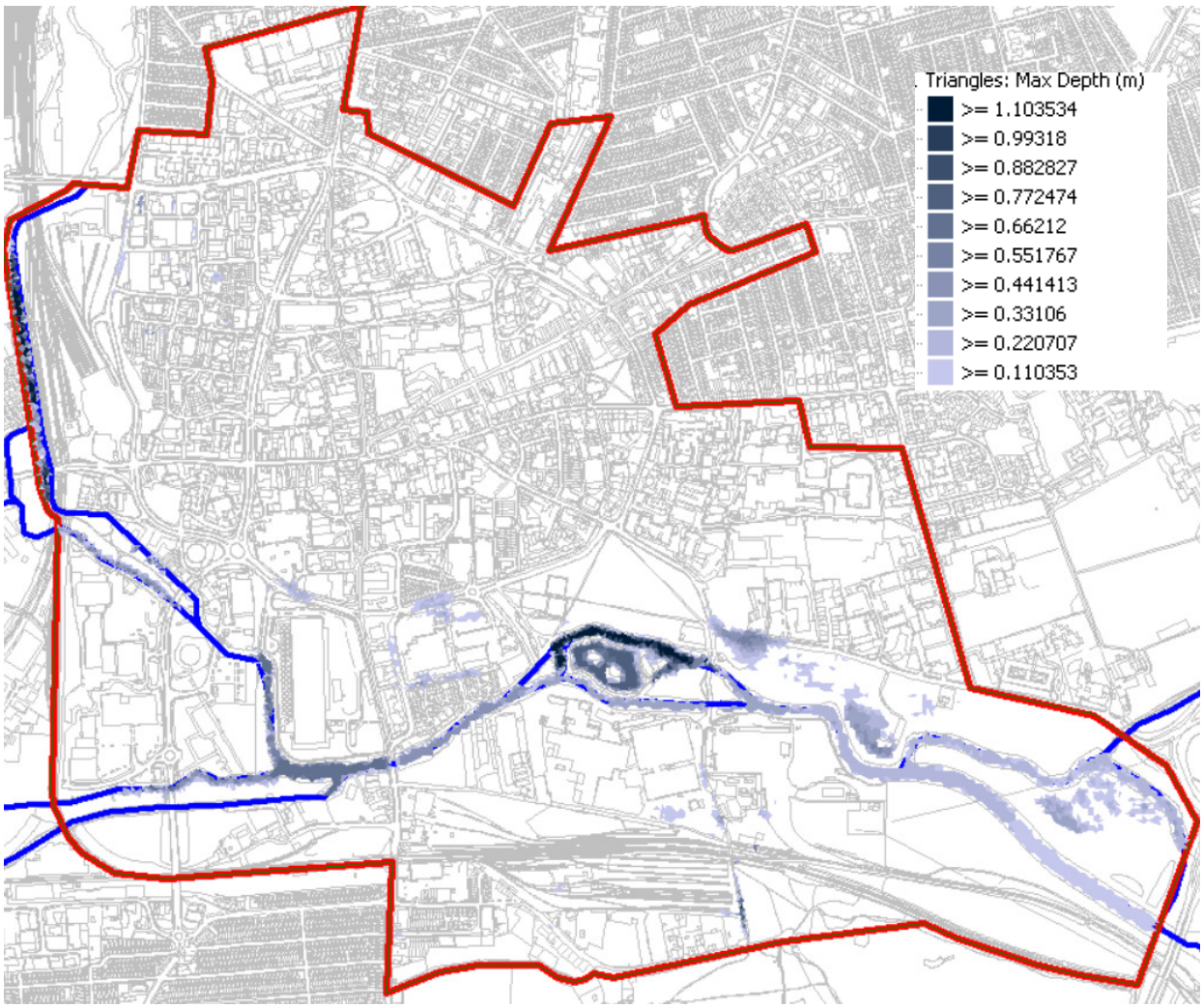

Figure 4-12 Peak surface water flood depth, 200 year rainfall return period, high river levels pre-redevelopment

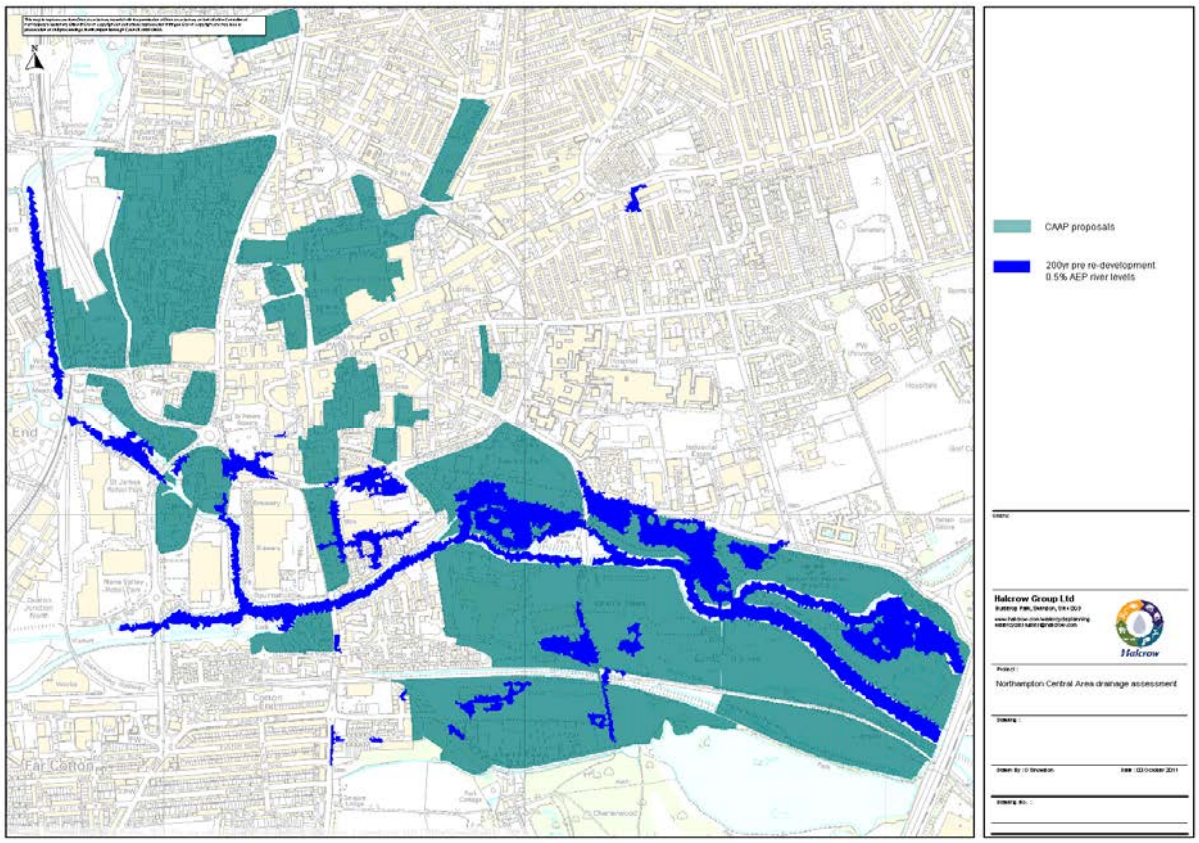

Figure 4-13 Peak surface water flood extent, 200 year rainfall return period, high river levels pre-redevelopment

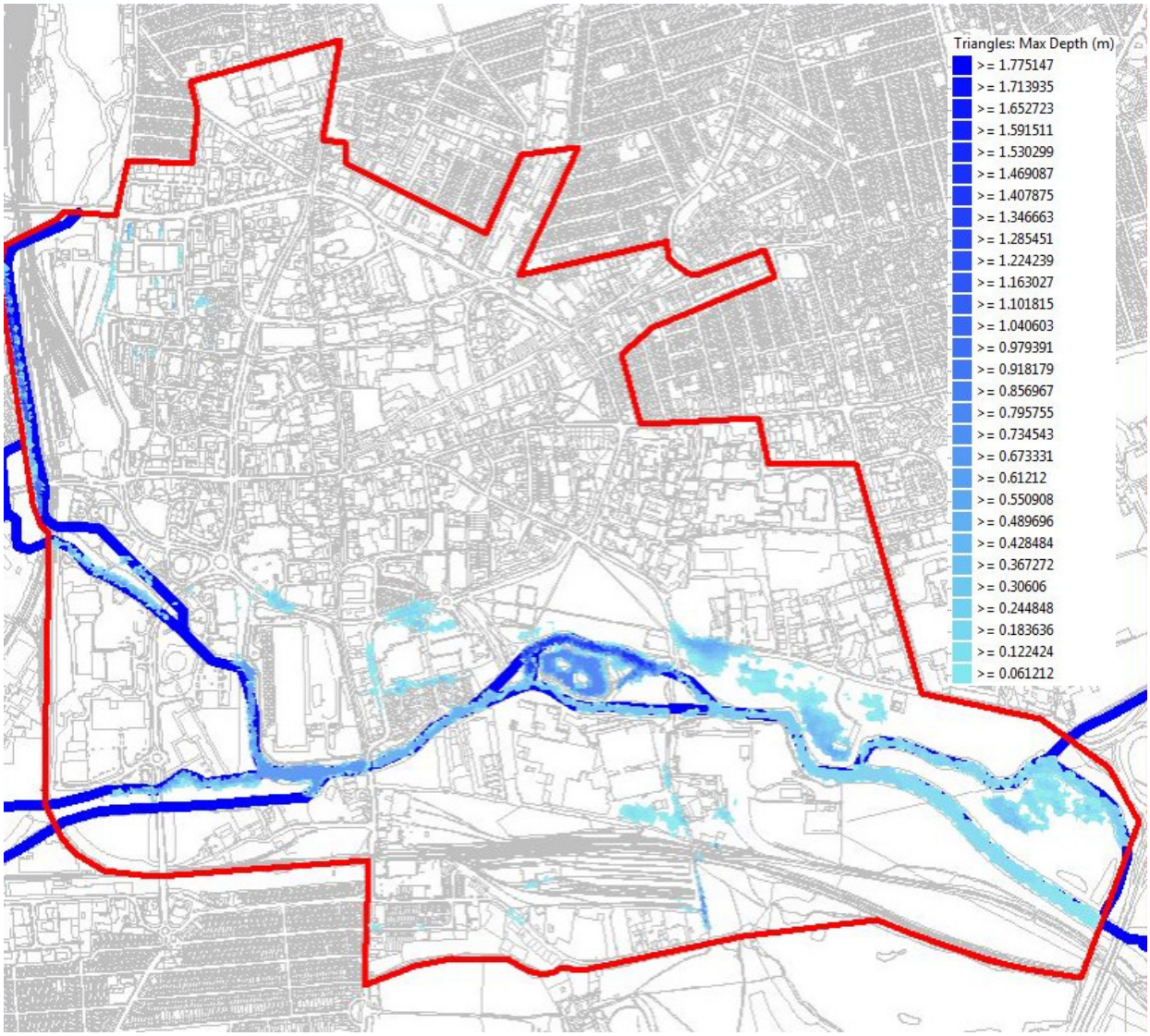

Figure 4-14 Peak surface water flood depth, 200 year rainfall return period, high river levels post-redevelopment

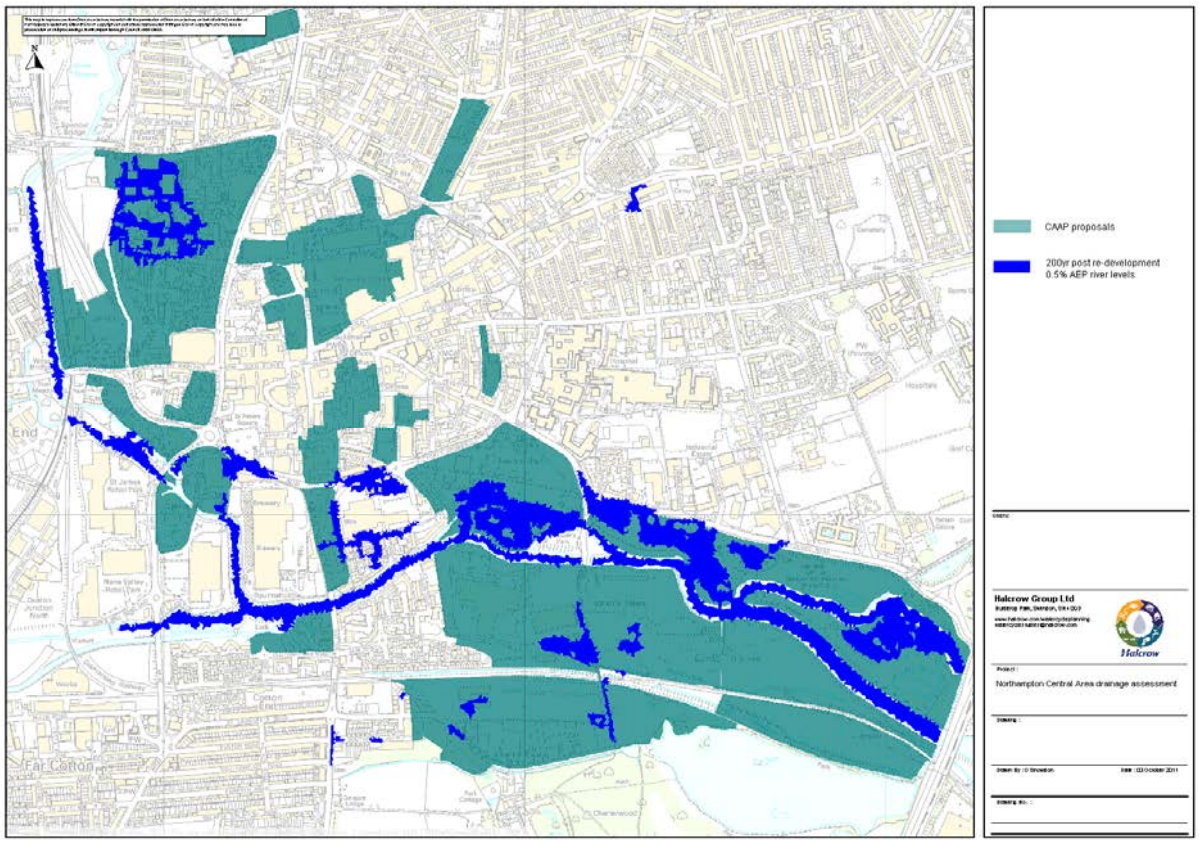

Figure 4-15 Peak surface water flood extent, 200 year rainfall return period, high river levels post-redevelopment

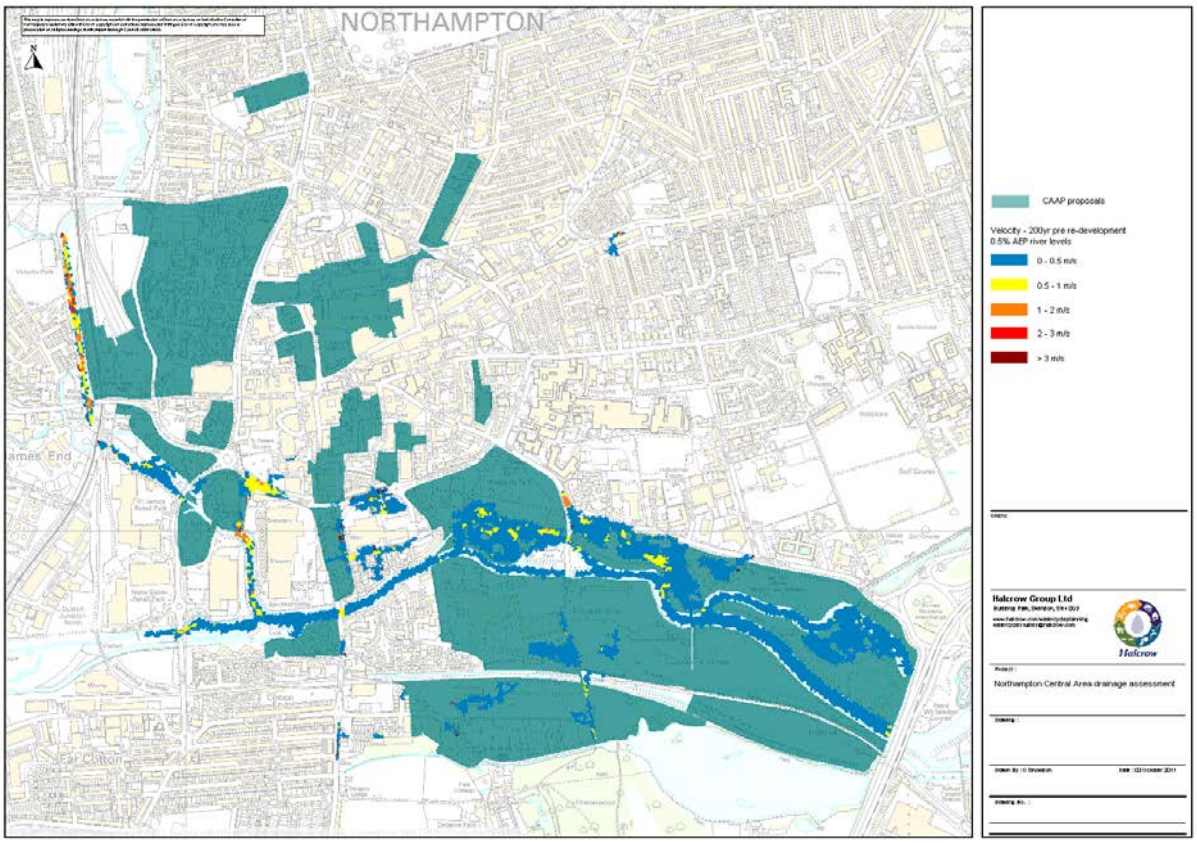

Figure 4-16 Peak surface water flood velocity, 200 year rainfall return period, high river levels post-redevelopment

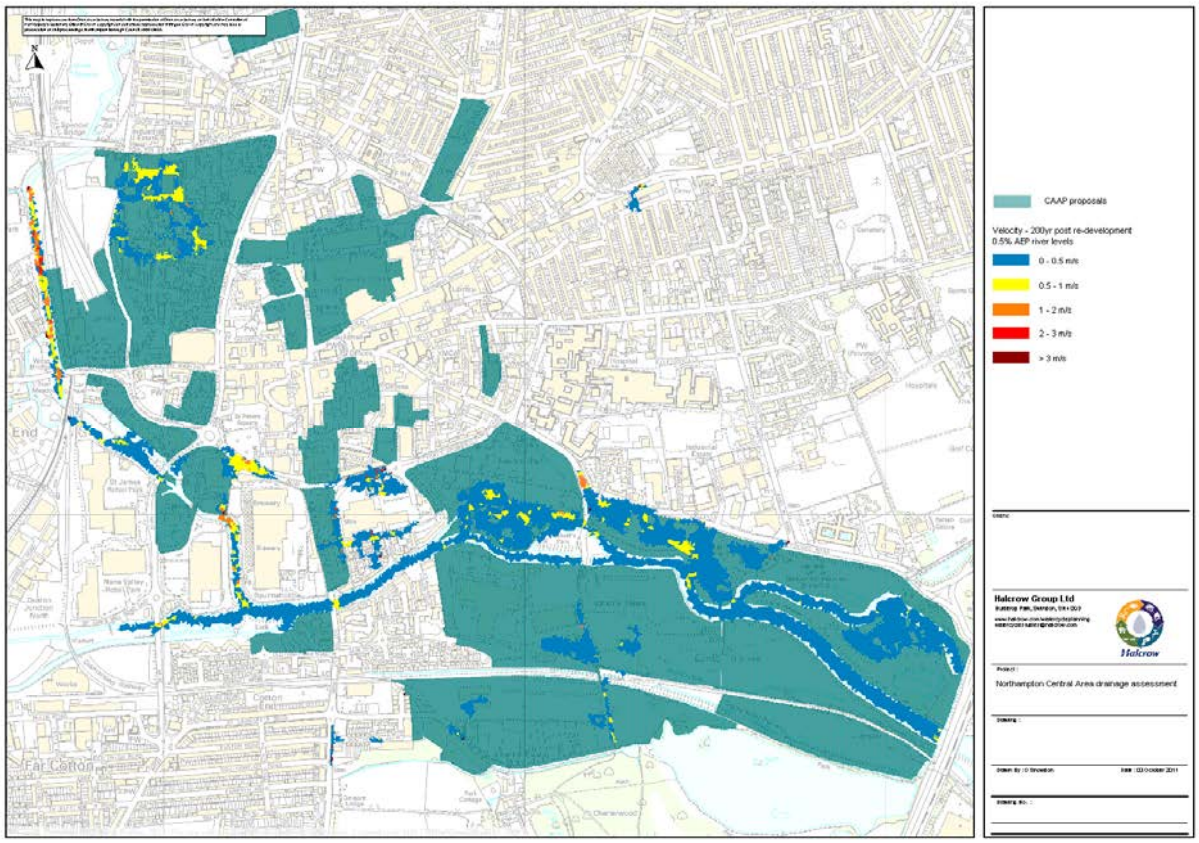

Figure 4-17 Peak surface water flood velocity, 200 year rainfall return period, high river levels post-redevelopment

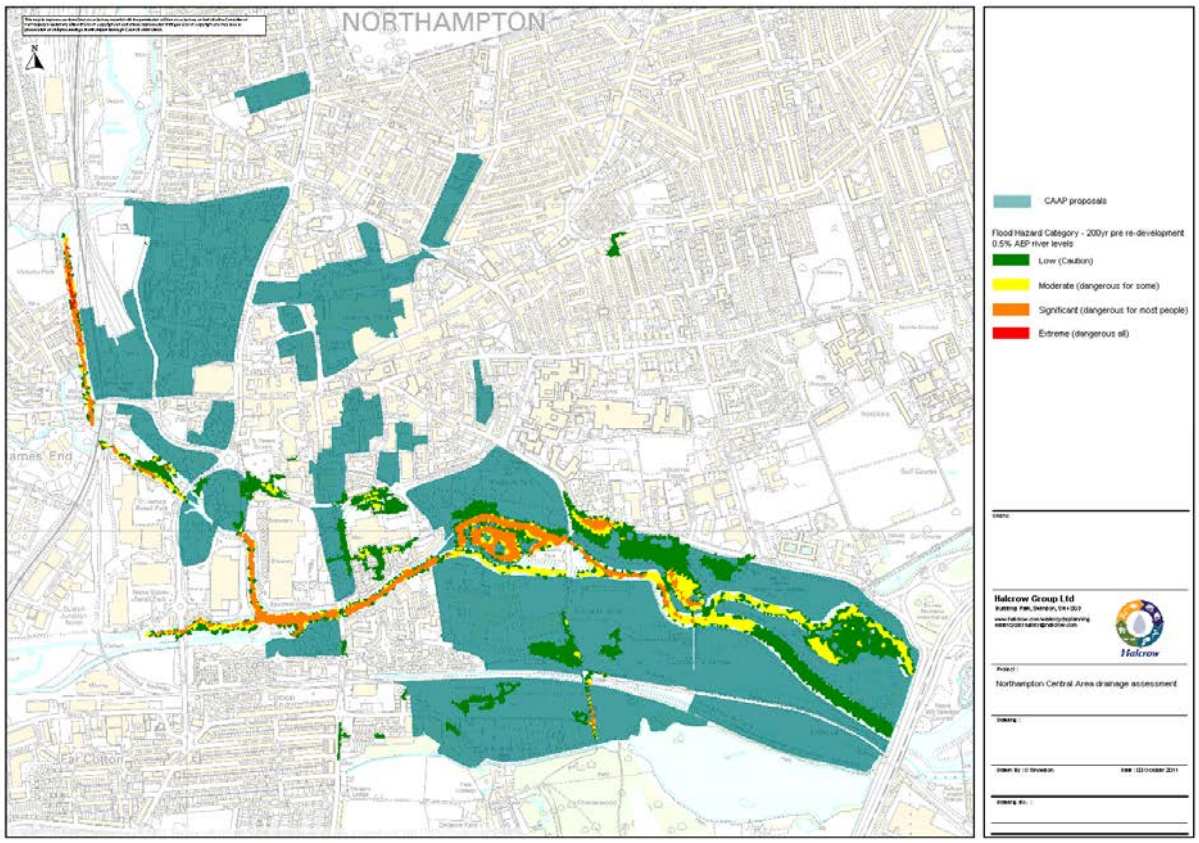

Figure 4-18 Peak surface water Defra flood hazard, 200 year rainfall return period, high river levels pre-redevelopment

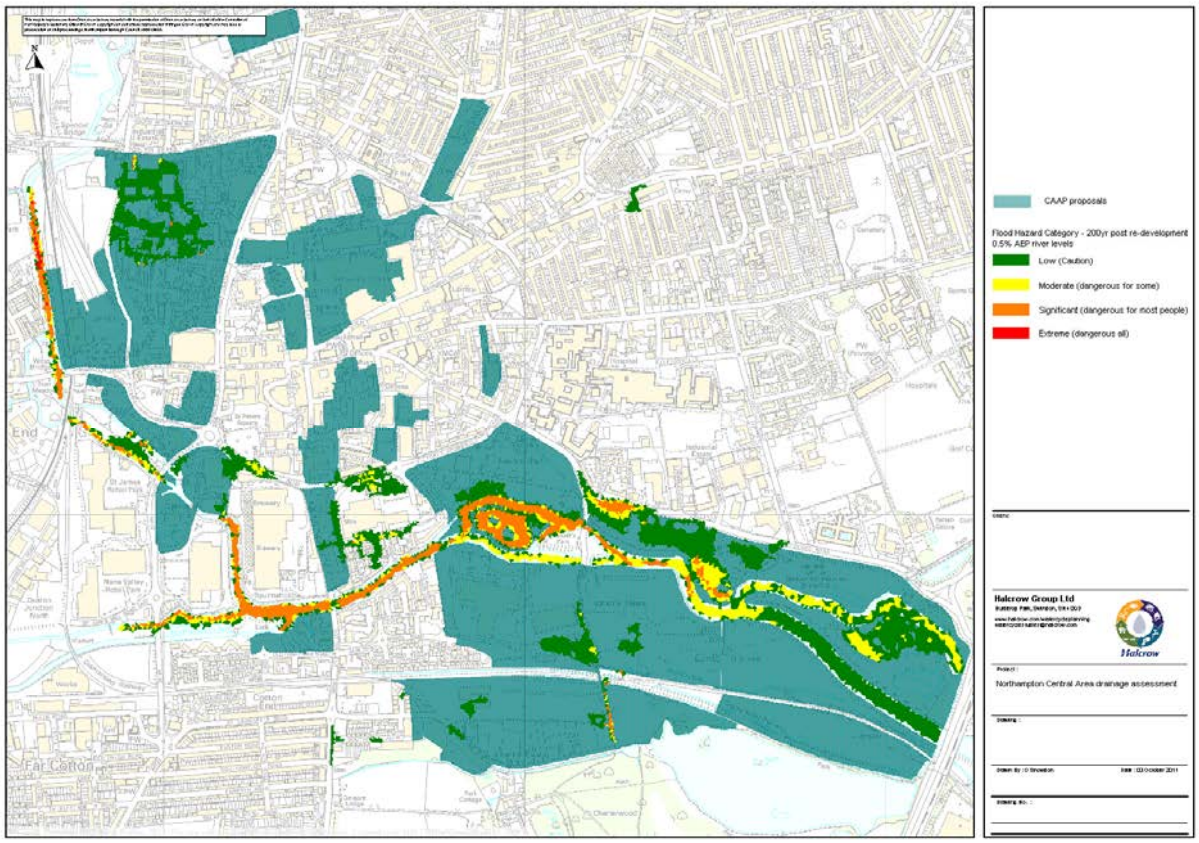

Figure 4-19 Peak surface water Defra flood hazard, 200 year rainfall return period, high river levels post-redevelopment

This analysis indicates that for the most extreme 200 year rainfall events, the existing surface water network is not capable of managing the rainfall that falls on the urban extent of the CAAP proposals.

Whilst there are some extensive areas at risk of surface water flooding, the modelled change in drainage strategy has minimal impact on the risk.

The proposals particularly affected by surface water flood risk are Spring Boroughs, Bridge Street and the waterside proposals. Of these, only Spring Boroughs shows a change in risk caused by the proposal itself.

There are areas of low and moderate hazard at St Peter's way North of the brewery, at Victoria Promenade south of Victoria Gardens, and to the East of Bridge Street along Auctioneers way.

There is only one area of significant risk that occurs outside of a river floodplain, and that is at the junction of Bedford Road and Avon Nunn Mills Ransome Road Road, in the north west extent of the Waterside: Nene Meadows proposal.

Chapter 5 considers recommendations for Spring Boroughs and the waterside proposals to ensure that the risk of surface water exceedance flooding is managed through masterplanning and the design of the drainage system serving these proposals.

5 Conclusions and recommendations

This chapter summarises the key conclusions of the CAAP drainage assessment, provides some CAAP wide recommendations that should be adhered to, proposes drainage standards that CAAP proposals should designed in accordance with, and finally provides some proposal specific recommendations.

5.1 Conclusions

Based on the 'worst case' modelling assessment presented above, we can draw the following key conclusions:

Removal of surface water from the foul/combined system

The removal of surface water from the foul and combined system where practicable is a priority. The modelling has tested a number of proposals where redevelopment and remodelling of the urban landscape should allow the removal of surface water from the combined system. Should it be possible to remove surface water in these locations, the CAAP proposals will not have any impact on strategic wastewater network capacity or on river water quality caused by combined sewer overflows. Small scale local improvements to the wastewater network are still likely to be required, but these are a matter for negotiation between Anglian Water and the proposal developers.

Potential impact on surface water flooding

The removal of surface water from the foul system and the transfer of this to the surface water sewer system have been undertaken as a modelling exercise, and to determine the worst case impact on river and surface water flood risk if no mitigation is provided. The modelling has identified that there are existing areas of surface water flood risk prior to any redevelopment. Unmitigated development exacerbates this risk, but not significantly.

The existing surface water system has not been designed for the conveyance of extreme rainfall events, and it is not good practice to manage extreme rainfall events through positive below ground drainage systems. Therefore, wherever practicable, source control will be required on individual proposals to mitigate extreme rainfall events, and flow exceedance pathways will need to be protected and managed. The application of the CAAP drainage standards identified in Section 5.2 will ensure that proposals meet the standards required to mitigate the impacts identified by this modelling process. The site specific recommendations in Section 5.3 identify those locations where we believe that site specific source control measures will be appropriate.

The density of development and proposal specifics within the CAAP area means that it unlikely to be practicable to provide source control in every proposal. Where this is the case, attenuation storage will need to be provided in the proposal. Irrespective of how well a drainage system is designed, there will always be a possibility of a rainfall event occurring that exceeds the design. Therefore, managed exceedance flow routes for above ground conveyance will need to be identified and protected. If managed exceedance flow routes change the speed at which the exceedance flow reaches the river, the potential impact on the peak flows in the river may need to be mitigated through the provision of strategic attenuation storage in downstream proposals. The site specific recommendations in Section 5.3 identify those locations where we believe that there are opportunities within proposals to provide strategic storage solutions.

Potential impact on river flooding

As stated above, the removal of surface water from the foul system and the transfer of this to the surface water sewer system have been undertaken as a modelling exercise, and to determine the worst case impact on river and surface water flood risk if no mitigation is provided. The results of the modelling show that the direct transfer of surface water from the combined / foul sewer to the surface water sewer significantly increases the volume of surface water being discharged in the two reaches of the Brampton Branch of the River Nene. Therefore, mitigation will need to be provided to ensure that this additional volume will not increase flood risk in these catchments. Wherever practicable this mitigation will need to be provided as source control or surface water storage on individual proposals. The application of the CAAP drainage standards identified in Section 5.2 will ensure that proposals meet the standards required to mitigate the impacts identified by this modelling process. The site specific recommendations in Section 5.3 identify those locations where we believe that site specific source control or storage solutions will be appropriate.

The density of development and proposal specifics within the CAAP area means that it is unlikely to be practicable to provide source control in every proposal. Where this is the case, attenuation storage will need to be provided in the proposal, or managed exceedance flow routes for above ground conveyance will need to be considered. If managed exceedance flow routes are required, the additional impact on the peak flows in the river will need to be mitigated through the provision of strategic attenuation storage in downstream proposals. The site specific recommendations in Section 5.3 identify those locations where we believe that there are opportunities within proposals to provide strategic storage solutions.

Based on the results of the worst case modelling undertaken, if no site specific source control or storage measures can be identified, and assuming that all surface water generated is conveyed to the identified river reach, the total volume of strategic storage required by river reach is presented in Tables 5.1 and 5.2 below.

Table 5-1 Strategic storage requirements 100 year return period low river levels

Rive reach	Total surface water flood volume post redevelopment (m3)	Change in surface water flood volume from CAAP proposals (m3)	Increase in surface water discharge to river (m3)	Total strategic storage volume required to mitigate CAAP proposals (m3)	Total strategic storage volume required to remove surface water flood risk (m3)
Brampton Branch 1	549	549	5407	5956	5956
Brampton Branch 2	3	0	3661	3661	3664
River Nene	6247	-248	-1346	-1594	4901

Table 5-2 Strategic storage requirements 200 year return period high river levels

River reach	Total surface water flood volume post redevelopment (m3)	Change in surface water flood volume from CAAP proposals (m3)	Increase in surface water discharge to river (m3)	Total strategic storage volume required to mitigate CAAP proposals (m3)	Total strategic storage volume required to remove surface water flood risk (m3)
Brampton Branch 1	769	752	1095	1847	1864
Brampton Branch 2	102	8	3721	3729	3823
River Nene	20804	-630	-2450	-3080	18354

5.2 General recommendations

Drainage masterplanning

It is critical that SUDS masterplanning, including the identification of opportunities for source control measures, is considered at the very earliest stages of development. Therefore we recommend that developers request pre-application discussions with the appropriate drainage authority (EA for main river, Anglian Water for connection to the AWS artificial drainage system, and Northampton Borough Council for all other drainage routes). Northamptonshire County Borough Council as the Lead Local Flood Authority will be responsible for approving all SUDS plans, therefore we recommend that that NBC undertake a coordinating role in pre-application discussions.

Designing for exceedance

Any developer should consider the possibility that their design for surface water may fail and as such should design a backup plan. Overland floodwater should be routed away from vulnerable areas. For acceptable depths and rates of flow, please refer to FD2320/TR2 'Flood Risk Assessment Guidance for New Development Phase 2'.

Northampton standards of protection

Following the significant flooding to Northampton town centre in Easter 1998 improvements were made to the defences along the River Nene. In order to secure the level of protection afforded by the new defence the Environment Agency have agreed with the West Northants Joint Planning Unit that the standards set for new development should also be improved, beyond that required by PPS25. Therefore all new development in the Upper Nene catchment should be designed for a flood with a 0.5% probability (1 in 200 chance) occurring in any year, including an appropriate allowance for climate change. This includes design of mitigation for main river flooding and any surface water attenuation. This applies across the whole of the Upper Nene catchment including all branches and arms of the Nene, upstream of Billing Aquadrome, and all tributaries such as Wootton Brook, Dallington Brook and Bugbrooke Brook. If the outfall of the attenuation facility is likely to be submerged in 0.5% (1 in 200 chance) rainfall event then within 24 hours of top water level being attained in a 0.5% (1 in 200) probability flood event the regulation facility must be capable of storing 80% of the additional run-off arising from a 10% (1 in 10) probability flood. The Northampton CAAP standards in the following section therefore include a requirement to achieve 1 in 200 standards.

5.3 Proposed CAAP Drainage standards

5.3.1 Runoff receptors

The following receptors must be considered for surface runoff in order of preference:

1. Discharge by infiltration into the ground[5]
2. Discharge to an open surface water body
3. Discharge to a surface water sewer
4. Discharge to a combined sewer

Discharge to a foul sewer will not be permitted, and discharge to combined sewer will only be permitted if:

- there are no other practicable options for discharge of surface water runoff, and
- it can be demonstrated that there will be no increase in the frequency or volume of discharge from intermittent storm discharges, or any increase in foul flooding downstream of the development site.

5.3.2 Peak flow rate and volume standards

There should be no discharge from the first 5mm of any rainfall event. Green roofs and permeable surfaces will be considered to discharge this requirement for roof and road runoff without further analysis. If these options are not applied, the developers site FRA should demonstrate how the first 5mm of rainfall will be retained on site.

5.3.3 Volume restrictions

The volume of runoff must not be greater than the greenfield runoff for the 1 in 200 year, 6 hour rainfall event.

5.3.4 Peak flow restriction

The peak flow rate discharged must not be greater than greenfield runoff rate for the:

1 in 1 year rainfall event;

1 in 30 year rainfall event;

1 in 100 year rainfall event;

1 in 200 year rainfall event;

1 in 200 year + climate change

[5] Although the impact assessment has identified that opportunities for large scale infiltration to ground is unlikely to be feasible in the Central Area, multiple small scale source control measures, such as rain gardens, can be explored.

In complying with the peak flow rate above the critical duration rainfall event for the site drainage must be used in determining the maximum storage volume.

If the above is not practicable due to site restrictions, the approach adopted should be as close as practicable. Where the above rules are not practicable, the peak flow rate to the surface water sewer, river or combined sewer should not exceed the peak flow prior to development for a 1 in 200, 1 in 100, 1 in 30 and 1 in 1 year event, and the volume discharged must not exceed that prior to development. The pre development peak flow rates will need to be calculated by the proposal site developer, and agreed with the appropriate regulatory authority (either the Lead Local Flood Authority (SAB approval body) or the Environment Agency) for discharge to non water company asset, and Anglian Water Services for existing discharges to water company assets.

5.4 Proposal specific recommendations

5.4.1 Brampton Branch 1 - Brampton Branch upstream of A4500 road bridge

Table 5-3 Site specific recommendations for Spring Boroughs

Spring Boroughs
Any future redevelopment will need to ensure that plans for surface water management follow the destination of drainage hierarchy as described in Section 5.2. The proximity of this site to the Brampton Branch of the River Nene, plus the existence of surface water sewers within the proposal that drain west into the Brampton Branch indicate that it is feasible to discharge surface water runoff into the Brampton Branch. Therefore surface water drainage from any redevelopment will not be permitted to connect to the foul/combined system. The impact of additional drainage area on the Brampton Branch should be mitigated through source control or on site SUDS, which should comply with the CAAP SUDS Standards, and that are fully compliant with any forthcoming national standards. The significant redevelopment of this proposal and remodelling of the urban landscape should provide sufficient opportunity to deliver SUDS solutions that provide significant gains with respect to rainfall runoff management. Developers will need to develop a site specific Flood Risk Assessment (FRA) and drainage strategy that provides sufficient surface water management capacity to allow for the removal of all rainfall runoff from the foul / combined system. The FRA and drainage strategy will need to detail all existing drainage systems within the proposal, both private and public, and show how their proposed drainage strategy makes best use of existing infrastructure. Developers will need to demonstrate compliance with the CAAP standards, and to show substantial betterment with respect to total discharge rates from the proposal for the 1, 30, 100 and 200 year events. Attenuation will be required for a minimum area of 4.17ha (the area which is to be disconnected from the foul/combined sewer) assuming that the rest of the site continues to drain to the surface water sewer. It should be noted however that the drainage hierarchy should be followed and every opportunity should be taken to redirect drainage from the whole of the site to the watercourse which would require additional attenuation. It should be assumed that any attenuation will be provided within the proposal boundary. However, where this is not feasible, Northampton borough Council are currently undertaking a further assessment to identify possible options for strategic attenuation storage. Drainage from the southern section of the site may require new surface water disposal route to the Brampton Branch. Consideration should be given to possible drainage routes through Castle Station land, and the planning authority may wish to ensure that suitable provision for drainage easements exist when considering any plans for Castle Station. The removal of surface water from the foul/combined sewer in this proposal capacity for additional foul water in other proposals, therefore the timing of development and of surface water removal must be planned alongside the delivery of other proposals. We recommend that developers also refer to the Northampton Level 2 Strategic Flood Risk Assessment for further site specific recommendations.

Table 5-4 Site specific recommendations for Castle Station

Castle Station
Any future redevelopment will need to ensure that plans for surface water management follow the destination of drainage hierarchy as described in Section 5.2. The proximity of this site to the Brampton Branch of the River Nene indicates that it is feasible to discharge surface water runoff into the Brampton Branch. Therefore surface water drainage from any redevelopment will not be permitted to connect to the foul/combined system. There is only limited runoff from this proposal area currently discharging to the public sewer system, implying that existing site drainage is managed through a system in private ownership. It is likely this system is owned by Network Rail. The modelled development proposals do not increase the overall area generating runoff. However, there is a large proposed increase in population, therefore the proposed removal of surface water from the foul/combined system is a prerequisite for ensuring there is foul drainage capacity available for the increase in population. In addition, the capacity created by the removal of surface water from the combined system in Spring Boroughs will be required, therefore the phasing of this development should be considered alongside the phasing of Spring Boroughs. The remodelling of the public areas around Castle Station will allow opportunities for source control and rainfall runoff management Developers will need to develop a site specific Flood Risk Assessment (FRA) and drainage strategy that provides sufficient surface water management capacity to allow for the removal of all rainfall runoff from the foul / combined system. The FRA and drainage strategy will need to detail all existing drainage systems within the proposal, both private and public. Our initial assessment indicates that a substantial area of the proposal may be drained by a private drainage system, therefore developers will need to ensure that they fully understand the existing infrastructure, and have the appropriate permissions before developing their strategy. Developers will need to demonstrate compliance with the CAAP standards, and to show substantial betterment with respect to total discharge rates from the proposal for the 1, 30, 100 and 200 year events. Drainage from the southern section of Spring Boroughs may require a new surface water disposal route to the Brampton Branch through this proposal. Consideration should be given to possible drainage routes through Castle Station land, and the planning authority may wish to ensure that suitable provision for drainage easements exist when considering any plans for Castle Station. We recommend that developers also refer to the Northampton Level 2 Strategic Flood Risk Assessment for further site specific recommendations.

5.4.2 Brampton Branch 2 - Sites that drain to Brampton Branch downstream of the A4500 road bridge, upstream of the confluence with River Nene at South Bridge

Table 5-5 Site specific recommendations for Freeschool Street

Freeschool Street
Any future redevelopment will need to ensure that plans for surface water management follow the destination of drainage hierarchy as described in Section 5.2. The proximity of this site to existing surface water sewers indicates that it is feasible to discharge surface water runoff into the Brampton Branch. Therefore surface water drainage from any redevelopment will not be permitted to connect to the foul/combined system. The impact of additional drainage area draining to the Brampton Branch (from the removal of surface drainage area from the foul/combined system) should be mitigated through source control or on site SUDS, which should comply with the CAAP SUDS Standards, and that are fully compliant with any forthcoming national standards. Developers will need to develop a site specific Flood Risk Assessment and drainage strategy that provides sufficient surface water management capacity to allow for the removal of all rainfall runoff from the foul / combined system. Developers will need to demonstrate compliance with the CAAP standards, and to show substantial betterment with respect to total discharge rates from the proposal for the 1 in 1, 30, 100 and 200 year events. Attenuation will be required for a minimum area of 0.73ha (the area which is to be disconnected from the foul/combined sewer) assuming that the rest of the site continues to drain through existing drainage routes. It should be noted however that the drainage hierarchy should be followed and every opportunity should be taken to redirect drainage from the whole of the site to the watercourse which would require additional attenuation. It should be assumed that any attenuation will be provided within the proposal boundary. However, where this is not feasible, Northampton borough Council are currently undertaking a further assessment to identify possible options for strategic attenuation storage. Where there are contamination issues arising from the gas holders on this site, control of water quality through a designed SUDS treatment train must be provided. An Environmental Permit may be required for discharge into the River Nene at the outfall of the surface water sewer, if a SUDS treatment system is used to control the quality of potentially contaminated surface water drainage. The requirement for a treatment train may require additional SUDS features may require additional land take, and this must considered in any FRA and drainage assessments prepared for the site. We recommend that developers also refer to the Northampton Level 2 Strategic Flood Risk Assessment for further site specific recommendations.

Table 5-6 Site specific recommendations for the Former Fish Market

Former Fish Market
Any future redevelopment will need to ensure that plans for surface water management follow the destination of drainage hierarchy as described in Section 5.2. The proximity of this site to existing surface water sewers indicates that it is feasible to discharge surface water runoff into the Brampton Branch. Therefore surface water drainage from any redevelopment will not be permitted to connect to the foul/combined system. The impact of additional drainage area on the Brampton Branch should be mitigated wherever possible through source control, which should include measures in the public realm or other open space. Developers will need to develop a site specific Flood Risk Assessment and drainage strategy that provides sufficient surface water management capacity to allow for the removal of all rainfall runoff from the foul / combined system. Developers will need to demonstrate compliance with the CAAP standards, and to show substantial betterment with respect to total discharge rates from the proposal for the 1 in 1, 30, 100 and 200 year events. Attenuation will be required for a minimum area of 0.33ha (the area which is to be disconnected from the foul/combined sewer) assuming that the rest of the site continues to drain through existing drainage routes. It should be noted however that the drainage hierarchy should be followed and every opportunity should be taken to redirect drainage from the whole of the site to the watercourse which would require additional attenuation. It should be assumed that any attenuation will be provided within the proposal boundary. However, where this is not feasible, Northampton borough Council are currently undertaking a further assessment to identify possible options for strategic attenuation storage. Redevelopment would normally provide an opportunity for greening of the space. However, the constrained nature of the site, and the lack of natural drainage routes indicate there are limited options for natural drainage. Therefore, source control measures that provide greenspace should be considered for any major structural change to retail space. Greenroofs are a good example of source control that provides greenspace. Rain gardens should be considered for any changes to roads or rights of way drainage prior to discharge to the surface system. If open space and space for above ground SUDS is constrained, as is currently predicted, below ground storage may be appropriate to control overall discharge rate to the surface water sewer to as close as practicable to the existing discharge rate to SWS for the 1 in 1, 30, 100 and 200 year events. We recommend that developers also refer to the Northampton Level 2 Strategic Flood Risk Assessment for further site specific recommendations.

Table 5-7 Site specific recommendations for the Grosvenor Centre

The Grosvenor Centre
The proposals primarily relate to remodelling of retail space, which might provide only minor opportunities for improving surface water management. However, any future redevelopment will need to ensure that plans for surface water management follow the destination of drainage hierarchy as described in Section 5.2. The proximity of this site to existing surface water sewers indicates that it is feasible to discharge surface water runoff into the Brampton Branch. Therefore surface water drainage from any redevelopment will not be permitted to connect to the foul/combined system. The impact of additional drainage area on the Brampton Branch should be mitigated wherever possible through source control in open space or the public realm. The FRA and drainage strategy will need to detail all existing drainage systems within the proposal, both private and public. Our initial assessment indicates that part of the proposal may be drained by a private drainage system, therefore developers will need to ensure that they fully understand the existing infrastructure, and have the appropriate permissions before developing their strategy. Developers will need to demonstrate compliance with the CAAP standards, and to show substantial betterment with respect to total discharge rates from the proposal for the 1, 30, 100 and 200 year events. Attenuation will be required for a minimum area of 1ha (the area which is to be disconnected from the foul/combined sewer) assuming that the rest of the site continues to drain through existing drainage. It should be noted however that the drainage hierarchy should be followed and every opportunity should be taken to redirect drainage from the whole of the site to the watercourse which would require additional attenuation. It should be assumed that any attenuation will be provided within the proposal boundary. However, where this is not feasible, Northampton borough Council are currently undertaking a further assessment to identify possible options for strategic attenuation storage. Redevelopment would normally provide an opportunity for greening of the space. However, the constrained nature of the site, and the lack of natural drainage routes indicate there are limited options for natural drainage. Therefore, source control measures that provide greenspace should be considered for any major structural change to retail space. Greenroofs are a good example of source control that provides greenspace. Rain gardens should be considered for any changes to roads or rights of way drainage prior to discharge to the surface system. If open space and space for above ground SUDS is constrained, as is currently predicted, below ground storage may be appropriate to control overall discharge rate to the surface water sewer to as close as practicable to the existing discharge rate to SWS for the 1 in 1, 30, 100 and 200 year events. We recommend that developers also refer to the Northampton Level 2 Strategic Flood Risk Assessment for further site specific recommendations.

Table 5-8 Site specific recommendations for the Waterside Development: Brampton Branch and St Peter's Way

Waterside development Brampton Branch and St Peter's Way
Any future redevelopment will need to ensure that plans for surface water management follow the destination of drainage hierarchy as described in Section 5.2. The whole of the site is in close proximity to the river system, therefore it should be feasible to discharge all surface water runoff from the proposal into the Brampton Branch, without needing to utilise public sewers. Therefore surface water drainage from any redevelopment will not be permitted to connect to the foul/combined system. Developers will need to develop a site specific Flood Risk Assessment (FRA) and drainage strategy that provides sufficient surface water management capacity to allow for the removal of all rainfall runoff from the foul / combined system. The FRA and drainage strategy will need to detail all existing drainage systems within the proposal, both private and public. Our initial assessment indicates that a substantial area of the proposal may be drained by a private drainage system, therefore developers will need to ensure that they fully understand the existing infrastructure, and have the appropriate permissions before developing their strategy. Developers will need to demonstrate compliance with the CAAP standards, and to show substantial betterment with respect to total discharge rates from the proposal for the 1, 30, 100 and 200 year events. If there is contamination relating to the previous use of the site, control of water quality through a designed SUDS treatment train should be allowed for when masterplanning the proposal. The significant proportion of the site proposed to be greenspace will provide enough land to ensure that an adequate treatment train can be provided, and that enough attenuation can be provided to ensure betterment of the existing situation. This proposal could potentially be used to provide a strategic solution to mitigate for all developments within this river catchment. The modelling indicates that a maximum strategic storage requirement of around 3,800 cubic metres would mitigate for the additional runoff in a 200 year high river level event in the Brampton Branch 2. If the additional runoff from Brampton Branch 1 is included, the maximum volume increases to approximately 5,700 cubic metres. We recommend that developers also refer to the Northampton Level 2 Strategic Flood Risk Assessment for further site specific recommendations.

5.4.3 Proposals that drain to the River Nene, downstream of the confluence with the Grand Union Canal (Nene 1)

Table 5-9 Site specific recommendations for Upper Mounts/Great Russell St

Upper Mounts/Great Russell Street
The proposal is already 100% hardstanding. Therefore there will be no increase in runoff area through the proposal. However, the proposed comprehensive redevelopment should offer substantial opportunity for improving existing surface water management from the proposal boundary. Developers will need to ensure that plans for surface water management follow the destination of drainage hierarchy as described in Section 5.2. The proximity of this site to existing surface water sewers indicates that it is feasible to discharge surface water runoff into the River Nene. Therefore surface water drainage from any redevelopment will not be permitted to connect to the foul/combined system. The impact of additional drainage area draining to the River Nene (from the removal of surface drainage area from the foul/combined system) should be mitigated through source control on or on site SUDS, which could include measures in the public realm or other open space. Developers will need to develop a site specific Flood Risk Assessment and drainage strategy that provides sufficient surface water management capacity to allow for the removal of all rainfall runoff from the foul / combined system. Developers will need to demonstrate compliance with the CAAP standards, and to show substantial betterment with respect to total discharge rates from the proposal for the 1 in 1, 30, 100 and 200 year events. Attenuation will be required for a minimum area of 1.97ha (the area which is to be disconnected from the foul/combined sewer) assuming that the rest of the site continues to drain through existing drainage routes. It should be noted however that the drainage hierarchy should be followed and every opportunity should be taken to redirect drainage from the whole of the site to the watercourse which would require additional attenuation. It should be assumed that any attenuation will be provided within the proposal boundary. However, where this is not feasible, Northampton borough Council are currently undertaking a further assessment to identify possible options for strategic attenuation storage. We recommend that developers also refer to the Northampton Level 2 Strategic Flood Risk Assessment for further site specific recommendations.

Table 5-10 Site specific recommendations for The Drapery

The Drapery
The proposals primarily relate to remodelling of retail space, which might provide only minor opportunities for improving surface water management. However, any future redevelopment will need to ensure that plans for surface water management follow the destination of drainage hierarchy as described in Section 5.2. The impact assessment modelling has identified that maintaining the existing drainage connection to combined sewer may be the only practicable option. Developers will need to develop a site specific Flood Risk Assessment and drainage strategy that assesses all practicable options for the destination of drainage. Even if it is only practicable to discharge surface water to combined sewer, developers will need to demonstrate compliance with the CAAP standards, and to show substantial betterment with respect to total discharge rates from the proposal for the 1 in 1, 30, 100 and 200 year events. Redevelopment would normally provide an opportunity for greening of the space. However, the constrained nature of the site, and the lack of natural drainage routes indicate there are limited options for natural drainage. Therefore, source control measures that provide greenspace should be considered for any major structural change to retail space. Greenroofs are a good example of source control that provides greenspace. Rain gardens should be considered for any changes to roads or rights of way drainage prior to discharge to the surface system. If open space and space for above ground SUDS is constrained, as is currently predicted, below ground storage may be appropriate to control overall discharge rate to the surface water sewer to as close as practicable to the existing discharge rate to SWS for the 1 in 1, 30, 100 and 200 year events. We recommend that developers also refer to the Northampton Level 2 Strategic Flood Risk Assessment for further site specific recommendations.

Table 5-11 Site specific recommendations for Angel Street

Angel Street
The proposal is already 100% hardstanding. Therefore there will be no increase in runoff area through the proposal. However, the proposed comprehensive redevelopment and remodelling of the public highway, coupled with the plans for a new public square and open greenspace offer substantial opportunities for improving existing surface water management from the proposal boundary. Developers will need to ensure that plans for surface water management follow the destination of drainage hierarchy as described in Section 5.2. The proximity of this site to existing surface water sewers indicates that it is feasible to discharge surface water runoff into the River Nene. Therefore surface water drainage from any redevelopment will not be permitted to connect to the foul/combined system. There is a small proposed increase in population, therefore the proposed removal of surface water from the foul/combined system is a prerequisite for ensuring there is foul drainage capacity available for the increase in population. The impact of additional drainage area draining to the River Nene (from the removal of surface drainage area from the foul/combined system) should be mitigated through source control on or on site SUDS, which could include measures in the public realm or other open space. The FRA and drainage strategy will need to detail all existing drainage systems within the proposal, both private and public. Our initial assessment indicates that part of the proposal may be drained by a private drainage system, therefore developers will need to ensure that they fully understand the existing infrastructure, and have the appropriate permissions before developing their strategy. Developers will need to demonstrate compliance with the CAAP standards, and to show substantial betterment with respect to total discharge rates from the proposal for the 1, 30, 100 and 200 year events. Attenuation will be required for a minimum area of 1.78ha (the area which is to be disconnected from the foul/combined sewer) assuming that the rest of the site continues to drain through existing drainage routes. It should be noted however that the drainage hierarchy should be followed and every opportunity should be taken to redirect drainage from the whole of the site to the watercourse which would require additional attenuation. It should be assumed that any attenuation will be provided within the proposal boundary. However, where this is not feasible, Northampton borough Council are currently undertaking a further assessment to identify possible options for strategic attenuation storage. There is modelled evidence of surface water flooding on St Peter's Way to the West of the southern extent of the proposal, and South of Victoria Promenade South of the St John's proposal. The FRA and drainage strategy for this proposal will need to pay particular attention to the risk of surface water flooding in these locations, and ensure that the proposals do not increase this risk. We recommend that developers also refer to the Northampton Level 2 Strategic Flood Risk Assessment for further site specific recommendations.

Table 5-12 Site specific recommendations for St John's

St John's
The proposal is already 100% hardstanding. Therefore there will be a marginal increase in runoff area through the proposal. However, the proposed comprehensive redevelopment of this proposal, coupled with the plans for a new public square and open greenspace offer substantial opportunities for improving existing surface water management from the proposal boundary. Developers will need to ensure that plans for surface water management follow the destination of drainage hierarchy as described in Section 5.2. The proximity of this site to existing surface water sewers indicates that it is feasible to discharge surface water runoff into the River Nene. Therefore surface water drainage from any redevelopment will not be permitted to connect to the foul/combined system. There is a small proposed increase in population, therefore the proposed removal of surface water from the foul/combined system is a prerequisite for ensuring there is foul drainage capacity available for the increase in population. The impact of additional drainage area draining to the River Nene (from the removal of surface drainage area from the foul/combined system) should be mitigated through source control or through on site SUDS, which could include measures in the public realm or other open space. Developers will need to develop a site specific Flood Risk Assessment and drainage strategy that provides sufficient surface water management capacity to allow for the removal of all rainfall runoff from the foul / combined system. Developers will need to demonstrate compliance with the CAAP standards, and to show substantial betterment with respect to total discharge rates from the proposal for the 1 in 1, 30, 100 and 200 year events. Attenuation will be required for a minimum area of 0.51ha (the area which is to be disconnected from the foul/combined sewer) assuming that the rest of the site continues to drain to the surface water sewer. It should be noted however that the drainage hierarchy should be followed and every opportunity should be taken to redirect drainage from the whole of the site to the watercourse which would require additional attenuation. It should be assumed that any attenuation will be provided within the proposal boundary. However, where this is not feasible, Northampton borough Council are currently undertaking a further assessment to identify possible options for strategic attenuation storage. There is modelled evidence of surface water flooding on St Peter's Way to the West of the proposal, and South of Victoria Promenade South of the proposal. The FRA and drainage strategy for this proposal will need to pay particular attention to the risk of surface water flooding in these locations, and ensure that the proposals do not increase this risk. We recommend that developers also refer to the Northampton Level 2 Strategic Flood Risk Assessment for further site specific recommendations.

Table 5-13 Site specific recommendations for Bridge Street

Bridge Street
The proposals are for a remodelling of the existing space to provide small scale retail and financial units alongside leisure and office use. Therefore the scope for significant remodelling of surface water drainage is uncertain. There is a small modelled increase in runoff area and population, although the increase in runoff area is a hypothetical modelling, rather than an actual increase. The proximity of this site to existing surface water sewers indicates that it is feasible to discharge surface water runoff into the River Nene. Therefore surface water drainage from any redevelopment will not be permitted to connect to the foul/combined system. Developers will need to develop a site specific Flood Risk Assessment and drainage strategy that provides sufficient surface water management capacity to allow for the removal of all rainfall runoff from the foul / combined system. Developers will need to demonstrate compliance with the CAAP standards, and to show substantial betterment with respect to total discharge rates from the proposal for the 1 in 1, 30, 100 and 200 year events. Attenuation will be required for a minimum area of 1.98ha (the area which is to be disconnected from the foul/combined sewer) assuming that the rest of the site continues to drain through existing drainage routes. It should be noted however that the drainage hierarchy should be followed and every opportunity should be taken to redirect drainage from the whole of the site to the watercourse which would require additional attenuation. It should be assumed that any attenuation will be provided within the proposal boundary. However, where this is not feasible, Northampton borough Council are currently undertaking a further assessment to identify possible options for strategic attenuation storage. Redevelopment would normally provide an opportunity for greening of the space. However, the constrained nature of the site, and the lack of natural drainage routes indicate there are limited options for natural drainage. Therefore, source control measures that provide greenspace should be considered for any major structural change to retail space. Greenroofs are a good example of source control that provides greenspace. Rain gardens should be considered for any changes to roads or rights of way drainage prior to discharge to the surface system. If open space and space for above ground SUDS is constrained, below ground storage may be appropriate to control overall discharge rate to the surface water sewer to as close as practicable to the existing discharge rate to SWS for the 1 in 1, 30, 100 and 200 year events. There is modelled evidence of surface water flooding on St Peter's Way to the north west of the proposal. The FRA and drainage strategy for this proposal will need to pay particular attention to the risk of surface water flooding in these locations, and ensure that the proposals do not increase this risk. We recommend that developers also refer to the Northampton Level 2 Strategic Flood Risk Assessment for further site specific recommendations.

Table 5-14 Site specific recommendations for Market Square

Market Square
There is no material change to the drainage of the site through the proposals, and no predicted increase in population. Therefore there may be limited opportunity to improve surface water management through the proposal. However, any future redevelopment will need to ensure that plans for surface water management follow the destination of drainage hierarchy as described in Section 5.2. The impact assessment modelling has identified that maintaining the existing drainage connection to combined sewer may be the only practicable option. Developers will need to develop a site specific Flood Risk Assessment and drainage strategy that assesses all practicable options for the destination of drainage. Even if it is only practicable to discharge surface water to combined sewer, developers will need to demonstrate compliance with the CAAP standards, and to show substantial betterment with respect to total discharge rates from the proposal for the 1 in 1, 30, 100 and 200 year events. Redevelopment would normally provide an opportunity for greening of the space. However, the constrained nature of the site, and the lack of natural drainage routes indicate there are limited options for natural drainage. Therefore, source control measures that provide greenspace should be considered for any major structural change to retail space. Greenroofs are a good example of source control that provides greenspace. Rain gardens and other source control measures should be considered for any changes to the public realm. If open space and space for above ground SUDS is constrained, below ground storage may be appropriate to control overall discharge rate to the surface water sewer to as close as practicable to the existing discharge rate to SWS for the 1 in 1, 30, 100 and 200 year events. We recommend that developers also refer to the Northampton Level 2 Strategic Flood Risk Assessment for further site specific recommendations.

Table 5-15 Site specific recommendations for the Telephone Exchange

Telephone exchange
The proposal is for mixed use development comprising mainly office and residential use. There is no proposed increase in drainage area for this proposal, and a small increase in population. The opportunities for improving surface water management through the proposal are unclear, however, any future redevelopment will need to ensure that plans for surface water management follow the destination of drainage hierarchy as described in Section 5.2. The impact assessment modelling has identified that maintaining the existing drainage connections, including maintaining the 25% of the site drainage that currently connects to combined sewer may be the only practicable option. Developers will need to develop a site specific Flood Risk Assessment and drainage strategy that assesses all practicable options for the destination of drainage. Currently only 25% of the site drainage area is understood to drain to the public system, therefore 75% of the site drainage discharges to an unknown destination. Developers will need to ensure that they fully understand the existing infrastructure, and have the appropriate permissions before developing their strategy. Even if it is only practicable to discharge surface water to combined sewer, developers will need to demonstrate compliance with the CAAP standards, and to show substantial betterment with respect to total discharge rates from the proposal for the 1 in 1, 30, 100 and 200 year events. Source control measures that provide reduce runoff to sewer must be considered to offset the proposed increase in population. Rain gardens and other source control measures should be considered for any changes to the public realm. If open space and space for above ground SUDS is constrained, below ground storage may be appropriate to control overall discharge rate to as close as practicable to the existing discharge rate to SWS for the 1 in 1, 30, 100 and 200 year events. We recommend that developers also refer to the Northampton Level 2 Strategic Flood Risk Assessment for further site specific recommendations.

Table 5-16 Site specific recommendations for Becket's Park

Becket's Park
The proposal allows for up to 500 square meters of development to allow for appropriate uses of the park. Any future redevelopment will need to ensure that plans for surface water management follow the destination of drainage hierarchy as described in Section 5.2. The proximity of this site to the River Nene indicates that it is feasible to discharge surface water runoff into the River Nene. Developers will need to develop a site specific Flood Risk Assessment and drainage strategy that ensures that surface water management mimics the existing natural drainage. The CAAP standards for Greenfield sites will apply to this proposal, and in keeping with the nature of the park, additional runoff area should be managed wherever possible with source control features and features that are as natural as practicable. Permeable surfaces should be considered as source control for any changes to parking, roads or rights of way drainage. Any new sports pitches provided should also have appropriate permeable drainage. There are areas of predicted surface water flooding within Becket's Park, and the FRA and the drainage strategy will need to demonstrate that this surface water flood risk is mitigated or managed. In combination with the other waterside developments, there are opportunities to use the significant open space of this proposal to provide strategic storage to offset any increase in surface water discharge from the CAAP proposals. The maximum modelled storage that would be needed to mitigate the impacts of the CAAP proposals if no source control or other surface water management features are deliverable in the upstream CAAP proposals is approximately 2,500 cubic metres. This value is the sum total of the change in surface water flooding and the change in surface water discharge to river for the whole of the CAAP proposals. The absolute maximum increase volume that could be discharged into the river system, assuming the existing surface water flooding issues are resolved through the provision of dramatically upgraded surface water conveyance capacity through the central area, and assuming no source control or attenuation of surface water runoff through the CAAP, is approximately 24,000 cubic metres (this is the total storage as detailed in Table 5.2). Any storage or attenuation SUDS features or structures within this proposal must be located outside the floodplain. We recommend that developers also refer to the Northampton Level 2 Strategic Flood Risk Assessment for further site specific recommendations.

Table 5-17 Site specific recommendations for Avon Nunn Mills Ransome Road

The Waterside: Avon Nunn Mills Ransome Road
This proposal is a significant development and redevelopment, which includes an increased population of around 5000, and a 20% increase in runoff area. Any future redevelopment will need to ensure that plans for surface water management follow the destination of drainage hierarchy as described in Section 5.2. The proximity of this site to the River Nene indicates that it is feasible to discharge surface water runoff direct to open watercourse. Therefore surface water drainage from any redevelopment will not be permitted to connect to the foul/combined system. Developers will need to develop a site specific Flood Risk Assessment and drainage strategy that provides sufficient surface water management capacity to allow for the removal of all rainfall runoff from the foul / combined system. Developers will need to demonstrate compliance with the CAAP standards, and for development on the previously developed areas will need to show substantial betterment with respect to total discharge rates from the proposal for the 1, 30, 100 and 200 year events. Attenuation will be required for a minimum area of 0.37ha (the area which is to be disconnected from the foul/combined sewer) assuming that the rest of the site continues to drain through existing drainage routes. It should be noted however that the drainage hierarchy should be followed and every opportunity should be taken to redirect drainage from the whole of the site to the watercourse which would require additional attenuation. It should be assumed that any attenuation will be provided within the proposal boundary. However, where this is not feasible, Northampton borough Council are currently undertaking a further assessment to identify possible options for strategic attenuation storage. Any storage or attenuation SUDS features or structures within this proposal must be located outside the floodplain. The large areas of open space promoted through this proposal provide significant opportunity for above ground surface water management features that fully comply with the CAAP standards. If there is a risk of contaminated surface water from the existing industrial uses of parts of the site, particular attention will need to be paid to the design of SUDS features that maximise treatment of runoff. An Environmental Permit may be required for discharge into the River Nene, if a SUDS treatment system is used to control the quality of potentially contaminated surface water drainage. The requirement for a treatment train may require additional SUDS features and additional land take, and this must considered in any FRA and drainage assessments prepared for the site. In combination with the other waterside developments, there are opportunities to use the significant open space of this proposal to provide strategic storage to offset any increase in surface water discharge from the CAAP proposals. The maximum storage that would be needed to mitigate the impacts of the CAAP proposals if no source control or other surface water management features are deliverable in the upstream CAAP proposals is approximately 2,500 cubic metres. This value is the sum total of the change in surface water flooding and the change in surface water discharge to river for the whole of the CAAP proposals. The absolute maximum increase volume that could be discharged into the river system, assuming the existing surface water flooding issues are resolved through the provision of dramatically upgraded surface water conveyance capacity through the central area, and assuming no source control or attenuation of surface water runoff through the CAAP, is approximately 24,000 cubic metres. This strategic attenuation would not necessarily resolve problems of exceedance flooding in the Central Area itself, but would ensure that the CAAP proposals would not have a knock on impact downstream of the area. We have not determined how such storage could work, or the feasibility of providing this storage. However, the significant area of greenspace across the three waterside developments in this area provides confidence that land availability should not be a constraining factor. We recommend that developers also refer to the Northampton Level 2 Strategic Flood Risk Assessment for further site specific recommendations.

Table 5-18 Site specific recommendations for the Waterside Southbridge West

The Waterside: Southbridge West
Proposals for Southbridge West are dependant on as more detailed flood risk assessment looking at the risk of flooding behind flood defences. Any future redevelopment will need to ensure that plans for surface water management follow the destination of drainage hierarchy as described in Section 5.2. The proximity of this site to the River Nene indicates that it is feasible to discharge surface water runoff directly into river subject to SUDS features being applied to control the rate and volume of runoff. Therefore surface water drainage from any redevelopment will not be permitted to connect to the foul/combined system. The FRA and drainage strategy will need to detail all existing drainage systems within the proposal, both private and public. Our initial assessment indicates that part of the proposal may be drained by a private drainage system, therefore developers will need to ensure that they fully understand the existing infrastructure, and have the appropriate permissions before developing their strategy. Developers will need to demonstrate compliance with the CAAP standards, and to show substantial betterment with respect to total discharge rates from the proposal for the 1, 30, 100 and 200 year events. Attenuation will be required for a minimum area of 0.29ha (the area which is to be disconnected from the foul/combined sewer plus the additional developed area) assuming that the rest of the site continues to drain through existing drainage routes. It should be noted however that the drainage hierarchy should be followed and every opportunity should be taken to redirect drainage from the whole of the site to the watercourse which would require additional attenuation. It should be assumed that any attenuation will be provided within the proposal boundary. However, where this is not feasible, Northampton borough Council are currently undertaking a further assessment to identify possible options for strategic attenuation storage. In combination with the other waterside developments, there are opportunities to use the significant open space of this proposal to provide strategic storage to offset any increase in surface water discharge from the CAAP proposals. The maximum storage that would be needed to mitigate the impacts of the CAAP proposals if no source control or other surface water management features are deliverable in the upstream CAAP proposals is approximately 2,500 cubic metres. This value is the sum total of the change in surface water flooding and the change in surface water discharge to river for the whole of the CAAP proposals. The absolute maximum increase volume that could be discharged into the river system, assuming the existing surface water flooding issues are resolved through the provision of dramatically upgraded surface water conveyance capacity through the central area, and assuming no source control or attenuation of surface water runoff through the CAAP, is approximately 24,000 cubic metres. This strategic attenuation would not necessarily resolve problems of exceedance flooding in the Central Area itself, but would ensure that the CAAP proposals would not have a knock on impact downstream of the area. We have not determined how such storage could work, or the feasibility of providing this storage. However, the significant area of greenspace across the three waterside developments in this area provides confidence that land availability should not be a constraining factor. We recommend that developers also refer to the Northampton Level 2 Strategic Flood Risk Assessment for further site specific recommendations.

Table 5-19 Site specific recommendations for the Waterside Nene Meadows

The Waterside: Nene Meadows
The proposal allows for up small scale development (up to 250 square metres) to allow for a central activity hub.
Any future redevelopment will need to ensure that plans for surface water management follow the destination of drainage hierarchy as described in Section 5.2. The proximity of this site to the River Nene indicates that it is feasible to discharge surface water runoff into the River Nene. Developers will need to develop a site specific Flood Risk Assessment and drainage strategy that ensures that surface water management mimics the existing natural drainage. The CAAP standards for Greenfield sites will apply to this proposal, and in keeping with the nature of the meadows, additional runoff area should be managed wherever possible with source control features and features that are as natural as practicable.
Permeable surfaces should be considered as source control for any changes to parking, roads or rights of way drainage.
There are areas of predicted surface water flooding within the Nene Meadows, and the FRA and drainage strategy will need to demonstrate that the proposed use of the site is consistent wit the risk of flooding.
It is possible that this proposal could be used to provide strategic attenuation to offset additional runoff area created within this river reach.
In combination with the other waterside developments, there are opportunities to use the significant open space of this proposal to provide strategic storage to offset any increase in surface water discharge from the CAAP proposals.
The maximum storage that would be needed to mitigate the impacts of the CAAP proposals if no source control or other surface water management features are deliverable in the upstream CAAP proposals is approximately 2,500 cubic metres. This value is the sum total of the change in surface water flooding and the change in surface water discharge to river for the 200 year event for the whole of the CAAP proposals.
The absolute maximum increase volume that could be discharged into the river system, assuming the existing surface water flooding issues are resolved through the provision of dramatically upgraded surface water conveyance capacity through the central area, and assuming no source control or attenuation of surface water runoff through the CAAP, is approximately 24,000 cubic metres.
This strategic attenuation would not necessarily resolve problems of exceedance flooding in the Central Area itself, but would ensure that the CAAP proposals would not have a knock on impact downstream of the area. We have not determined how such storage could work, or the feasibility of providing this storage. However, the significant area of greenspace across the three waterside developments in this area provides confidence that land availability should not be a constraining factor.
We recommend that developers also refer to the Northampton Level 2 Strategic Flood Risk Assessment for further site specific recommendations.