



FLOOD RISK ASSESSMENT

Site Address

Connell Co-Op College

301 Alan Turing Way

Manchester

M11 3BS

Client

Darwin Group

Date

11/12/2020



1 Document Control



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Site Address:	Connell Co-Op College 301 Alan Turing Way Manchester M11 3BS
National Grid Reference:	387373, 397939
STM Reference:	STM – 2020 – 000143
Version No:	1.0
Prepared for:	Darwin Group
Date:	11/12/2020
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2 Abbreviations

Abbreviation	Description
STM	STM Environmental Consultants Limited
BGS	British Geological Survey
EA	Environment Agency
OS	Ordnance Survey of Great Britain
FRA	Flood Risk Assessment
NPPF	National Planning Policy Framework
FWD	Floodline Warning Direct
FRMS	Flood Risk Management Strategy
MCC	Manchester City Council
SWMP	Surface Water Management Plan
SFRA	Strategic Flood Risk Assessment
CDA	Critical Drainage Area
SuDS	Sustainable Drainage Systems
GWSPZ	Groundwater Source Protection Zone
LLFA	Lead Local Flood Authority
mbgl	metres below ground level
DCLG	Department for Communities and Local Government
PPGPS	Planning practice guidance and Planning system

3 Disclaimer

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4 Executive Summary

Location	Connell Co-Op College, 301 Alan Turing Way, Manchester, M11 3BS Grid reference: 387373, 397939
Proposed Development	Erection of single-storey detached building for educational use (Class F.1) comprising of classrooms, WC's, plant room, store, ancillary staff offices and canopy linkway to the existing building. Additional parking, playground, landscaping, external works and servicing.
Flood Zone	Flood Zone 1.
Topography	58.5mAOD (NE) to 60.1mAOD (E).
Main Sources of Flooding	Surface Water.
Flood Defences	None.
EA Records of Historic Flooding	None.
Fluvial (River) and Tidal (Sea) Flood Risk	Very Low – the site lies within flood zone 1. It will remain dry during all modelled events.
Pluvial (Surface Water) Flood Risk	Low to Medium – the majority of the site, including the proposed new building, will remain dry during all modelled events. Some ponding along the eastern boundary of the site during the 1 in 100 and 1 in 1000-year events. The site lies within a CDA, it is in an area that may have witnessed a significant number of sewer flooding incidents.
Flood Risk from Artificial (Canals and Reservoirs) Sources	Low – the site lies outside the Canal's breach extent and the reservoir's flood extent.
Groundwater Flood Risk	Low – although site is potentially susceptible to groundwater flooding, no recorded incidents have been identified.
Development Impacts on Local Flood Risk	The development will increase the site impermeable area. As such it may increase surface water runoff rated. The use of a SUDS strategy is highly recommended.
Proposed Flood Risk Mitigation Measures	- Finished floor levels will be set 300mm above general ground levels at proposed location of the building; - Construction will utilise flood resistant materials and services will be placed as high as practicable to reduce impact of flooding; - Safe egress to flood zone 1 is available within the site boundary.
Surface Water Management (SuDS)	SuDS would reduce current surface water run off rates. Given the size of the site, there is good potential for implementation. Consideration should be given to swales, soakaways, rainwater harvesting and permeable paving where possible.
Conclusions	Based on the information reviewed and taking into account the proposed mitigation measures, it is considered that overall flood risk to the proposed development is low. With the implementation of a suitable SUDS strategy, the proposal is unlikely to have a significant impact upon local flood risk.

8 Summary of Data Review Undertaken

The following research has been undertaken as part of the FRA:

-  Desktop assessment of topographical, hydrological and hydrogeological settings through review of the information sourced from the British Geological Survey (BGS), the Environment Agency (EA) and the Ordnance Survey (OS);
-  Review of publicly available flood risk mapping provided by the EA;
-  Review of the Preliminary Flood Risk Assessment (PFRA) and Level 1 Strategic Flood Risk Assessment (SFRA) produced by the LLFA outlining flood risk from various sources within the borough.

9 Legislative and Policy Context

9.1 Legislative Context

The Flood and Water Management Act was introduced in 2010. The Act defines the role of lead local flood authority (LLFA) for an area. All LLFA are required to develop, maintain, apply and monitor a strategy for local flood risk management in its area, called “local flood risk management strategy”.

Alongside the Act, Flood Risk Regulations (2009) outline the roles and responsibilities of the various authorities, which include preparing Flood Risk Management Plans and identifying how significant flood risks are to be mitigated.

9.2 Policy Context

9.2.1 National Planning Policy Framework (NPPF)

The NPPF sets out the government’s planning policies for England and how these are expected to be applied. It also provides a set of guidelines and philosophy with which local planning authorities (LPAs) can build their own unique policies to appropriately regulate development within their jurisdictions.

Section 14 entitled “Meeting the challenge of climate change, flooding and coastal change” deals specifically with flood risk. Among other things it states that LPAs should try to ensure that “Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere”. It further states that when determining planning application, LPAs should “ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

-  within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
-  development is appropriately flood resilient and resistant;
-  it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
-  any residual risk can be safely managed; and
-  safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

Applications for minor development and changes of use should not be subject to the Sequential or Exception Tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 50.

Footnote 50 states: “A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in

future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.”

The NPPF also lays out requirements for how LPAs should deal with planning applications in coastal areas. They should ensure that should they “reduce risk from coastal change by avoiding inappropriate development in vulnerable areas or adding to the impacts of physical changes to the coast.”

Developments in Coastal Change Management Areas should only be considered appropriate where it is demonstrated that:

-  it will be safe over its planned lifetime and will not have an unacceptable impact on coastal change;
-  the character of the coast including designations is not compromised;
-  the development provides wider sustainability benefits;
-  the development does not hinder the creation and maintenance of a continuous signed and managed route around the coast.

9.2.2 Local Planning Policy

Policy EN 14 of Manchester Core Strategy addresses Flood Risk:

-  In line with the risk-based sequential approach contained within PPS25, development should be directed away from sites at the greatest risk of flooding, and towards sites with little or no risk of flooding; this should take account of all sources of flooding identified in the Manchester-Salford-Trafford Strategic Flood Risk Assessment (SFRA).
-  In addition to the requirements for site-specific Flood Risk Assessments (FRAs) set out in PPS25, an appropriate FRA will also be required for all development proposals, including changes of use, on sites greater than 0.5ha within Critical Drainage Area(CDAs) and Canal Hazard Zones identified in the SFRA.

- All new development should minimise surface water run-off, including through Sustainable Drainage Systems (SUDS) and the appropriate use of Green Infrastructure. Developers should have regard to the surface water run-off rates in the SFRA User Guide. In CDAs, evidence to justify the surface water run-off approach / rates will be required.
- The City of Manchester contains many sections of rivers which are culverted or 'hidden'; where these are indicated in the SFRA beneath the proposed development site, further investigation will be required and the development proposal should take this into account; where feasible and appropriate development should seek to open up culverted/hidden rivers to reduce the associated flood risk and danger of collapse, taking advantage of opportunities to enhance biodiversity and Green Infrastructure.

9.3 EA Standing Advice on Flood Risk

The Environment Agency's [standing advice](#) lays out the process that must be followed when carrying out flood risk assessments for developments.

Flood risk assessments are required for developments within one of the flood zones. This includes developments:

- in flood zone 2 or 3 including minor development and change of use more than 1 hectare (ha) in flood zone 1;
- less than 1 ha in flood zone 1, including a change of use in development type to a more vulnerable class (for example from commercial to residential), where they could be affected by sources of flooding other than rivers and the sea (for example surface water drains, reservoirs);
- in an area within flood zone 1 which has critical drainage problems as notified by the Environment Agency.

10 Site Description and Environmental Characteristics

10.1 Site Location and Area

The site is located at Connell Co-Op College, 301 Alan Turing Way, Manchester, M11 3BS. It is centred at national grid reference 387373, 397939. The site has an area of approximately 10084m².

A site location map and aerial photo are shown below. Photographs of the site are available in [Appendix 1](#).





10.2 Site Access

The site will be accessed via a driveway off Wilson Street.

10.3 Local Planning Authority

The site falls within the jurisdiction of Manchester City Council (MCC) in terms of the planning process.

10.4 Lead Local Flood Authority

MCC is also the Lead Local Flood Authority (LLFA).

10.5 Flood Zone

For planning purposes, the site is located in Flood Zone 1 as defined by the EA and LLFA.

10.6 Site and Surrounding Land Uses

10.6.1 Site Current Land Use

The site is currently used as an educational facility – College.

10.6.2 Surrounding Land Uses

A description of current land uses surrounding the boundaries of the site is given below in

Table 1 below.

Table 1: Summary of surrounding land uses

Boundary	General Local Area (i.e. within 250m)
Northern	Training Ground / Stadium
Eastern	Commercial / Industrial
Southern	Residential
Western	Commercial / Residential

10.7 Hydrology

The nearest watercourse is the Corn Brook which runs at approximately 830m to the south of the site. The EA has confirmed that the “Corn Brook” is not designated as a main river.

10.8 Geology

Data from the British Geological Survey indicates that the underlying superficial geology is characterised as Till Devensian. The underlying bedrock geology is characterized as Pennine Upper Coal Measures.

10.9 Hydrogeology

The site lies upon an unproductive superficial aquifer and a secondary A bedrock aquifer.

[Appendix 3](#) provides BGS mapping showing the hydrogeology at the site location.

10.10 Topography

A LIDAR map showing the topology of the site and surrounding area is available in [Appendix 3](#). The ground level at the site ranges from 56.6mAOD in the north-east to 62.6mAOD in the south.

A topographic survey has been conducted and is also available in [Appendix 3](#). It shows that the ground level at the site ranges from 58.5mAOD (NE) to 60.1mAOD (E).

11 The Sequential and Exception Tests

11.1 The Sequential Test

The Sequential Test aims to steer developments and redevelopments to areas of lower flood risk. The test compares the proposed development site with other available sites, in terms of flood risk, to aid the steering process. The Sequential Test is not required if the proposed development is a minor development or if it involves a change of use unless the development is a caravan, camping chalet, mobile home or park home site.

Minor development means:

-  minor non-residential extensions: industrial/commercial/leisure etc extensions with a footprint less than 250 square metre.
-  alterations: development that does not increase the size of buildings eg alterations to external appearance.
-  householder development: For example; sheds, garages, games rooms etc within the curtilage of the existing dwelling, in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed

development that would create a separate dwelling within the curtilage of the existing dwelling eg subdivision of houses into flats.

The development is not considered to be minor. However, due to its location within flood zone 1, the Sequential Test should not be required by the LLFA.

11.2 The Exception Test

If alternative sites of lower flood risk are not available then the proposed development may require an Exception Test to be granted planning permission. Where the exception test is required, it should be applied as soon as possible to all local development document allocations for developments and all planning applications other than for minor developments. All three elements of the exception test have to be passed before development is allocated or permitted. For the exception test to be passed:

-  It must demonstrate that the development provides wider sustainability benefits to the community that outweigh the flood risk, informed by an SFRA, where one has been prepared;
-  The development should be on developed land or on previously developed land;
-  A flood risk assessment must demonstrate that the development will be safe without increasing flood risk elsewhere, and where possible will reduce the overall flood risk.

The requirements for an Exception Test are given in Table 2 and are defined in terms of Flood Zone and development vulnerability classification.

Table 2: NPPF flood zone vulnerability compatibility (source: NPPF).

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible

Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required	X	Exception Test required	✓	✓
Zone 3b	Exception Test required	X	X	X	✓

Key:

✓ Development is appropriate

X Development should not be permitted.

Based on its scale and nature, the development is considered to be “more vulnerable”. As such the Exception Test should not be required by the LLFA.

12 Site Specific Flood Risk Analysis

The PFRA and Level 1 SFRA produced by the LLFA and maps from the EA provide information regarding historic flooding events and incidents as well as predictions of flood extents and depths during extreme rainfall events.

12.1 Fluvial (River) and Tidal (Sea) Flood Risk

12.1.1 Mechanisms for Fluvial Flooding

Fluvial, or river flooding, occurs when excessive rainfall over an extended period of time or heavy snow melt causes a river to exceed its capacity. The damage from a fluvial flood can be widespread as the overflow may affect downstream tributaries, overtopping defences and flooding nearby inhabited areas. Fluvial flooding consists of two main types:

 **Overbank flooding** – this occurs when water rises steadily and overflows over the edges of a river or stream;

Flash flooding – this is characterized by an intense, high velocity torrent of water that occurs in an existing river channel with little to no notice. Flash floods are very dangerous and destructive not only because of the force of the water, but also the hurtling debris that is often swept up in the flow.

12.1.2 Definition of EA Modelled Fluvial Flood Risk Zones

Fluvial flood risk is assessed using flooding maps produced by the Environment Agency. These maps use available historic data and hydraulic modelling to define zones of flood risk. The maps allow a site to be defined in terms of its flood zone (e.g. 1, 2, 3) and in terms of the overall flood risk (very low, low, medium or high). It is important to note that existing flood defences are not taken into account within the models or the maps. The EA fluvial flood zones are defined as follows:

- Flash Flood zone 1: Less than 1 in 1000 (0.1%) annual probability of flooding;
- Flash Flood zone 2: Between 1 in 100 (1%) and 1 in 1000 (0.1%) annual probability of flooding;
- Flash Flood zone 3: Greater than 1 in 100 (1%) annual probability of fluvial flooding.

Flood zone 3 is split into two sub-categories (3a and 3b) by LLFAs depending on whether the land is considered to be a functional flood plain (i.e. an important storage area for flood waters in extreme events).

- Flash Flood zone 3a: Greater than 1 in 100 (1%) annual probability of fluvial flooding and/or greater than 1 in 200 (0.5%) annual probability of tidal flooding;
- Flash Flood zone 3b: Functional flood plain (definition specific to the LLFA). Less than a 1 in 20 (5%) annual probability of fluvial and/or tidal flooding.

12.1.3 Main Potential Sources of Local Fluvial Flooding

The nearest potential source of fluvial flooding to the site is considered to be the Corn Brook.

12.1.4 Records of Historic Fluvial Flooding Incidents

The EA informed that they do not have any information on recorded flood incidents in the vicinity of the site.

12.1.5 Designated Fluvial Flood Risk Zone for the Site

The site is considered to be located within flood zone 1 as defined by the Environment Agency and the LLFA indicating that it has lower than 1 in 1000 annual probability of fluvial flooding.

12.1.6 Mechanisms for Tidal Flooding

Tidal flooding may be described simply as the inundation of low lying coastal areas by the sea, or the overtopping or breaching of sea defences. Tidal flooding may be caused by seasonal high tides, storm surges and where increase in water level above the astronomical tide level is created by strong on shore winds or by storm driven wave action.

12.1.7 Definition of EA Tidal Flood Risk Zones

As with fluvial flood risk, tidal flood risk is assessed using flooding maps produced by the Environment Agency. The difference is in the probability return periods used to define tidal flood zones. The EA tidal flood zones are defined as:

- | | |
|---|--|
|  | Flood zone 1: Less than 1 in 1000 (0.1%) annual probability of flooding; |
|  | Flood zone 2: Between 1 in 200 (0.5%) and 1 in 1000 (0.1%) annual probability of tidal flooding; |
|  | Flood zone 3: Greater 1 in 200 (0.5%) annual probability of tidal flooding. |

12.1.8 Potential Sources of Tidal Flooding

The area in which the site is located is considered unlikely to be affected by tidal flooding.

12.1.9 Flood Defences

The EA's Areas benefitting from flood defences and current flood defences map shows no indication of any flood defences in the vicinity of the site.

12.1.10 Climate Change - EA Modelled Predictions of Fluvial and Tidal Flood Levels and Extents

2D values at the site are not part of the EA Product 4 dataset as the proposal lies within flood zone 1. The EA provides modelled data in-channel within the Corn Brook. These are shown in [Appendix 12](#).

The modelled flood levels within the Corn Brook show a maximum level of 54.04mAOD confirming that the site does not lie within modelled flood extents.

12.1.11 Long Term Fluvial Flood Risk Considering Flood Defences

The EA's [long term flood risk maps](#) give an indication of the actual risk associated with flooding after taking into account the effect of any flood defences in the area. Copies of maps for the site which are available in [Appendix 8](#) indicate that the long-term risk from fluvial flooding to the site is very low.

12.2 Pluvial (Surface Water) Flood Risk

A pluvial, or surface water flood, is caused when heavy rainfall creates a flood event independent of an overflowing water body. Surface water flooding occurs when high intensity rainfall leads to run-off which flows over the ground surface, causing ponding in low-lying areas when the precipitation rate or overland flow rate is greater than the rate of infiltration, or return into watercourses. Surface water flooding can be exacerbated when the underlying soil and geology is saturated (as a result of prolonged precipitation or a high-water table) or when the drainage network has insufficient capacity.

12.2.1 Mechanisms of Pluvial Flooding

The chief mechanisms for surface water flooding can be divided into the following categories:

-  Runoff from higher topography;
-  Localised surface water runoff – as a result of localised ponding of surface water;
-  Sewer Flooding – areas where extensive and deep surface water flooding is likely to be influenced by sewer flooding. Where the sewer network has reached capacity, and surcharged, this will exacerbate the flood risk in these areas;
-  Low Lying Areas – areas such as underpasses, subways and lowered roads beneath railway lines are more susceptible to surface water flooding;
-  Railway Cuttings – railway infrastructure cut into the natural geological formations can cause extra surface run off and pooling disrupting service and potentially affecting adjacent structures;
-  Railway Embankments – discrete surface water flooding locations along the up-stream side of the raised network rail embankments where water flows are interrupted and ponding can occur;
-  Failure of artificial sources (i.e. man-made structures) such as such as canals and reservoirs.

12.2.2 Main Potential Sources of Local Pluvial Flooding

The main potential source of pluvial flooding to the site is considered to be surface water ponding and flooding associated with heavy rainfall.

12.2.3 Records of Historic Pluvial Flooding Incidents

A map showing the location of surface water flooding incidents is not available.

Examination of the LLFA's Level 2 SFRA identifies localised flooding problems in central Manchester and Salford. SFRA analysis shows significant surface water flooding hotspots between the Irk and Medlock and in Crumpsall, Cheetham Hill, Clifton Green, Newtown, Charlestown and Broughton.

12.2.4 Surface Water Flood Risk from Artificial Sources (Reservoirs and Canals)

An examination of OS mapping and the EA's mapping revealed indication of the Ashton Canal which is located 450m to the North-East of the site.

However, the EA's reservoir flood risk map indicates that the site does not lie within an area that is at risk of reservoir flooding.

Additionally, the site lies outside the Canal Breach Map as stated in the SFRA and shown in the figure available in [Appendix 11](#).

12.2.5 Sewer Flooding

In Manchester, sewer and drainage problems have been identified during rainfall events, with issues in Northenden, Didsbury, Fallowfield and in the city centre. A map showing recorded incidents of sewer flooding is not available as part of the SFRA. Examination of the Level 2 SFRA identifies 5 postcode areas with over 10 properties affected in the DG5 register within Manchester.

12.2.6 Climate Change - Modelled Predictions of Surface Water Run-off Flooding

Mapping of the predicted extent and depth of surface water flooding for the 1 in 30-year, 1 in 100-year and 1 in 1000-year rainfall return periods provided by the EA are available in [Appendix 6](#).

The maps show that the site would remain dry during the 1 in 30-year precipitation event.

During the 1 in 100-year and 1 in 1000-year events, an area along the eastern boundary of the site would flood with depths up to 600mm and 900mm respectively.

The proposed location of the new building will remain dry during all precipitation events.

12.4.2 Susceptibility to Groundwater Flooding

The Groundwater Flood Susceptibility Map provided by BGS, which is available in [Appendix 9](#) indicates that the potential for groundwater flooding to occur at the surface exists. The Groundwater Depth map also provided by BGS indicates that the groundwater level may be at less than 3mbgl.

However, the SFRA does not locate the site as being within an area at risk from ground water flooding.

12.5 Critical Drainage Area

A Critical Drainage Area (CDA) may be defined as “a discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure”. A CDA is defined in the Town and Country Planning (General Development Procedure) (Amendment) (No. 2) (England) Order 2006 as “an area within Flood Zone 1 which has critical drainage problems and which has been notified... [to]...the local planning authority by the Environment Agency”.

The Manchester Salford Trafford Hybrid SFRA identifies nearly the entire City as being within a Critical Drainage Area, whilst the SWMP identifies further areas at potential risk. Critical Drainage Areas are those identified from historical flood events and/or modelled data as having a significant risk from surface water flooding and include drainage catchments for the sewer network. The drainage infrastructure across the City changes over time as new developments are constructed, is in multiple ownerships and varying condition, and is complex by its very nature. In light of the existing Critical Drainage Areas in the SFRA and the widespread surface water flood risk, and with the agreement of the Environment Agency and other key stakeholders, establishing a Critical Drainage Area covering the whole of the City would be an effective means of managing surface water runoff going forward.

The site is located within the Conurbation Core Critical Drainage Area as shown in the map available in [Appendix 10](#).

13 Potential Impacts of the Development on Local Flood Risk

13.1 Impacts on Flood Storage

13.1.1 Changes to Impermeable Area and Building Footprint

Changes in ground cover arising from the development are presented in Table 3 below. The change to the impermeable area of the site is considered to be significant.

Table 3: Existing and proposed site ground cover.

	Impermeable Area (m ²)	Permeable Area (m ²)	Total Area (m ²)
Existing	5402	4682	10084
Proposed	7357	2727	10084

As the development will significantly alter the site impermeable area, it is considered possible that it will impact upon surface water runoff rates.

However, although it will change the site's built up area, it lies within flood zone 1, and as such, it is unlikely to impact upon local flood storage.

13.2 Impacts on Flood Flow Routes

As the development does involve the addition of buildings at the site, it may alter flood flow paths. However, as the proposed location of the building will remain dry during all modelled events, the impact on flow routes is not considered to be significant.

14 Flood Risk Mitigation Measures

14.1 SuDS

Planning practice guidance (PPG) which is prepared by the Ministry of Housing, Communities and Local Government (DCLG) states that developers and Local Authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

As such, the developer has to implement a SuDS strategy in line with the drainage hierarchy as outlined in Table 4 below to reduce surface water discharges from the site.

Table 4: SuDs Options

	Store rainwater for later use;
	Use infiltration techniques, such as porous surfaces in non-clay areas;
	Attenuate rainwater in ponds or open water features for gradual release;
	Attenuate rainwater by storing in tanks or sealed water features for gradual release;
	Discharge directly to a water course;
	Discharge rainwater directly to a surface water sewer/drain;
	Discharge to a combined sewer.





Figure 1: Surface water storage facilities and potential SuDS features - rainwater harvesting, on-site tank storage, rain garden soak-away and green roofs. (Source: UK SuDS Manual)

Given the nature of the development and the size of the site, it is considered that there are good opportunities for implementing SuDS. Measures such as green roofs, rainwater harvesting, infiltration (soakaways, permeable paving, rain gardens) or attenuation storage tanks should be considered. When required, the SuDS strategy will be detailed in a separate report as is outside the scope of works of this FRA.

14.2 Flood Resilience

Flood resilient construction uses methods and materials that reduce the impact from a flood, ensuring that structural integrity is maintained, and the drying out and cleaning required, following inundation and before reoccupation, is minimised.

14.2.1 Finished Floor Levels

For vulnerable developments, EA Standing Advice states that finished floor level of the lowest habitable room in any building Ground floor levels should be a minimum of 300millimetres (mm) above the general ground level of the site or 300mm above the estimated river or sea flood level whichever is higher.

As the proposed location of the building will remain dry during all modelled scenarios, finished floor levels can be set to 300mm above general ground level.

14.2.2 Flood displacement storage

All new development within Flood Zone 3 must not result in a net loss of flood storage capacity. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage.

As the proposal lies within flood zone 1, the proposal will not impact upon the capacity of the floodplain to store water. As such, flood compensatory storage is not considered to be required.

14.2.3 Flood Resilience Measures

In terms of achieving resilience, there are two main strategies, whose applicability is dependent on the water depth the property is subjected to. These are:

-  Water exclusion strategy - where emphasis is placed on minimising water entry whilst maintaining structural integrity, and on using materials and construction techniques to facilitate drying and cleaning. This strategy is favoured when low flood water depths are involved (not more than 0.3m);
-  Water entry strategy - buildings are at significant risk of structural damage if there is a water level difference between outside and inside of about 0.6m or more. This strategy is therefore favoured when high flood water depths are involved (greater than 0.6m).

Given that flood depths less than 0.3m are predicted in extreme scenarios, the water exclusion strategy is considered most applicable for this site.

Flood resilience design and measures that will be implemented are outlined below. Water-resistant and resilient materials will be utilized through the construction to minimize the flood risk and potential impacts.

Floor construction:

-  Use of a concrete slab 150mm thick;
-  Use of ceramic tiles or stone floor finishes is recommended;
-  Maintain existing under floor ventilation by UPVC telescopic vents above 400 mm to external face of extension;
-  Avoid the use of MDF carpentry.

Wall construction:

- Include in the external face of the extension a damp – proof course, 250 mm above ground level, to prevent damp rising through the wall.

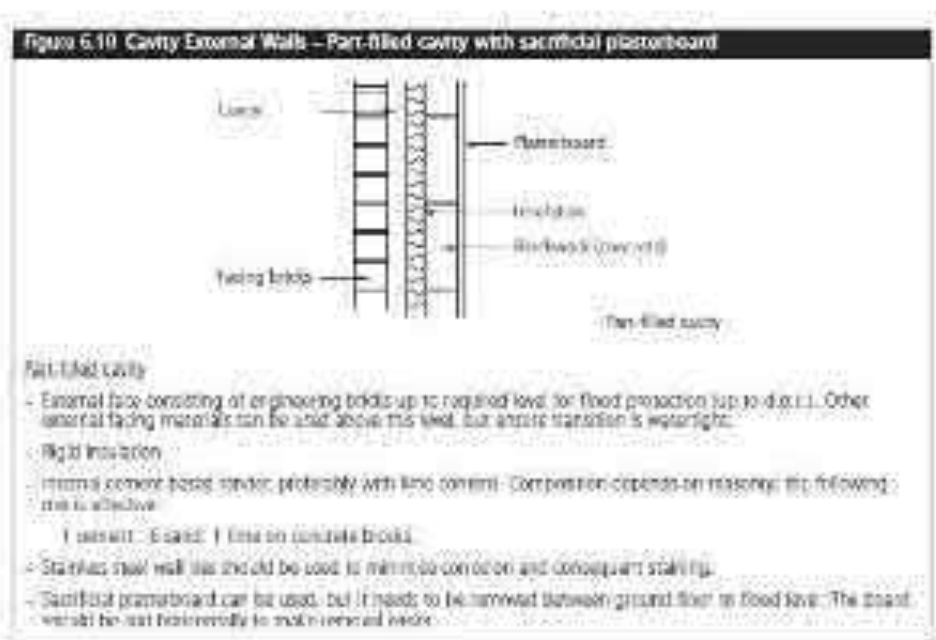
Doors:

- Seal doors around edges and openings. UPVC or composite material will be used with passive protection meaning that minimal intervention will be required in the event of flooding.

Underground drainage:

- Avoid use of metal for any underground piping;
- Use closed cell insulation for pipes that are below the predicted flood level;
- Provide non – return valves for the drainage system to prevent back water flow;
- Use UPVC or clay pipework for foul and surface water drainage.

Improving the flood performance of new buildings



As well as the above the following flood resilience features should be applied as part of the development:

-  Electrical sockets should be installed above flood level for the ground floor;
-  Utility services such as fuse boxes, meters, main cables, gas pipes, phone lines and sockets will be positioned as high as practicable;
-  All external openings for pipes or vents below 400mm to be sealed around pipe or vent with expanding foam and mastic.

14.3 Emergency Plan

The dangers associated with flood water to people are possible injury and/or death. This can occur as a result of drowning or being carried along by the waters into hard objects or vice versa.

The risk to life is largely a function of the depth and velocity of the floodwater as it crosses the floodplain. Fast flowing deep water that contains debris would represent the greatest hazard.

The assessment of danger to people from walking in floodwater is described in the Flood Risks to People guidance documents (FD2321_TR1 and FD2321_TR2) by DEFRA/EA. Danger can be estimated by the simple formula:

$$HR = d \times (v + 0.5) + DF$$

where, HR = (flood) hazard rating; d = depth of flooding (m); v = velocity of floodwaters (m/sec); and DF = debris factor.

The proposal lies within flood zone 1 and it will remain dry during all modelled flood events. As such, flood hazard at the majority of the site can be classified as being very low.

14.3.1 Access and Safe Egress

Safe egress to Flood Zone 1 is available within the site boundary.

14.3.2 Safe Refuge

The proposed development will not have internal connections to upper floors in the property which will act to provide sufficient safe refuge in the event of an extreme flood event. However, due to its location within flood zone 1, safe refuge is not considered to be required.

15 Conclusions and Recommendations

This assessment has considered the potential risks to the application site associated with flooding from fluvial, tidal, surface water, artificial and groundwater sources and the potential impacts of climate change.

A review of LLFA's PFRA and SFRA as well as data provided by the EA was undertaken. The main findings of the review and assessment are provided below:

-  The main source of potential flooding to the site is surface water;
-  The EA define the site as being within flood zone 1;
-  EA mapping indicates that the site is not in an area that benefits from flood defences;
-  No records of fluvial, tidal or artificial flooding incidents were identified at or in the vicinity of the site;
-  The site is within a CDA;
-  The site lies outside the Ashton Canal's breach extent;
-  No records of groundwater flooding incidents were identified at or in the vicinity of the site;
-  The development will result in a significant change in the impermeable area of the site and therefore may increase surface water runoff rates;

-  There is good opportunity for implementing SuDS mitigation measures. Consideration should be given to use of soakaways, swales, rainwater harvesting and/or permeable paving where possible;
-  Flood resilient materials and construction methods will be used so as to ensure that the impacts of any potential flooding are minimised as much as possible;
-  Safe egress to flood zone 1 is available within the site boundary.

Based on the information reviewed and taking into account the proposed mitigation measures, it is considered that overall flood risk to the proposed development is low. With the implementation of a suitable SUDS strategy, the proposal is unlikely to have a significant impact upon local flood risk.

16 References

1. Communities and Local Government - National Planning Policy Framework NPPF, March 2012.
2. Communities and Local Government - Planning Practice Guidance: Flood Risk and Coastal Change, Updated 06 March 2014.
3. Strategic Flood Risk Assessment Level 2 Hybrid – Manchester City, Salford and Trafford Councils, 2011.
4. Strategic Flood Risk Assessment Level 1 Hybrid – Manchester City, Salford and Trafford Councils, 2010.
5. Core Strategy – Manchester City Council, 2012.
6. Local Flood Risk Management Strategy – Manchester City Council, 2014.
7. CIRIA, Defra, Environment Agency – UK SuDS Manual, 2015.
8. Google Maps accessed December 20.

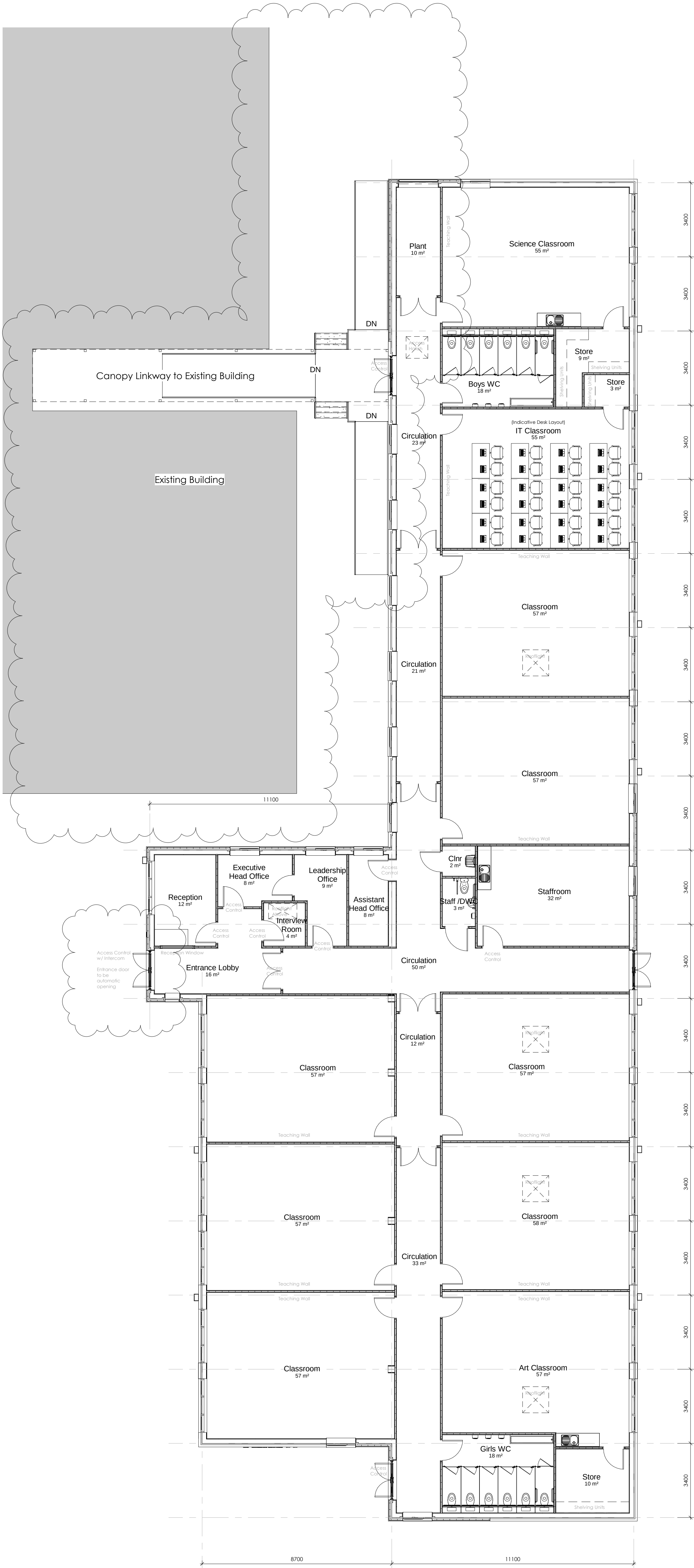
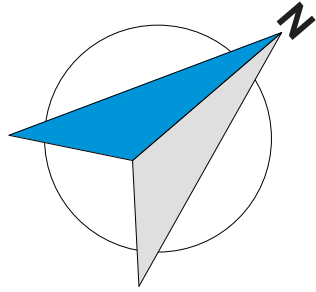
17 Appendices

17.1 Appendix 1 – Site Photographs

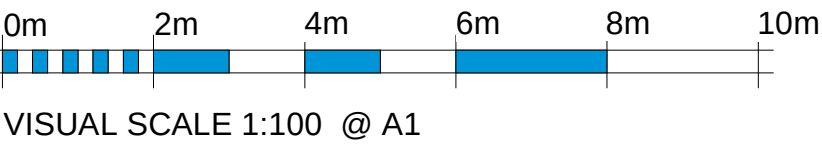


17.2 Appendix 2 – Development Plans

Connell Co-op College



00_Ground_Floor_Plan
1 : 100



VISUAL SCALE 1:100 @ A1

Module Schedule		
W X L X H(Soffit) - (m)	Level	Quantity
3.4 x 8.7 x 2.9	GF	6
3.4 x 11.1 x 2.9	GF	20
		26

Rev	Description	By	Chk	Date
P5	Canopy to main entrance omitted, external plant room door omitted and replaced with internal access and external ventilation louvre, ramp and stepped access adjacent to link added, proximity between existing and proposed updated to suit new position, rooflights added	WH		11/12/20

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PROJECT TITLE

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Manchester
M11 3BS

DRAWING TITLE

General_Arrangement

DRAWING REFERENCE

180389 | DGL | 01 | 00 | DR | A | 2000

INITIAL ISSUE DATE

19/10/2020

INITIAL ISSUE BY

DK

INITIAL CHECKED BY

TM

GFA

896 m²

SUITABILITY

S0

Initial Status

SCALE

As indicated

SHEET

A1

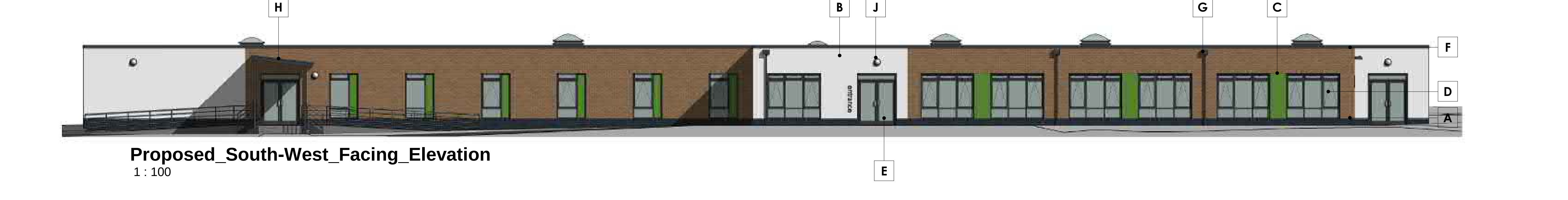
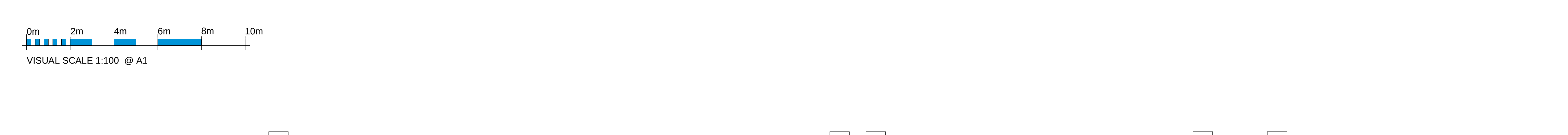
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P5

STATUS CODE

STATUS DESCRIPTION

Connell Co-op College

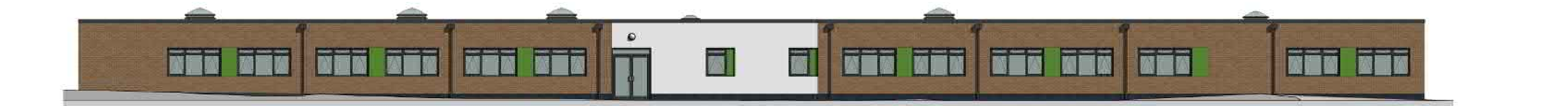


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1 : 100

Proposed_North-West_Facing_Elevation
1 : 100



Proposed_North-West_Facing_Elevation
1 : 100



Proposed_North-East_Facing_Elevation
1 : 100

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DRAWING TITLE									
Elevations									
DRAWING REFERENCE									
180389	DGL	01	ZZ	DR	A	2100			
PROJECT	ORIGINATOR	VOLUME	LEVEL	TYPE	ROLE	NUMBER			
INITIAL ISSUE DATE		INITIAL ISSUE BY		INITIAL CHECKED BY		GIFA			
19/10/2020		DK		TM		896 m ²			
SUITABILITY				SCALE		SHEET		REV	
Initial Status				As indicated		A1		P2	
S0		STATUS DESCRIPTION							

17.3 Appendix 3 – Environmental Characteristics

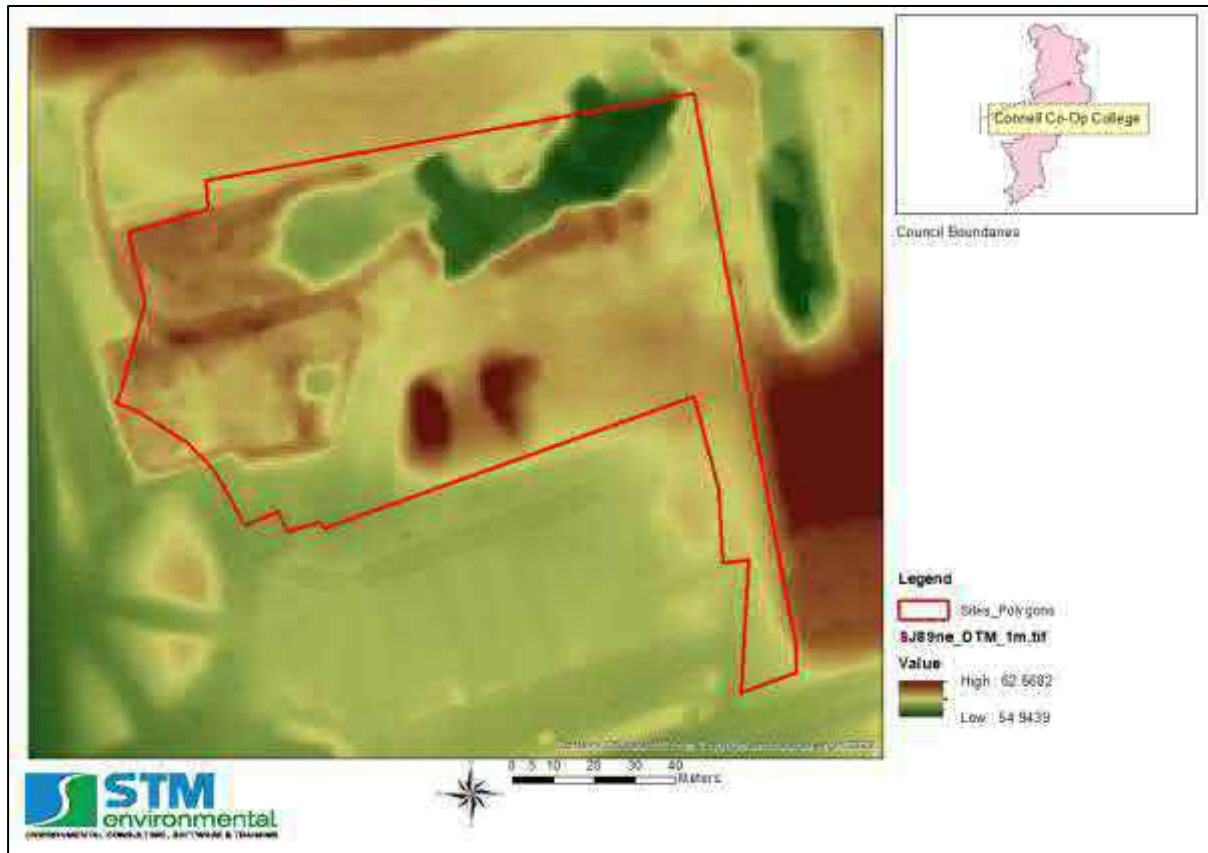
17.3.1 Superficial Hydrogeology Map



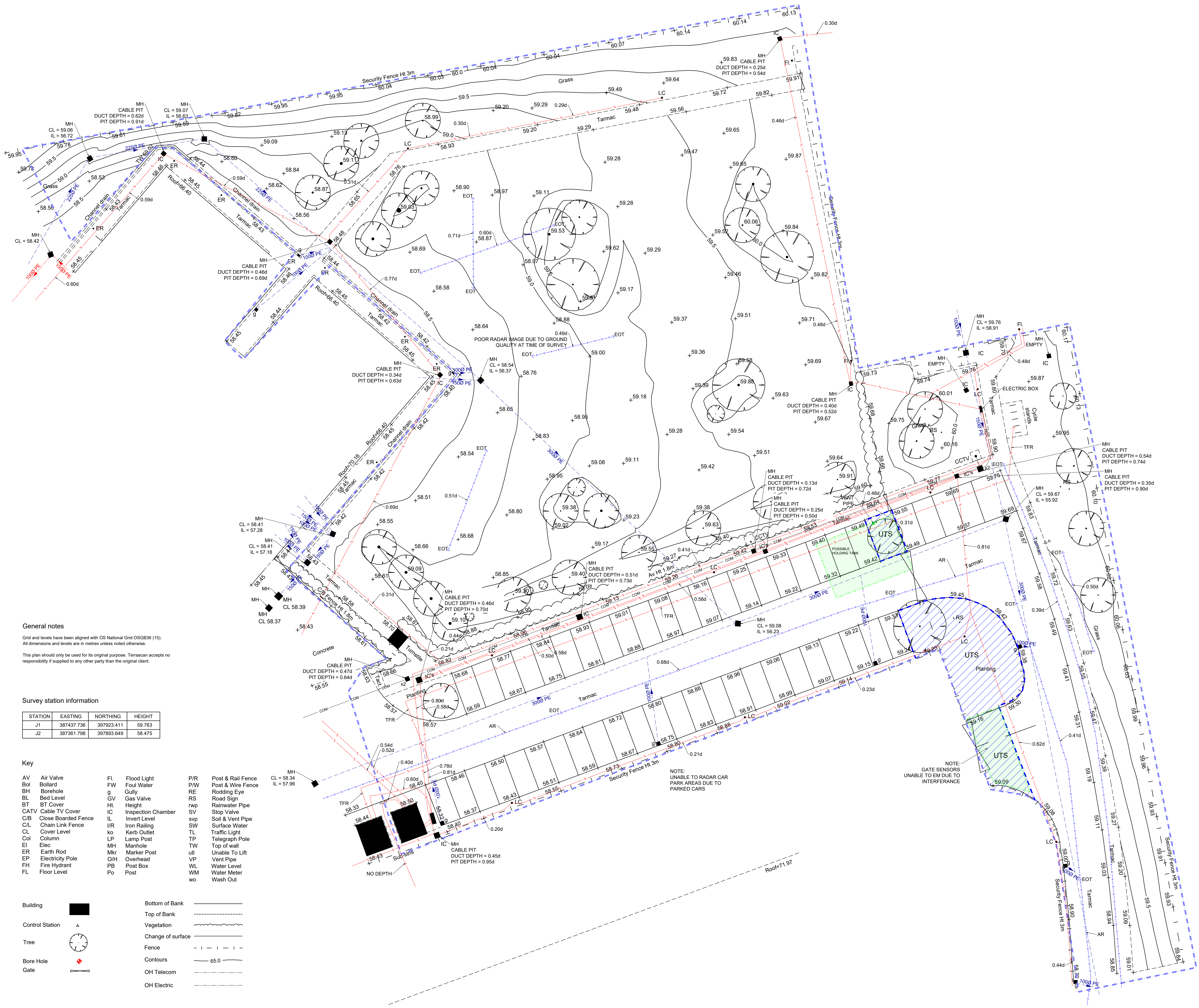
17.3.2 Bedrock Hydrogeology Map



17.3.3 Topology Map



17.3.4 Topographic Survey



General notes

Grid and levels have been aligned with OS National Grid OSG836 (15).
All dimensions and levels are in metres unless noted otherwise.

This plan should only be used for its original purpose. Terrascan accepts no responsibility if supplied to any other party than the original client.

Survey station information

STATION	EASTING	NORTHING	HEIGHT
J1	387437.736	397923.411	59.763
J2	387361.798	397893.649	58.475

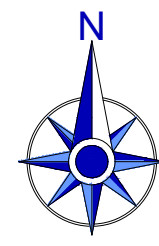
Key

AV	Air Valve	FI	Flood Light	P/R	Post & Rail Fence
Bol	Bollard	FW	Foul Water	P/W	Post & Wire Fence
BH	Borehole	g	Gully	RE	Rodding Eye
BL	Bed Level	GV	Gas Valve	RS	Road Sign
BT	BT Cover	HL	Height	rwp	Rainwater Pipe
CATV	Cable TV Cover	IC	Inspection Chamber	SV	Stop Valve
C/B	Close Boarded Fence	IL	Invert Level	svp	Soil & Vent Pipe
CL	Chain Link Fence	I/R	Iron Railing	SW	Surface Water
CL	Cover Level	ko	Kerb Outlet	TL	Traffic Light
Col	Column	LP	Lamp Post	TP	Telegraph Pole
El	Elec	MH	Manhole	TW	Top of wall
ER	Earth Rod	Mkr	Marker Post	utl	Unable To Lift
EP	Electricity Pole	OH	Overhead	VP	Vent Pipe
FH	Fire Hydrant	PB	Post Box	WL	Water Level
FL	Floor Level	Po	Post	WM	Water Meter
		wo	Wash Out		

Building		Bottom of Bank	
Control Station		Top of Bank	
Tree		Vegetation	
Bore Hole		Change of surface	
Gate		Fence	
		Contours	
		OH Telecom	
		OH Electric	

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2. ENSURE THAT AN ADEQUATE ALLOWANCE DEPENDANT ON THE STATED SCALE IS MADE FOR THE INEVITABLE DISTORTIONS INTRODUCED BY PLOTTING/PRINTING AND COPYING PROCESSES



Sheet Diagram

UTILITIES KEY

	SURVEY BOUNDARY
	FOUL DRAINAGE
	SURFACE DRAINAGE
	COMBINED DRAINAGE
	ELECTRIC CABLE
	TELECOM CABLE
	WATER PIPE
	GAS PIPE
	CATV / CABLE TELEVISION
	COMMUNICATIONS CABLE
	TRAFFIC LIGHTS
	DUCTING
	UNIDENTIFIED
	EARTH CABLE
	PUMPING MAIN
	FUEL PIPE
	VENT PIPE
	OFFSET FILL PIPE
	VAPOUR RECOVERY
	GAUGE LINE
	RADAR TRACE
	RADAR AREA ANOMALY
	RADAR UTILITY TRACE
	RADAR UTILITY ANOMALY
	UNABLE TO SURVEY

ABBREVIATIONS

AR	-	ASSUMED ROUTE
BD	-	BACKDROP
CL	-	COVER LEVEL
CR	-	CABLE RISER
EM	-	ELECTROMAGNETIC
EOT	-	END OF TRACE
GPR	-	GROUND PENETRATING RADAR
FH	-	FIRE HYDRANT
HV	-	HIGH VOLTAGE
IL	-	INVERT LEVEL
LV	-	LOW VOLTAGE
MH	-	MANHOLE
MM	-	MONITORING WELL
NL	-	NOT LOCATED
OSA	-	OUTSIDE SURVEY AREA
PR	-	PIPE RISER
RWP	-	RAIN WATER PIPE
TFR	-	TAKEN FROM RECORDS
TP	-	TELEGRAPH POLE
UTGA	-	UNABLE TO GAIN ACCESS
UTL	-	UNABLE TO LIFT
UTR	-	UNABLE TO ROD
UTS	-	UNABLE TO SURVEY
UTT	-	UNABLE TO TRACE
VP	-	VENT PIPE
WWP	-	WASTE WATER PIPE

Rev	Details	Date	Drawn

Terrascan

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Project: Connell Co-Op College

Title: Underground Utility Survey

Scale: 1:200@A1

Job No: 03661

Date: 05.11.20

Revision: 001

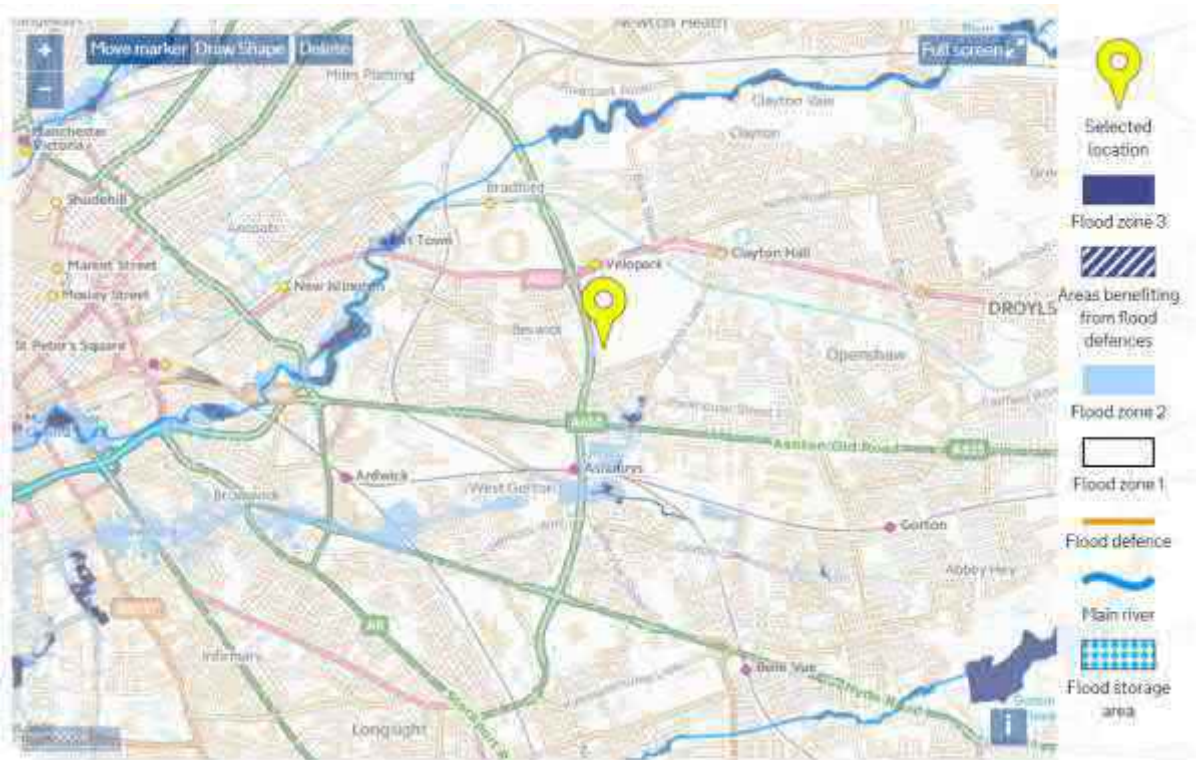
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17.4 Appendix 4 – Historical Flood Incident Maps

17.4.1 EA Historic Flood Outlines

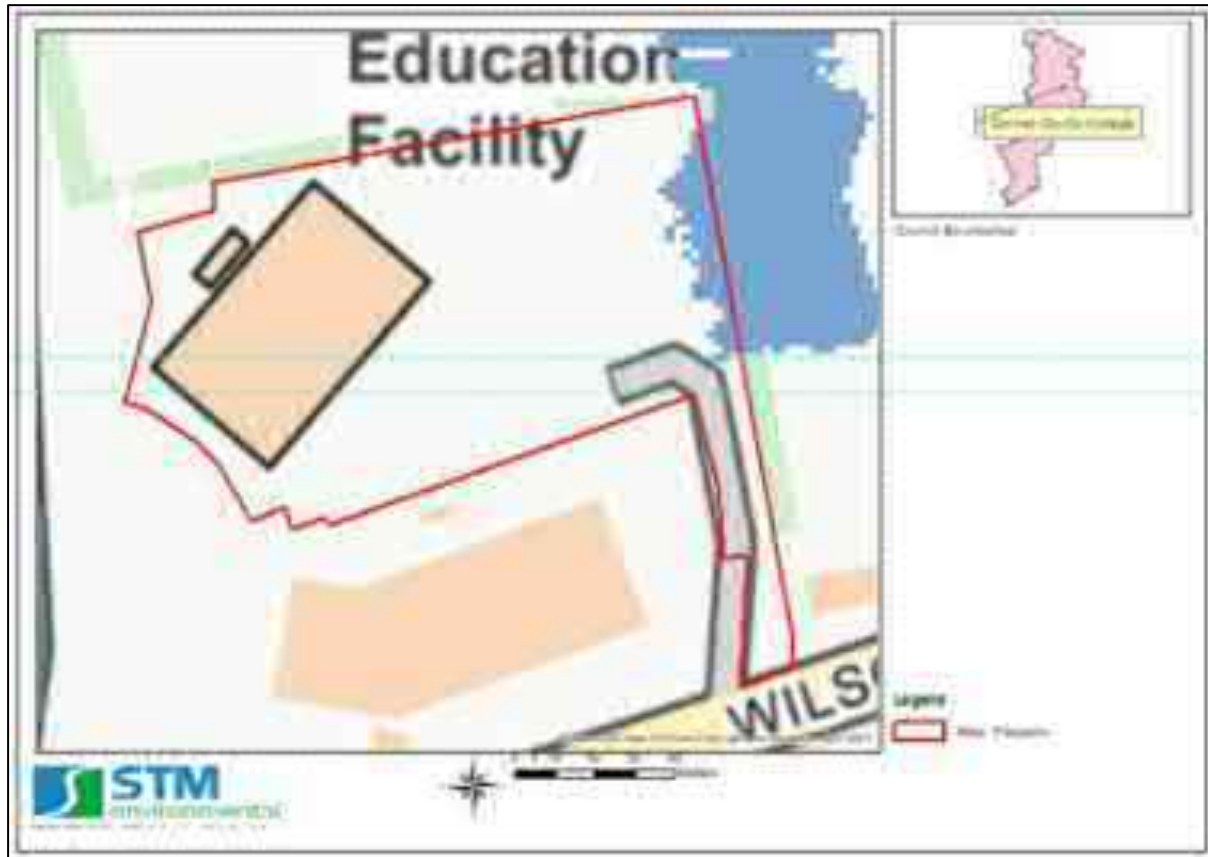
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17.5 Appendix 5 - EA Flood Zone Map

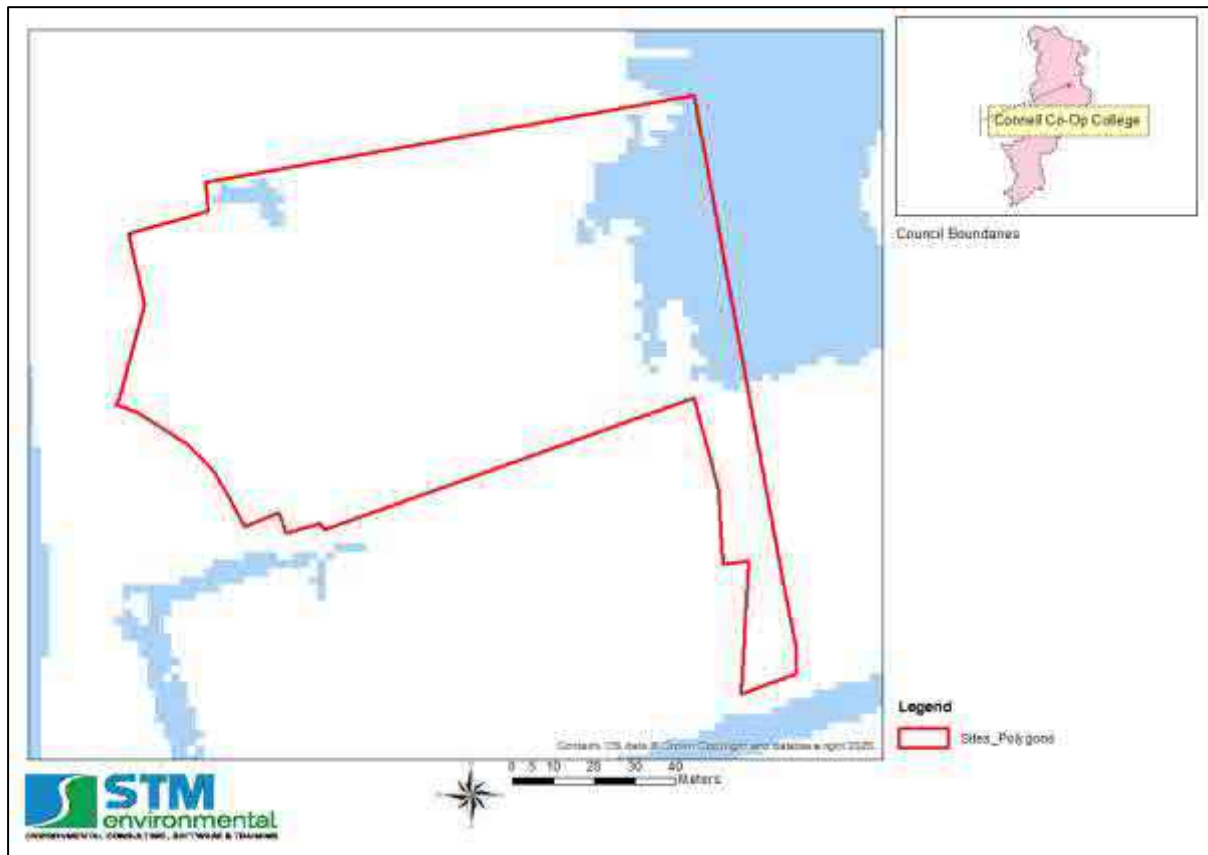


17.6 Appendix 6 – Surface Water Flood Extent and Depth Maps

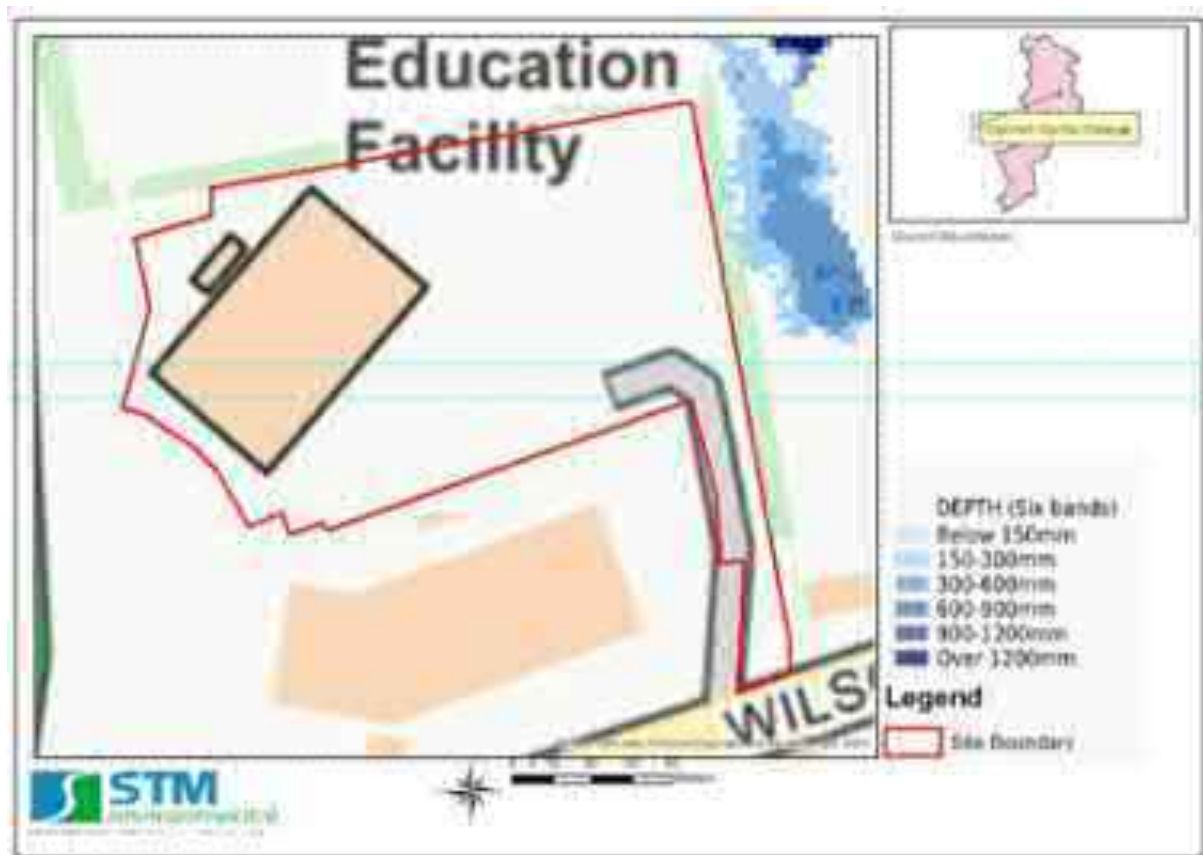
17.6.1 Map showing surface water flood extent for the 1 in 100-year rainfall return period (Source: EA, 2016).



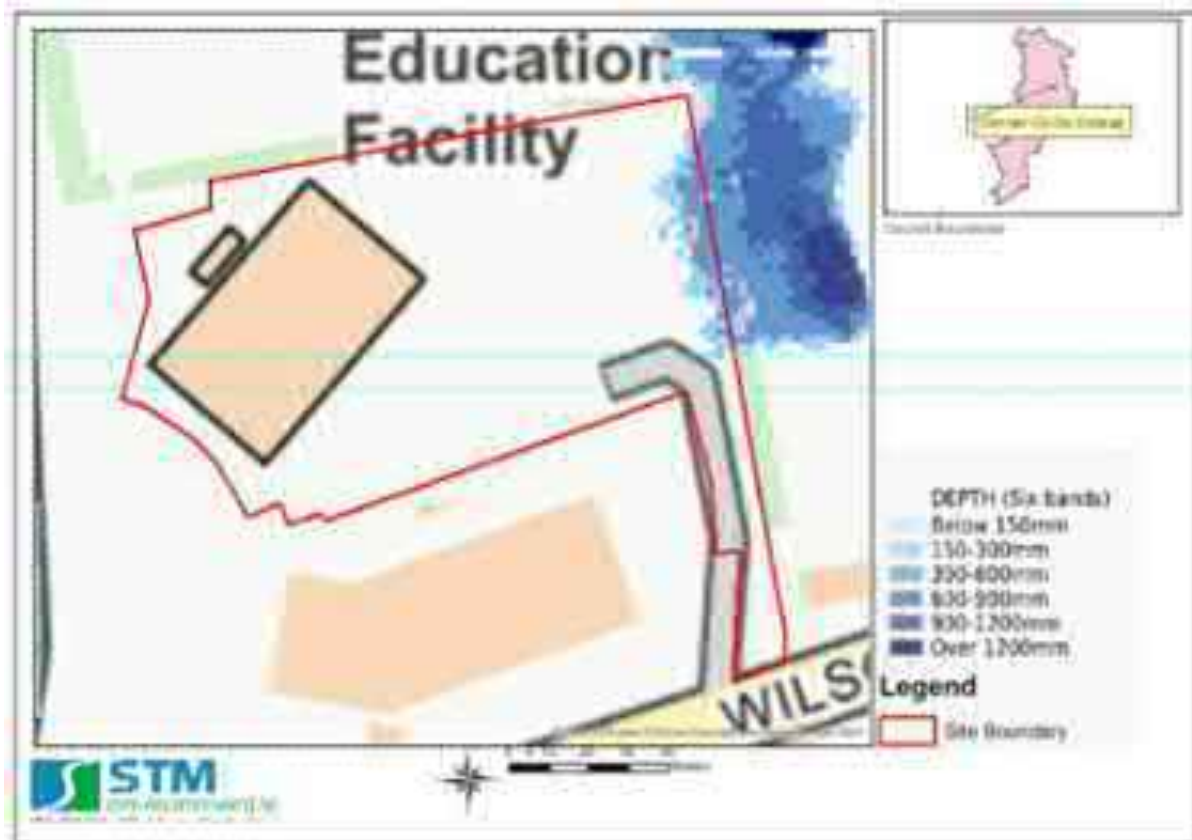
17.6.2 Map showing surface water flood extent for the 1 in 1000-year rainfall return period (Source: EA, 2016).



17.6.3 Predicted surface water flood depth for the 1 in 30-year return period (Source: EA, 2016).



17.6.4 Predicted surface water flood depth for the 1 in 100-year return period
(Source: EA, 2016).



17.6.5 Predicted surface water flood depth for the 1 in 1000-year return period
(Source: EA, 2016).



17.7 Appendix 7 –Flood Defence and Reservoir Flood Risk Maps

17.7.1 EA Map showing areas benefitting from flood defences

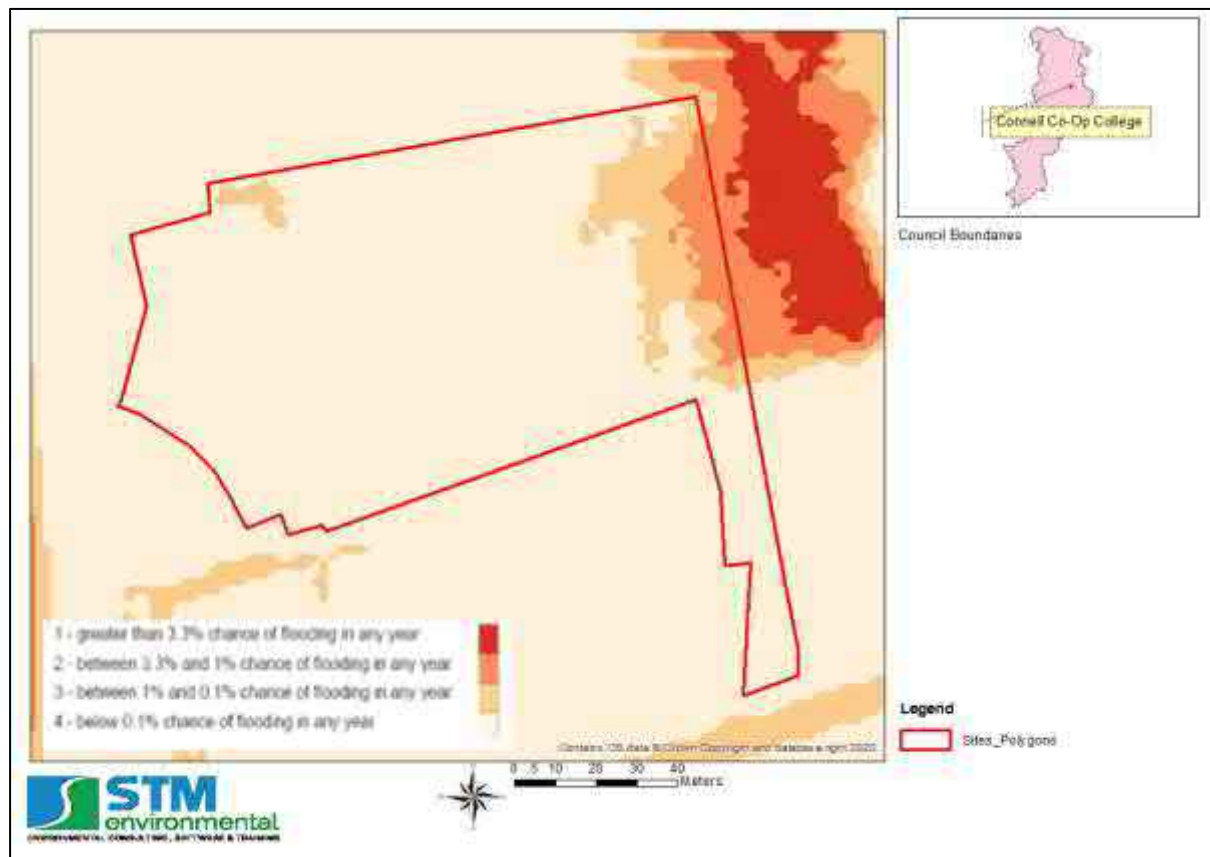
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17.7.2 Reservoir Flood Risk Map

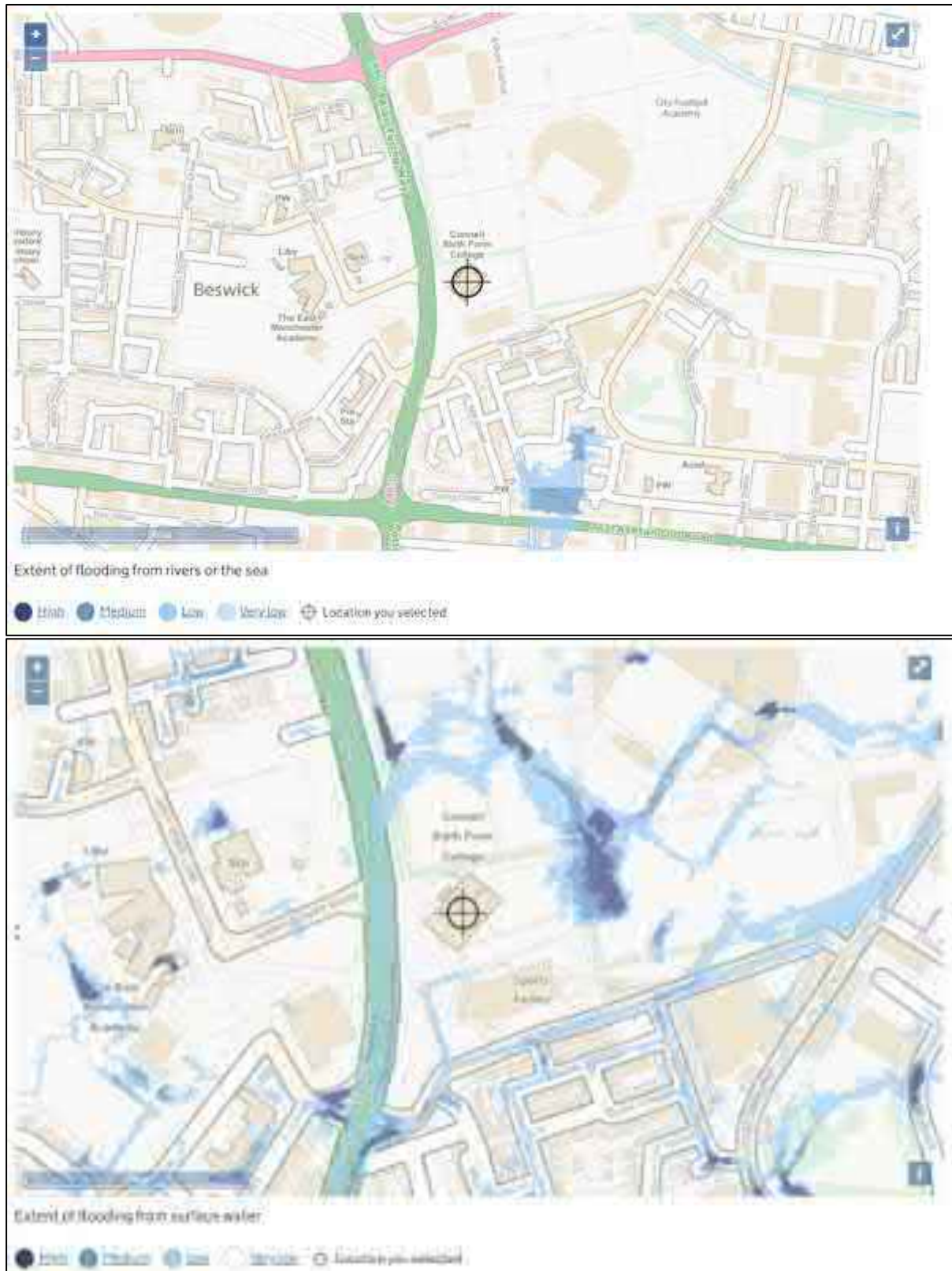
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17.8 Appendix 8 – Flood Risk Maps

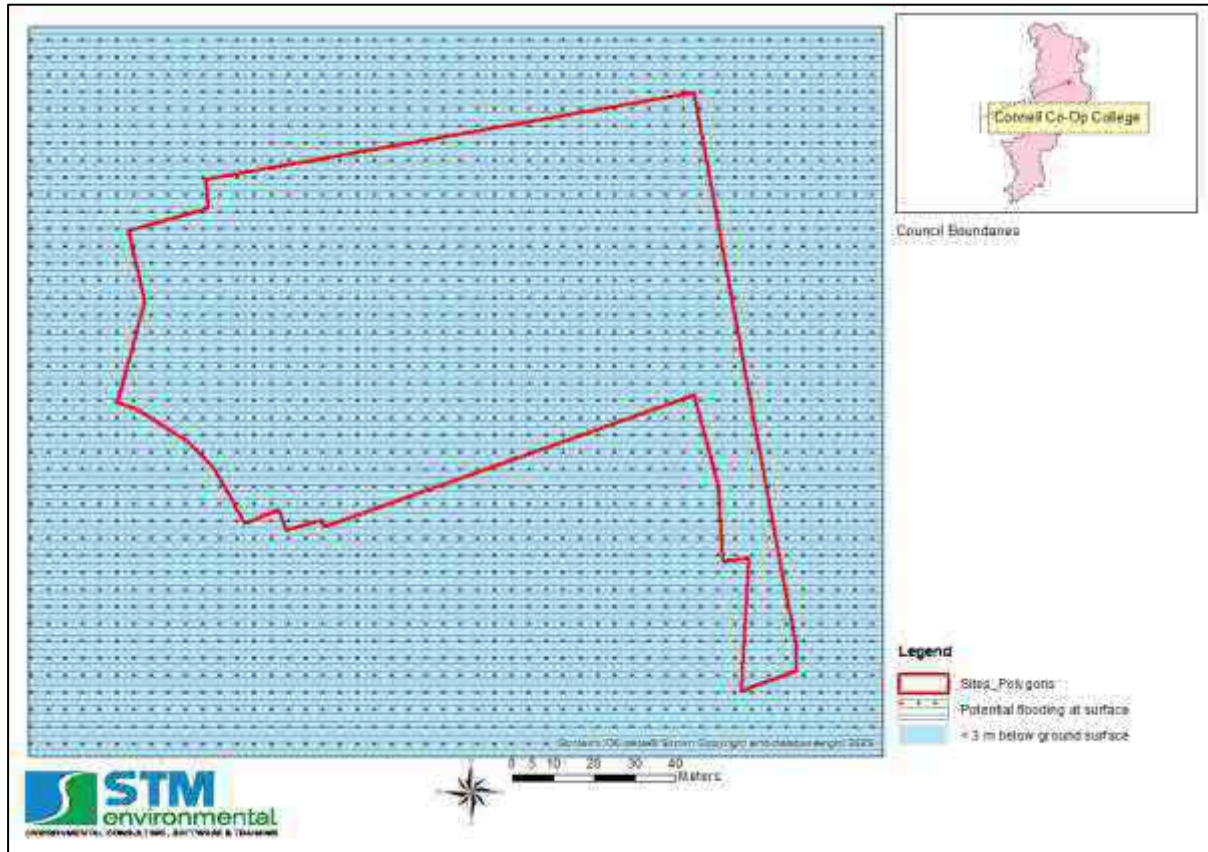
17.8.1 Risk of Flooding from Multiple Sources Map



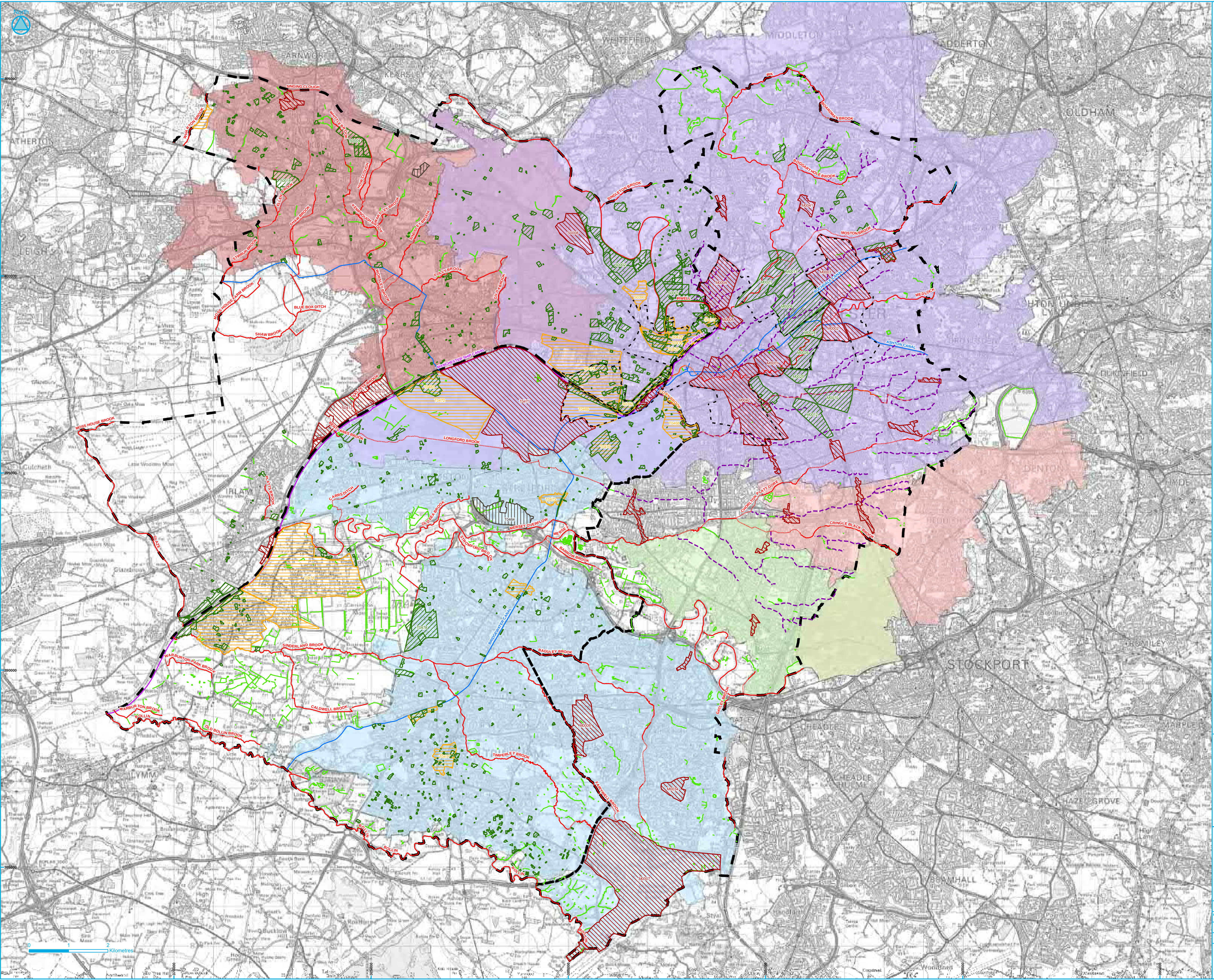
17.8.2 Long Term Flood Risk Maps



17.9 Appendix 9 – Groundwater Flood Susceptibility Map



17.10 Appendix 10 – SFRA Critical Drainage Areas Map



- Council Boundary
- - - Lost Watercourses
- Critical Drainage Areas**
- Conurbation Core
- Didsbury
- Levenshulme and Fallowfield
- Manchester and Trafford South
- Salford North West
- Main Rivers (V8.0)**
- Ashton, Bridgewater and Rochdale Canals
- Manchester Ship Canal / Grey Inwell
- Other Waterbodies
- Culverted
- Open
- Digitised River Lines**
- Culverted
- Open
- Potential Development Sites / Locations**
- Employment
- Housing
- Mixed Use
- Other
- Regional Centre Boundary

This map has been produced in accordance with PPS25: Development and Flood Risk.

Certain locations are particularly sensitive to an increase in the rate of surface water runoff and/or volume from new development. There are generally known local flooding problems associated with these areas. These areas have been defined as Critical Drainage Areas in the SFRA. Specific drainage requirements are required in these areas to help reduce local flood risk.

Chapter 5 of the Level 2 SFRA covers the flooding from surface water and sewers and how Critical Drainage Areas have been defined.

The Main River information shown in the SFRA is provided by the Environment Agency; the centreline data may deviate from that shown on basemapping due to inherent differences in data resolution. Further information on Main Rivers is provided on the Environment Agency's website. The mapping of culverted sections of watercourse is a strategic screening only based upon Ordnance Survey 1:10,000 mapping and should be confirmed for more detailed studies such as site specific Flood Risk Assessment. The canals layer does not necessarily cover all the canal arms, but the modelled overtopping/breaching and hydraulic interactions with rivers and other waterbodies is complete and accurate as appropriate for a Strategic Flood Risk Assessment.

The River Inwell between Victoria Station and Pomona Island is not shown as a Main River on the Environment Agency's Flood Map although Flood Zones related to the river are. The same approach has been taken in this SFRA.



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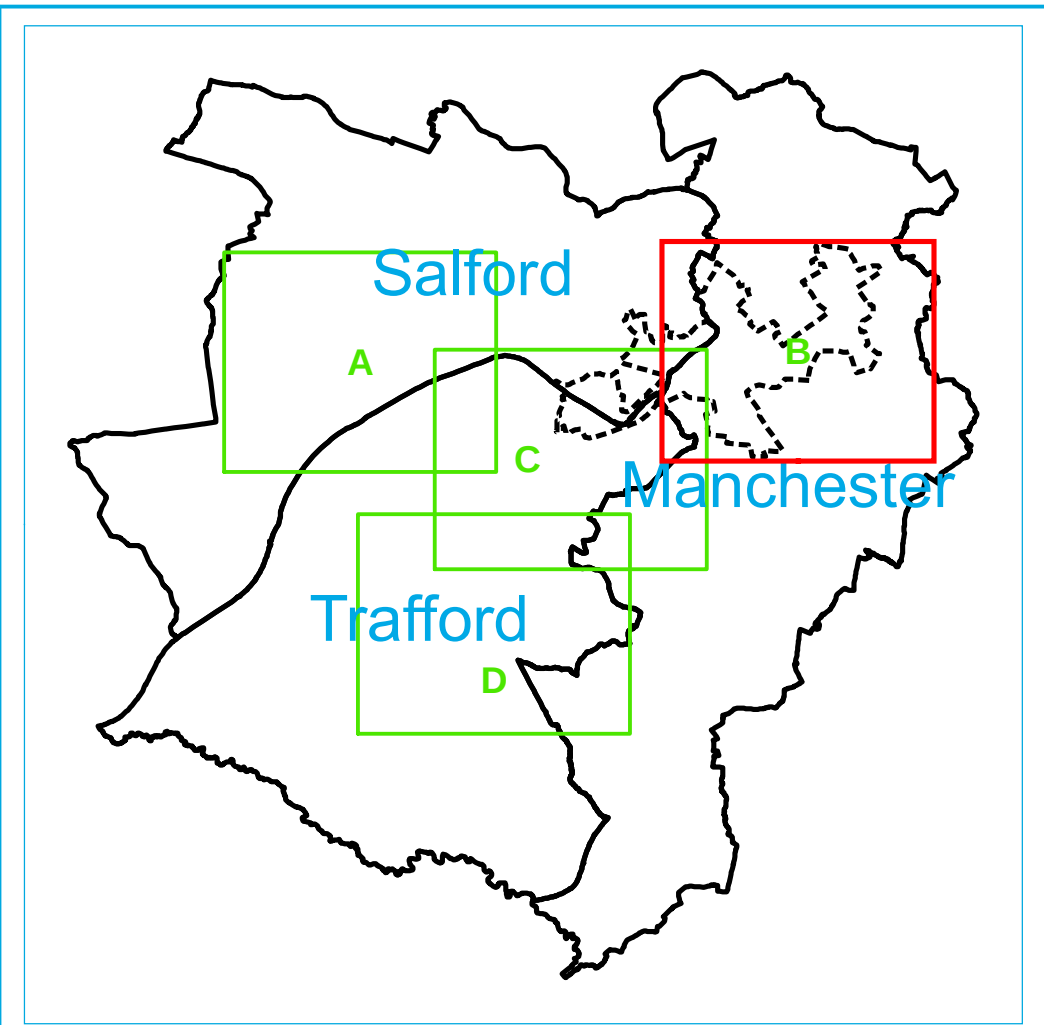
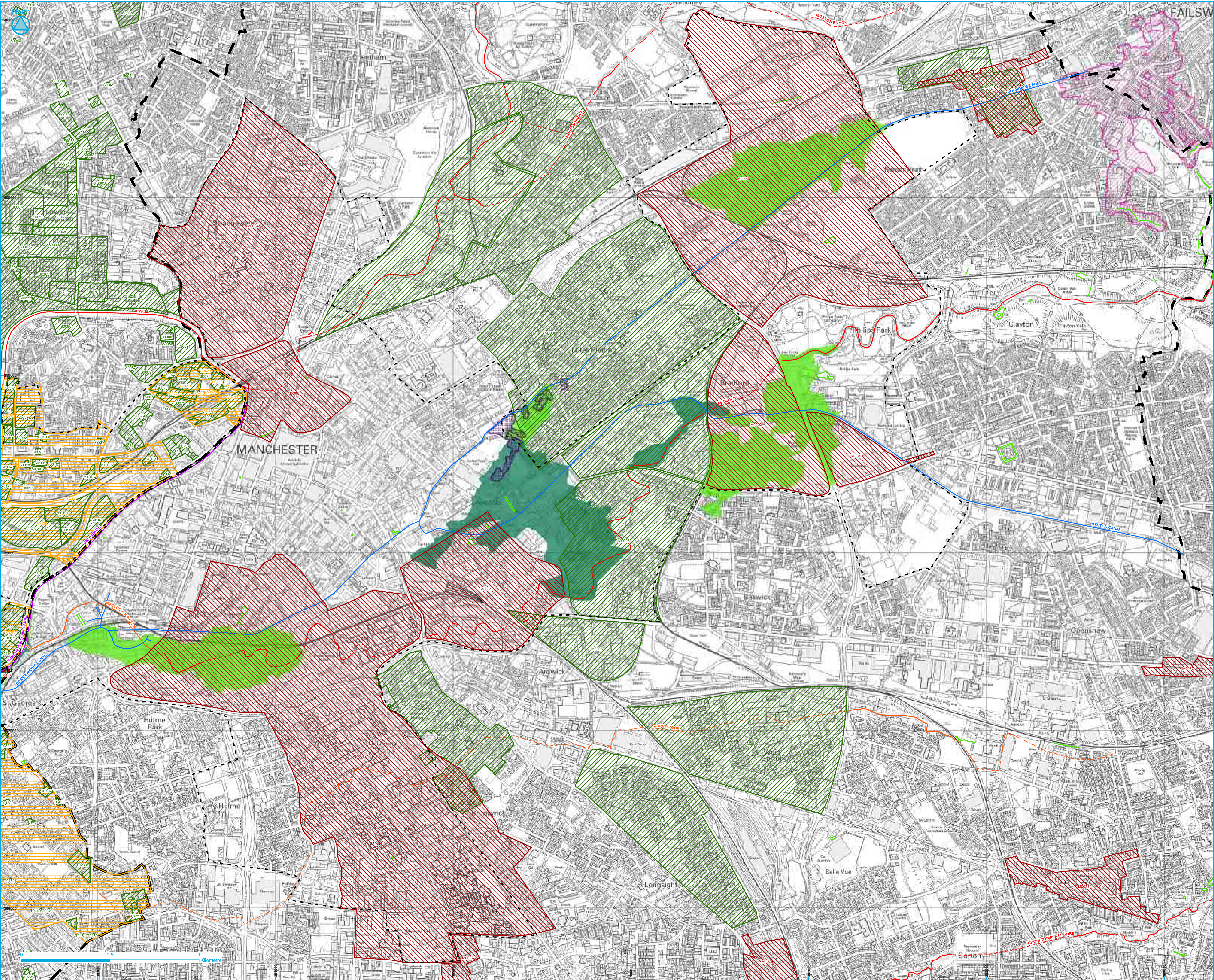
Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA

Critical Drainage Areas

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Approved by: J Cooper	Date: 01/02/2011	
File Name: ...ArcViewMapping\Level2MST_CDA_Current_V1.2.mxd		
Drawing Number: SS_4.5	Status: FINAL	Scale: 1:45,000

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17.11 Appendix 11 – Canal Breach Map



- Legend**
- Council Boundary
 - Canal Overtop Hazard Zone
 - Canal Breach Hazard Zone
 - Potential Development Sites / Locations
 - Regional Centre Boundary
 - Ashton, Bridgewater and Rochdale Canals
 - Manchester Ship Canal / Grey Inwell
 - Other Waterbodies
 - Main Rivers (V8.0)
 - Digitised River Lines
- Canal Overtop Hazard Zone**
- Canal Overtop Hazard Zone
- Canal Breach Hazard Zone**
- Canal Breach Zone A
 - Canal Breach Zone B
 - Oldham SFRA Canal Hazard Zone
- Potential Development Sites / Locations**
- Employment
 - Housing
 - Mixed Use
 - Other
- Main Rivers (V8.0)**
- Culverted
 - Open
- Digitised River Lines**
- Culverted
 - Open

This map has been produced in accordance with PPS25: Development and Flood Risk.

Two indicative "Canal Hazard Zones" have been created for the Bridgewater, Ashton and Rochdale Canals. These have been generated using broadscale 2D modelling to show areas that could potentially be affected by flooding in the event of:

- *Canal Overtop Hazard Zone
- *Canal Breach Hazard Zone

The potential breach locations / areas were sub-divided into two Canal Breach Zones:

- *Canal Breach Zone A: A walkover survey of the canal was undertaken to identify the embankments more likely to breach, based on their height and width. This zone shows those areas that would be affected by a breach of one of these embankments. In this zone a detailed examination of canal breach flood risks is required in a site specific FRA.
- *Canal Breach Zone B: Less likely breach locations, such as at wide, low or very low embankments, were identified by a walkover survey of the canal. At such locations it is more likely that this source of risk could be scoped out within any site specific FRA.

It should be noted that these outlines are based on broadscale modelling techniques and should only be taken as an indication of areas that might be at risk and inform Flood Risk Assessments. There are a number of uncertainties associated with the simulation of flooding from canals in either overtopping or breach conditions. The assumptions behind the modelling should be considered when using and reviewing the hazard zones that have been produced. Full details of the methodology used to derive Canal Hazard Zones is provided in Chapter 3 of the Level 2 SFRA and guidance on the use of the Canal Hazard Zones is provided in Chapter 3 of the SFRA User Guide.

The Canal Hazard Zone resulting in a breach from the Rochdale Canal in Oldham has also been included on the map and has been taken from the Oldham SFRA (2010). This was based on a similar broadscale methodology.

Interactions between the Bridgewater Canal and the River Medlock in Castlefield may result in overtopping of the Canal during severe weather events, as shown elsewhere in the SFRA.

For further information please see the Level 2 SFRA Chapter 3.

The Main River information shown in the SFRA is provided by the Environment Agency; the centreline data may deviate from that shown on basemapping due to inherent differences in data resolution. Further information on Main Rivers is provided on the Environment Agency's website. The mapping of culverted sections of watercourse is a strategic screening only based upon Ordnance Survey 1:10,000 mapping and should be confirmed for more detailed studies such as site specific Flood Risk Assessment. The canals layer does not necessarily cover all the canal arms, but the modelled overtopping/breaching and hydraulic interactions with rivers and other waterbodies is complete and accurate as appropriate for a Strategic Flood Risk Assessment.

The River Inwell between Victoria Station and Pomona Island is not shown as a Main River on the Environment Agency's Flood Map although Flood Zones related to the river are. The same approach has been taken in this SFRA.

The map should be considered when applying the Sequential Test and used to scope the inclusion of canal flood risk within a site specific FRA.



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for

Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA

Canal Hazard Zones

Drawn by: J Cheetham	Date: 15/03/2011	This map is based upon Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office. © Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings. Licence number: 100019558 2011.
Checked by: J Dimelow	Date: 01/02/2011	
Approved by: J Cooper	Date: 01/02/2011	
File Name: ...ArcViewMapping\Level2\MST_Canal_Hazard_V1.3.mxd		
Drawing Number: MM_3.2B	Status: FINAL	Scale: 1:10,000

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17.12 Appendix 12 – EA Product 4 Data

Detailed Flood Map centred on Alan Turing Way, Manchester, M11 3BS. Created on 08/12/2020 [GMMC195813AB]



1:10,001



Legend

-  Site Location
-  Model Measurements
-  Flood Zone 3
-  Flood Zone 2

Undertended																		
Map Reference	Model Node Reference	Easting	Northing	Data	50 % AEP (1 in 2 year)	20 % AEP (1 in 5 year)	10 % AEP (1 in 10 year)	5 % AEP (1 in 20 year)	4 % AEP (1 in 25 year)	2 % AEP (1 in 50 year)	1.33 % AEP (1 in 75 year)	1 % AEP (1 in 100 year)	1 % AEP (1 in 100 year) + 30% increase in flow	1 % AEP (1 in 100 year) + 35% increase in flow	1 % AEP (1 in 100 year) + 70% increase in flow	0.5 % AEP (1 in 200 year)	0.1 % AEP (1 in 1000 year)	0.1 % AEP (1 in 1000 year) + 30% increase in flow
1	ea013_0249_m00436	387691	396996	Modelled Water Level (m aodN)	53.17	53.24	53.28	53.31	53.34	53.44	53.50	53.55	53.64	53.66	53.80	53.68	53.97	54.04
				Modelled Flow (cumecs)	0.71	1.01	1.26	1.43	1.59	2.37	2.92	3.38	4.49	4.67	6.55	4.89	30.34	12.61
2	ea013_0249_corn7703	387313	397118	Modelled Water Level (m aodN)	49.22	49.28	49.33	49.39	49.44	49.69	49.87	49.95	50.58	50.73	50.84	50.84	50.84	50.84
				Modelled Flow (cumecs)	1.31	1.87	2.31	2.69	2.98	5.52	5.58	6.10	8.07	8.78	9.79	9.79	9.79	9.79
3	ea013_0249_corn7268	386887	397081	Modelled Water Level (m aodN)	46.01	46.11	46.19	46.25	46.31	46.57	46.80	47.05	49.54	49.61	49.61	49.66	50.23	50.63
				Modelled Flow (cumecs)	0.32	0.46	0.57	0.66	0.76	1.24	1.55	1.81	2.35	2.44	3.08	2.54	5.15	6.69

Model data taken from Corn Brook 2017 Study
AEP - Annual Exceedence Probability
m aodN - metres above ordnance datum Newlyn
cumecs - cubic metres per second

Notes:
*Climate Change Scenario - 30%, 35% and 70% increases in flow calculated for the 2080's (2070 - 2115). Please see <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances> for more information regarding the new climate change guidance. The location of the site and the type (vulnerability) of development determine the climate change allowances to consider in any flood risk assessment.