Greater Manchester Level 2 Hybrid Strategic Flood Risk Assessment – Main Report

Final Report

October 2020

www.jbaconsulting.com

GMCA GREATER MANCHESTER COMBINED AUTHORITY

ANDY BURNHAM MAYOR OF GREATER MANCHESTER

Churchgate House

56 Oxford Street

Manchester

M1 6EU

JBA Project Manager

Mike Williamson
Mersey Bank House
Barbauld Street
Warrington
Cheshire
WA1 1WA

Revision history

Revision Ref/Date	Amendments	Issued to
P01/March 2020		Alex McDyre
P02/October 2020	GMCA comments addressed	Alex McDyre

Contract

This report describes work commissioned by David Hodcroft, on behalf of the Greater Manchester Combined Authority, by email dated 26 June 2019. The Greater Manchester Combined Authority representative for the contract was Alex McDyre. Jack Pordham and Mike Williamson of JBA Consulting carried out this work.

Prepared by ..... Jack Pordham BSc MA

Analyst

Reviewed by ..... Mike Williamson BSc MSc CGeog FRGS EADA

Principal Flood Risk Analyst

Approved by ..... Howard Keeble MPhil BEng BSc CertBusStud CEng CEnv CSci MICE MCIWEM C.WEM

Technical Director

Purpose

This document has been prepared as a Final Report for the Greater Manchester Combined Authority. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to the Greater Manchester Combined Authority.

Acknowledgements

JBA thanks representatives of the Greater Manchester Combined Authority, the Environment Agency, all ten Greater Manchester District Councils and United Utilities for information provided to inform this assessment.

Carbon footprint

A printed copy of the main text in this document will result in a carbon footprint of 66g if 100% post-consumer recycled paper is used and 84g if primary-source paper is used. These figures assume the report is printed in black and white on A4 paper and in duplex.

JBA is aiming to reduce its per capita carbon emissions.

Abbreviations

ABD	Area Benefitting from Defences
AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
CAM	Condition Assessment Manual
CC	Climate change
CDA	Critical Drainage Area
CRT	Canal & River Trust
DRN	Detailed River Network
DTM	Digital Terrain Model
EA	Environment Agency
FAA	Flood Alert Area
FEH	Flood Estimation Handbook
FMfP	Flood Map for Planning
FRA	Flood Risk Assessment
FRCC-PPG	Flood Risk and Coastal Change - Planning Practice Guidance
FSA	Flood Storage Area
FWA	Flood Warning Area
GM	Greater Manchester
GMCA	Greater Manchester Combined Authority
GMSF	Greater Manchester Spatial Framework
HFM	Historic Flood Map
LIDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
MSC	Manchester Ship Canal
NFM	Natural Flood Management
NPPF	National Planning Policy Framework

OAFCDM	Opportunity Areas for Further Critical Drainage Management
OS	Ordnance Survey
RFM	Reservoir Flood Map
RFO	Recorded Flood Outline
RoFRS	Risk of Flooding from Rivers and Sea
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage System
UKCP09	UK Climate Change Projections 2009
UKCP18	UK Climate Change Projections 2018
UU	United Utilities
WwNP	Working with Natural Processes

Contents

Appendices

List of Tables

1 Introduction

The requirement was to prepare a Level 2 'Hybrid' Strategic Flood Risk Assessment (SFRA) for the Greater Manchester Combined Authority (GMCA). The SFRA must comply with the latest National Planning Policy Framework[1] (NPPF), revised in June 2019, and the latest Flood Risk and Coastal Change Planning Practice Guidance[2] (FRCC-PPG), published March 2014.

The SFRA is to support the Greater Manchester Spatial Framework (GMSF) which is being produced by the GMCA on behalf of the 10 local authorities of Greater Manchester.

This Level 2 SFRA aligns closely with the GMSF and will help guide policy making in the GMSF to assist in achieving sustainable development across Greater Manchester.

This Level 2 study follows on from the GMCA Level 1 SFRA (2019). The Level 1 SFRA helped identify high risk sites to be assessed through this Level 2 SFRA, and the GMCA Strategic Flood Risk Management Framework (2019). The Framework helped provide a broad spatial framework for flood risk management across Greater Manchester, highlighting the key strategic flood risks and recommending key priorities for intervention.

This report is the front-end main Level 2 SFRA report. It is intended to tie together all facets of the GMCA Level 2 SFRA into a short concise document.

---

[1] National Planning Policy Framework

[2] Flood Risk and Coastal Change Planning Practice Guidance

Overall, there are five separate components of the Level 2 SFRA, encompassing:

1. 56 individual Level 2 site screening assessment reports for 52 residential land supply sites and five GMSF allocations,
2. Broadscale fluvial modelling of nine GMSF allocations,
3. Broad flood risk reviews of 14 large GMSF strategic sites,
4. Identification of possible opportunity areas for flood management,
5. Defining of methodology for the future update of existing GM Critical Drainage Area (CDA) boundaries.

The outcomes from each component are summarised in this report and the main documents for each component are stored within the Appendices.

1.1 Objectives

The overarching objective of the project is to prepare a Level 2 SFRA for Greater Manchester to complete the evidence base that complies with the NPPF to support the GMSF.

In accordance with the NPPF and based on the GMCA's requirements stated in the Project Brief document, the key objectives of this Level 2 Hybrid SFRA are to:

- Demonstrate whether the second part of the Exception Test (part b) can be passed for the 56 potential development sites. This should be through detailed assessment of flood risk for multiple modelled exceedance probability events both now and in the future. Taking account of climate change using the EA's latest allowances on peak river flows (February 2016 at the time of writing),
- Carry out modelling of the latest climate change allowances where this information is not available from existing EA models,
- Document residual risk, including from reservoirs, canals and possible defence failure in the future,
- Provide site-specific advice on mitigation options. For example:

- developable / non-developable areas;
- blue / green infrastructure and open spaces;
- maintenance of fluvial and / or surface water flow routes;
- land raising and compensatory storage; and
- advice on likely minimum finished floor levels,

- Provide site-specific surface water flood risk screening / drainage calculations including:
  - recommendations on the requirements for drainage control;
  - surface water runoff rates and impact mitigation, including Sustainable Drainage Systems (SuDS); and
  - design solutions that could reduce flood risk,
- Assess existing flood warning, emergency planning procedures and safety of site access and egress routes in times of flood,
- Provide recommendations for additional and future works required following on from or to supplement the Level 2 SFRA. For example:
  - further fluvial and/or surface water modelling,
  - residual risk modelling (culvert blockages, defence breaches),
  - modelling of site layout/design options including provisions for safe access and egress routes,
  - development optioneering (land raising, compensatory storage,
  - flow routes/rates),
  - drainage strategies,
  - site-specific Flood Risk Assessment (FRA) requirements,
- Assess any catchment-wide or strategic solutions. For example upstream opportunity areas for flood management (storage solutions) to mitigate against the risk of flooding downstream and elsewhere,
- Assess the potential effects from Natural Flood Management (NFM) and Working with Natural Processes (WwNP) schemes on mitigating flood risk,

- Carry out broadscale 2D fluvial modelling for the nine GMSF allocations which contain unmodelled watercourses, including for climate change,
- Develop methodology for future updates to Greater Manchester CDAs using the most up-to-date available data.
- Develop recommendations for surface water management through the development planning system and policy approach for local plans.

2 Level 2 SFRA

The aim of a Level 2 study is to build on the findings of the Level 1 assessment, focussing on high-risk communities or sites. This allows the SFRA to be time efficient using detailed modelling techniques only where they are required.

These locations usually include significant development and regeneration areas that are at higher risk from:

- main rivers,
- ordinary watercourses or
- surface water.

Flood risk data such as:

- modelled flood extents,
- modelled depths,
- modelled velocities, and
- modelled hazards

are used to assess the sustainability of these areas, appropriate mitigation techniques and achievable site layouts.

This detailed information should:

- support further application of the Sequential Test,
- identify whether sites will pass the Exception Test at the site-specific FRA stage, where applicable, and
- allow for flood risk indicators to be produced for use in the Sustainability Appraisal.

In August 2019, the Environment Agency (EA) updated its online guidance on how local planning authorities (LPAs) should be preparing SFRAs. The

commission of this Level 2 SFRA in June 2019 predates the release of this updated guidance. Therefore, there are certain aspects that may not be fully covered such as an accompanying user guide document.

In summary, the updated EA guidance states that a Level 2 SFRA should:

- be published online,
- include detailed flood risk maps showing all flood sources (including modelled depth and hazard information),
- include a supporting report and a user guide,
- be detailed enough to identify which development allocation sites have the least risk of flooding,
- contain the information needed to apply the exception test, if relevant, and
- inform on whether development can be made safe without increasing flood risk elsewhere.

2.1 The Exception Test

The FRCC-PPG states:

In considering an allocation in a Local Plan a level 2 Strategic Flood Risk Assessment should inform consideration of the second part of the Exception Test. (FRCC-PPG para 025).

The NPPF sets out the Exception Test as follows:

The application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage.

For the exception test to be passed it should be demonstrated that:

a) *the development would provide wider sustainability benefits to the community that outweigh the flood risk; and*

b) *the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

Both elements of the exception test should be satisfied for development to be allocated or permitted. (NPPF paras 160 and 161).

The Exception Test is a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.

Essentially, the 2 parts to the Test require proposed development to show that it will provide wider sustainability benefits to the community that outweigh flood risk, and that it will be safe for its lifetime. Without increasing flood risk elsewhere and where possible reduce flood risk overall. (FRCC-PPG para 023).

It is demonstrated that part a) of the Exception Test is satisfied through the Flood Risk and Water Management Topic Paper. At the time of writing, this paper is due to be published as evidence to support the GMSF.

This Level 2 SFRA therefore assesses whether each site can pass part b) of the Exception Test at the FRA stage. It does this by providing further, more detailed, site-specific assessments based on the latest EA flood modelling and information. Several EA models were used in producing this Level 2 SFRA, a list of which is provided in in Appendix A.

2.2 Level 2 site screening assessments

56 individual tabular Level 2 site screening reports have been produced. Each report summarises the detailed site-specific information required to inform the Exception Test.

Each report concludes with a statement on the likelihood of the site passing the Exception Test at the FRA stage. They also provide recommendations on further work that may be required to further inform this statement.

Each Level 2 site screening report includes the following:

- redline site boundary location plans overlain with the EA's Flood Map for Planning (FMfP),
- flood defences,
- Detailed River Network (DRN),
- EA's national Risk of Flooding from Surface Water (RoFSW) map,
- EA modelled flood outlines, including for climate change, where available,
- details of existing onsite and offsite land use and topography,
- assessment of modelled flood depths and hazards for existing and long term (through climate change) fluvial risk,

- assessment of surface water flood depths and hazards using national mapping,
- indicative vehicular and pedestrian site access and egress points in times of flood,
- details of any available flooding history,
- details of existing flood defence infrastructure and information on any existing flood warning arrangements,
- details of any land within NFM/WwNP areas or nearby opportunity areas for flood management, as defined in this Level 2 SFRA,
- summary of mitigation options and site suitability based on fluvial and surface water risk and also any residual risk,
- details on any possible or known groundwater flood risk,
- assessment of any residual risk from reservoirs and canals,
- details of greenfield runoff rates and targeted rates for new development,
- estimated developable/impermeable areas based on provisional layout or an agreed preliminary development area percentage,
- quantify typical runoff and attenuation requirements for a range of design events,
- options for managing surface water runoff and exceedance flows,
- opportunities for SuDS and identification of appropriate areas of the site for attenuation,
- statement on likelihood of the site passing the second part of the Exception Test at the FRA stage,
- summary of recommendations for further investigative work or mitigation and FRA requirements.

JBA has developed its own groundwater map which can be used to assess groundwater flood risk. It uses a modelling approach which calculates the

maximum position of the groundwater table during flood conditions. This considers spatial variations in:

- aquifer storage properties,
- groundwater recharge volumes,
- topography, and
- groundwater levels in typical winter conditions.

JBA has also developed a surface water flood map for climate change, using the same methodology as used for the national surface water flood map.

These datasets were not available in time to be incorporated within this Level 2 SFRA. However, any updates to the Level 2 SFRA should account for this information, along with any other new or updated flood risk data, policy or legislation.

All 56 Level 2 SFRA site screening assessment reports are provided in Appendix A. Also provided in Appendix A1 is a sites summary document which summarises, for each site:

- The key risks,
- The main barriers to development and/or passing the Exception Test,
- Overall recommendation on whether development should proceed and whether it can pass the second part of the Exception Test, and
- Further work required and recommended next steps following EA, LLFA and LPA consultation.

Appendix A2 includes a table stating how the names and references of the allocations has evolved over time since the inception of the Level 2 SFRA in 2019. The reader should consult this table when reading this Level 2 SFRA alongside any other more recent GMSF documentation.

3 Broadscale fluvial modelling

Of the GMSF allocations, nine are situated near watercourses or contain watercourses within the site boundaries that have not been modelled by the EA or LLFA. These watercourses can be Main River or Ordinary Watercourse. For these allocations, it was necessary to build new river models containing sufficient detail to map the flood hazard and risk across each site. This provides a high-level indication of risk and inform the Exception Test.

For each allocation, based on our knowledge gained from the Level 1 SFRA, fluvial modelling was required for the watercourses listed in Table 3-1Table 3-1 below.

Allocation	Unmodelled watercourse	Modelling approach	Length of watercourse (km) to be modelled	Number of structures to be modelled
Northern Gateway	Castle Brook (Main River)	New model build	14.5	32
	Brightley Brook (Main River/Ordinary Watercourse)			
	Upper reaches of Whittle Brook (Ordinary Watercourse)			
Woodhouses Cluster	Lord's Brook (Main River)	New model build	2.25	2
	Ordinary watercourse – tributary of River Medlock	New model build		
Land East of Boothstown	Shaw Brook (Main River)	Existing Shaw Brook model is old (2009) and 1D only.	3.47	9

Allocation	Unmodelled watercourse	Modelling approach	Length of watercourse (km) to be modelled	Number of structures to be modelled
	Tributaries of Shaw Brook (Ordinary Watercourses)	Therefore, a new build model of Shaw Brook and its relevant tributaries was undertaken		
High Lane	Unnamed Main River (Watercourse code – HISH)	New model build	1.48	4
Woodford Aerodrome	Tributaries of the River Dean and Red Brook (Ordinary Watercourses)	New model build	1.98	2
South of Hyde	Unnamed Main River (watercourse code – BOWL) – tributary of River Tame	New model build, with downstream boundary from Tame model	2.49	2
	Unnamed Ordinary Watercourse – tributary of River Tame	As above – both these models were combined in 2D as they use the same floodplain. LIDAR was not available for this site therefore a detailed drone survey was carried out in order to build the 2D domain		
Land South of Pennington	Carr Brook (Main River)	Existing Carr Brook model is old (2008) and 1D only. Therefore, a new build model of Carr Brook was undertaken	4.33	6
	Ordinary watercourses / drains	New model build		

Allocation	Unmodelled watercourse	Modelling approach	Length of watercourse (km) to be modelled	Number of structures to be modelled
North of Mosley Common	Honksford Brook (Main River) – upper reaches	New model build	4.23	5
	Several tributaries of Honksford Brook (Ordinary Watercourses)			
Elton Reservoir Area	Crows Tree Brook (Main River) – tributary of River Irwell	New model build, with downstream boundary from River Irwell model	11.92	19
	Several reservoirs / watercourses; inflows from and outflows to several ordinary watercourses	New model build		

Table 3-1 Allocations, unmodelled watercourses and modelled approach

3.1 Modelling approach

Due to time constraints associated with the GMSF programme, a broadscale 2D modelling approach using a Digital Terrain Model (DTM) was used. This provided a rapid yet informed assessment of fluvial flood risk at each allocation listed in Table 3-1. JBA's in-house JFlow modelling software was used to carry out the modelling.

JFlow is designed for efficient modelling of shallow flows over large areas. This includes:

- simulating the routing of water from out-of-bank fluvial flows,
- surface water flooding,
- rising groundwater levels,
- reservoir failures and

- defence overtopping.

The overall methodology and modelling approach using JFlow is accepted by the EA. It has previously been used to update the FMfP for many locations across England. The modelling approach used for this Level 2 SFRA would not be appropriate for detailed site-specific FRAs, however.

The advantages of using JFlow over more detailed 1D-2D linked modelling include:

- rapid, high efficiency simulations,
- reduced post-processing times of modelled outputs,
- subsequent reduced modelling costs,
- reduced costs of surveys.

The broadscale modelling approach makes a generalised assumption about the capacity of a watercourse. However, it does route excess flows across a similar discretised 2D model surface grid to that of a detailed model. A key difference between the broadscale approach and the detailed modelling is that the river channels and structures are not modelled using detailed survey methods. However, general walkover surveys were carried out, where possible, to take broad measurements of structures such as:

- culvert inlets and outlets,
- weirs and
- bridges.

General assumptions were made where access to certain structures was restricted due to:

- landowners not granting access permissions,
- the presence of overgrown vegetation, and
- safety issues with gaining access to the banks of certain watercourses.

Although the JFlow modelling approach is broadscale and simplified; detailed hydrological assessments were undertaken to calculate the model inflows. Detailed hydrological inputs were required due to the fact that many of the catchment areas for the unmodelled watercourses are comparatively small. Careful consideration of catchment boundaries was required in order to limit any inaccuracies. This could have resulted in proportionally large errors in flows, therefore precluding a simplified hydrological approach.

Given the limitations discussed above, and where a channel has variable capacity and flooding is structurally controlled, more detailed modelling is recommended, certainly at the FRA stage. More detailed modelling is highly recommended for GMSF allocations:

- 'Land East of Boothstown',
- 'Land South of Pennington' and
- 'Elton Reservoir'.

Appendix C includes nine short modelling reports, one for each GMSF allocation. They summarise:

- site-specific modelling approaches,
- assumptions on modelled structures, and
- limitations of the modelling.

Modelled outputs include fluvial flood extents, depths, hazards and velocities, enabling an informed overview of risk to the allocations.

Appendix B includes individual high level flood risk review reports of all nine allocations listed in Table 3-1. Also, with a further five GMSF allocations, as requested in the project brief. The modelling also accounts for climate change using the EA's latest allowances (updated February 2019), at the time of writing,

for peak water levels[3]. These allowances were the most up to date allowances available during the preparation of the Level 2 SFRA.

[3] Environment Agency Climate Change Allowances

4 Opportunity Areas for Flood Management

The NPPF para 157 states that local plans should look to safeguard land from development that is required, or likely to be required, for current or future flood management.

The GMCA Level 1 SFRA (2019) included a high-level screening assessment of the EA's WwNP dataset against thousands of potential development sites provided by the GM district councils. This was to flag up any areas where further investigation should be carried out to assess whether there may be benefits to safeguarding such sites for flood management. The Level 2 SFRA sites screening assessments investigated this further. Please refer to the individual Level 2 reports in Appendix A for site-specific information regarding WwNP.

The project brief requested that the Level 2 SFRA should identify broad opportunity areas for flood management, including natural flood management techniques across Greater Manchester. The methodology and results of this assessment can be viewed in Appendix D.

42 areas within Flood Zone 2 have been proposed that provide a high-level indication of areas the district councils may wish to consider for flood storage rather than development. As well as being in Flood Zone 2, other criteria used to identify opportunity areas included:

- current land use,
- hectarage, and
- the presence of downstream or nearby communities that may potentially benefit.

Identifying areas to formally safeguard for flood storage through local plans is not a straightforward process. Hence why the Level 2 SFRA has identified 'opportunity' areas rather than 'safeguarded' areas.

The broad-brush approach applied in this Level 2 SFRA will require further investigation. This will be to understand the potential storage volumes available and the associated construction costs before any opportunity area could be considered viable for safeguarding. Subsequently, any safeguarding of land or generation of any viable storage schemes would be in the longer term.

The EA states that the best sites for flood storage are areas of open land close to watercourses that are not currently floodplain. It is difficult however, at this stage, to identify such sites. This is because there is a requirement to understand the difference in ground levels between the site and the watercourse. Therefore, the volume of excavation required to generate effective storage would need to be calculated.

It was not possible to do this at the GM-wide scale for this Level 2 SFRA. It should therefore be considered that there may be several other areas suitable for flood storage that have not been identified.

Appendix D contains a short summary report outlining the methodology used to identify the opportunity areas and a number of maps showing the locations and boundaries of the proposed opportunity areas.

To reiterate what has been discussed above, the opportunity areas are not, at this stage, recommended for formal safeguarding. They are opportunity areas for the local authorities to assess in further detail through the local plan development process.

5 Critical Drainage Areas

At the time of writing, eight of the ten GM local authorities have CDAs defined from previous SFRAs (Stockport and Bolton have no defined CDAs at the time of writing). The CDAs were defined for the district council's own uses to impose more stringent guidelines on surface water runoff restrictions on new development. However, the CDA boundaries date back to between 2009-2011 and therefore require possible revision using more up-to-date and robust datasets.

Not to be confused with Areas with Critical Drainage Problems (ACDP) which are identified by the EA. The Development Management Procedure Order (2015) requires that the EA is consulted on all developments within ACDPs. CDAs are designated by local authorities to highlight areas at significant surface water risk wherein any new development is required to meet tighter controls on surface water and runoff.

The GM Level 1 SFRA (2019) produced 'Opportunity Areas for Further Critical Drainage Management' (OAFCDM) as a first step towards updating the CDAs. This used:

- historic surface water and sewer flooding records held by the local authorities and United Utilities (UU);
- the surface water flooding hotspots dataset, developed through the GM Surface Water Management Plan (2013); and
- UU's Drainage Area Zones dataset, which shows the areas of GM that drain to specific Wastewater Treatment Works.

The project brief requests a review of the CDAs and OAFCDMs using the most up-to-date information available. A clear rationale for their locations and boundaries is required. This is to enable practical use within the planning

process, supported by recommendations for management of surface water through the development planning system and policy approach for local plans.

Due to misalignment of the availability of certain data provisions and the timing of the GMSF programme, it was not possible to refine the CDAs and OAFCDMs. However, a methodology has been formulated and agreed with the GMCA and will be applied as an addendum to this Level 2 SFRA. This will be included within a later stage of the GMSF, and as part of individual district local plans. The agreed methodology and descriptions of the datasets to be used are detailed in Appendix E.

Offices at:

Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Glasgow
Haywards Heath
Isle of Man
Limerick
Newcastle upon Tyne
Newport
Peterborough
Saltaire
Skipton
Tadcaster
Thirsk
Wallingford
Warrington

Registered Office:
1 Broughton Park
Old Lane North
Broughton
Skipton
North Yorkshire
BD23 3FD

+44(0)1756 799919
info@jbaconsulting.com
www.jbaconsulting.com
Follow us:

Jeremy Benn Associates Limited

Registered in England 3246693

JBA Group Ltd is certified to:
ISO 9001:2015
ISO 14001:2015
ISO 45001:2018