

**Aberdeen City Council
Local Development Plan 2022**

Strategic Flood Risk Assessment

Working Document

Version	Date Updated
1	June 2018
2	November 2018

1. Introduction

Strategic Flood Risk Assessment (SFRA) is designed to inform the development planning process and to reduce flood risk by avoiding areas at significant risk of flooding.

SFRA is a strategic overview of flood risk to the development plan area and involves the collection, analysis and presentation of all existing and readily derivable information on flood risk sources. It has been produced in consultation with the Scottish Environmental Protection Agency (SEPA) as well as other Council services.

This SFRA has been prepared to assist the preparation of the Local Development Plan 2022, particularly in regards to making decisions about preferred site allocations. It will also contribute to baseline monitoring for Strategic Environmental Assessment, assist in policy development and enable the planning of new flood management schemes.

2. Legislation and Policy

Scottish Planning Policy says that we should prevent development which would have a significant probability of being affected by flooding or would increase the probability of flooding elsewhere. We must take the probability of flooding from all sources and associated risks involved into account when preparing development plans. Strategic Flood Risk Assessment is used to inform choices about the location of development and policies for flood risk management.

Carrying out SFRA helps the Council to satisfy the requirements placed on local authorities under section 1 of the Flood Risk Management (Scotland) Act 2009 ('the Act'). Section 1 of the Act requires Local Authorities to exercise their functions with a view to reducing overall flood risk and promoting sustainable flood risk management.

3. Aims and Objectives

The primary aim of the SFRA is to guide the emerging Local Development Plan to ensure that future development is directed to areas of little or no flood risk wherever possible and does not increase flood risk elsewhere, for example, by affecting the storage or conveyance capacity of flood plains. Its main objectives are:

- To identify flood risk areas based on the Flood Risk Framework identified in Scottish Planning Policy, helping to determine the appropriate planning response to development proposals in these areas;
- To identify functional flood plain areas (even if already developed) to help ensure that development on these areas does not increase the risk of flooding elsewhere;

- Provide an evidence-based report on flooding and drainage issues to contribute to the production of the Main Issues Report and emerging LDP;
- To contribute to the Monitoring Report and baseline for the Strategic Environmental Assessment.

4. Sources

This report has been prepared with reference to 'Strategic Flood Risk Assessment - Technical Guidance to Support Development Planning', a guidance document published by SEPA in August 2015. This guidance suggests a number of potential sources of information on flood risk which may be examined for the report. Those considered most useful for the Aberdeen City context are:

- SEPA Flood Extent Maps;
- SEPA National Flood Risk Assessment (and the draft NFRA 2);
- North East Flood Risk Management Plan
- The Aberdeen Integrated Catchment Study was carried out in to support the surface water management planning process in Aberdeen, Westhill, and Stonehaven. The study has improved knowledge and understanding of surface water flood risk and interactions between the above ground and below ground drainage network e.g. with the sewer network, watercourses and the sea.
- Previous Aberdeen City Council Biennial Reports on the prevention or mitigation of flooding in Aberdeen - the last Biennial Report was produced in 2009;
- Previous flood risk studies;
- GIS Layers including flood extents, watercourses and reservoirs, flooding incidents etc;
- Information on Flood Prevention Schemes in Aberdeen.

Note on SEPA Flood Maps

The key sources of evidence are the Indicative Flood Extent Maps produced by SEPA, which show different levels of flood risk for rivers and the coast. Updated maps became available during 2018 and the high-level assessment of flood risk included in this document is informed by these maps.

It should be noted that the Flood Maps do not show very small watercourses (those with a catchment area of less than 3km²) and do not take account of the effect of any flood defences or hydraulic structures which may be present. SEPA's flood hazard maps are designed to give a high-level indication of potential flood risk, but do not imply complete accuracy or certainty.

Note on National Flood Risk Assessment

The National Flood Risk Assessment (NFRA) identifies those areas of Scotland which are most vulnerable to flooding, taking into account the likelihood of flooding from all sources and the potential impact on people, property and the environment. Although it is primarily intended to inform the

production of the new Flood Risk Management Plans, it also provides useful, albeit high-level, information for land use planning and the SFRA.

The NFRA classifies catchment units according to flood risk from 'Very Low' to 'Very High'. All units classified 'Medium' or above are designated as Potential Vulnerable Areas (PVAs). 5 units in Aberdeen City, covering most of the local authority area, are classified as PVAs. Datasheets are produced for each PVA and these provide a high-level indication of why the areas were designated as being at risk, details of the sources of flooding within it, and impacts predicted. These are now based on 500m grid squares.

As and when new or updated information becomes available, this document will be updated to reflect any changes.

5. Evidence of Flood Risk in Aberdeen

There are 6 main potential sources of flood risk: rivers (fluvial), the sea (coastal), surface water (pluvial), groundwater, drainage and sewers and infrastructure failure (e.g. reservoir or canal breaches). This report now examines the flood risk posed to the ALDP area from each of these sources.

5.1 Fluvial and Coastal

There is over 600km of watercourses (both open and culverted) in Aberdeen City (Map 1). Many of these are small watercourses which are not identified by the SEPA maps, but may still be vulnerable to localised flooding, particularly where blockages occur. It is important to consider the presence of small watercourses when assessing flood risk on individual sites.

SEPA's flood hazard maps which are available online, show the areas identified as being at risk of flooding from fluvial, coastal and surface water sources. For the purposes of planning, we are chiefly concerned with areas affected by a 0.5% annual probability of flooding (1 in 200 years).

The main areas at high flood risk in Aberdeen are along the large watercourses, including the River Dee, River Don and the Denburn and the coast and harbour-side area (Maps 2 to 4).

SEPA have mapped natural susceptibility to coastal erosion based on natural features including the height and geology of the land (relative to sea level), distance to the sea and wave action.

The National Coastal Change Assessment aims to create a shared evidence base to support more sustainable coastal and terrestrial planning decisions in the light of a changing climate. Coastal erosion maps can be viewed at www.dynamiccoast.com

5.2 Pluvial (Surface Water) and Rising Groundwater

Pluvial flooding, or flooding due to excess surface water, occurs after periods of intense and prolonged rainfall which saturate either the natural substrate or urban drainage systems, so excess water cannot be safely drained away. Therefore, pluvial flooding is more likely to occur where the ground is naturally poorly drained or has been developed without adequate urban drainage systems in place.

SEPA has produced maps showing flood risk from surface water at a national level (Maps 5, 6 and 7). This map is available from the SEPA website and gives some indication that areas in Aberdeen may be at risk from pluvial flooding.

Flooding due to rising groundwater is also likely to occur after periods of intense and prolonged rainfall, when the water table rises up from underlying rocks or flowing from springs. Groundwater is generally a contributing factor to flooding rather than the primary source. The SEPA website has a map showing where groundwater could influence the duration and extent of flooding from other sources. It does not show where groundwater alone could cause flooding.

Map 8 gives a broad indication of vulnerability to groundwater flooding. The PVA datasheets also give an indication of which catchment units may be at risk from rising groundwater; this type of flooding has the potential to affect a large part of the Aberdeen City Area.

5.3 Roads Drainage and Sewers

Roadside drains, sewers and culverts can also be the cause of flood events if they fail, become blocked or are inundated with water that exceeds their capacity. Many of the flood incident points shown on Map 9 occurred as a result of blocked drains, gullies, culverts and other small watercourses. These occurred all across the city, although 'hotspots' may be identified.

Flooding due to blocked drains is addressed by Roads Maintenance. There is also a regime for the inspection of open watercourses in place, and hecks (debris screens) are inspected on a monthly basis and before anticipated high level rainfall.

5.4 Infrastructure Failure

There is not considered to be any significant risk of flooding due to infrastructure failure in Aberdeen. Although a number of reservoirs and canals do exist in and around the urban area, there are no large dams or levees and no records of previous flooding of this type. Flooding may also occur as a result of burst water mains, however these are the responsibility of Scottish Water and it is not possible to predict these events.

See Map 10 for a map of reservoirs in Aberdeen, of which there are very few. The majority of these are located in the Deeside area. SEPA have also produced Reservoir Inundation Maps which show the area of land that is likely to be flooded in the event of an uncontrolled release of water from a reservoir. This can be viewed on the SEPA website.

5.5 Natural Flood Management

The NFM maps on the SEPA website identify areas where there are opportunities for alteration or restoration of natural features to help manage flood risk. The maps are of a strategic nature and are primarily to support FRM planning decisions at the catchment level. They provide a high level assessment of those areas within catchments and along coastlines where the implementation of the specified NFM techniques could be most effective and merit further investigation. Five natural flood management maps have been produced: run-off reduction; floodplain storage; sediment management; estuarine surge attenuation; wave energy dissipation.

6. Significant Historical Flooding Events in Aberdeen

Council Committee Reports and media reports provide a useful source of information on significant flooding events experienced in Aberdeen.

- Historic flood events on the River Dee have been reported in 1789, 1790, 1829, 1873, 1876, 1881, 1882, 1892, 1894, 1909, 1920, 1922, 1926, 1927, 1928, 1929, 1938 and 1946. The Den Burn is reported to have flooded in 1869, 1872, and 1874.
- The Bridge of Don area experienced flooding in 2000 and 2001, when problems with the drainage system resulted in ponding. This was exacerbated by gullies surcharging due to the high water level in the Glashieburn and properties in Lochside Drive, Jesmond Drive and Brook Crescent were affected. Regular surcharging of the combined sewer in Jesmond Drive has been reported as has flooding at Ellon Road due to debris accumulation blocking the watercourse.
- September 2009 – Weeks of solid rain in the North East resulted in heavy flooding in parts of Aberdeen, many properties affected had previously been flooded, highlighting their vulnerability.
- 25 August 2012 (see *Committee Report EPI 12 240, 6 November 2012*) - On this date, Aberdeen experienced a localised, intense rainfall event of relatively short duration. It is believed that up to 30mm fell within one hour, meaning the downpour was at least a 1 in 100 year event. This gave rise to a number of flooding incidents across the city, affecting both commercial and residential properties, as well as disrupting travel. The full Committee Report details all of the recorded flooding incidents for this day.

- November 2012 – The coastal village of Footdee was engulfed in sea foam after intense storms swept Aberdeen. The foam caused a good deal of damage and nuisance, and required a large expenditure on clean up operations.
- Large parts of Aberdeen were affected by surface water flooding in July 2015. Many manhole covers became dislodged, roads were submerged and Aberdeen airport's terminal building was flooded. Many roads were affected by flooding, including Market Street, Guild Street and Holburn Street. Cars on Polmuir Road started to float due to the depth of the water. A nursery had to be evacuated due to flooding in its basement.
- January 2017 – Storm Frank caused extensive flood damage to housing and other properties throughout north east Scotland. Areas especially affected on the River Don include Kemnay, Inverurie, Kintore and into Aberdeen including Riverside Drive and the Grandholm area. On the River Dee, Ballater was particularly affected.
- The Cults Burn has caused flooding at Inchgarth Road due to blockages on the watercourse backing it up from the River Dee.

7. Existing Flood Defence Schemes

Flood Prevention Schemes currently in place or under construction in Aberdeen include:

- Glashieburn, Bridge of Don close to Lochside Drive
- Fraser Road, to the north of Hutcheon Street
- Gilcomston Burn
- West Cults Farm (private scheme)
- Jacks Brae
- Aberdeen Beach Recharge- To protect the revetments and the area around Aberdeen beach from continued erosion and failure, a programme of beach recharge took place in July and August 2006. To ensure the stability of the new beach and to protect the area from further erosion, rock t-head extensions to the present timber groynes were constructed.
- Leggart Terrace Culvert diversion
- Bridge of Dee Flood gates
- Stronsay Park Flood Control structure

- Maidencraig Flood storage Scheme
- Heatheryfold Park SUDS

Regional SUDS Schemes

Areas are currently being identified by the Council for upstream retention basins to help reduce run-off further downstream and prevent flooding in the more built up areas of the City. These areas will be identified through the next Local Development Plan and safeguarded from development. The Maidencraig Flood Storage Scheme mentioned above is the first to be developed.

8. The Impacts of Climate Change on flood risk

Annual rainfall in Scotland has increased by 7% since 1961. [UK Climate Projections \(UKCP09\)](#) sets out climate information for areas of the UK and includes data for the north east of Scotland region.

In the coming decades the climate of the north east of Scotland will change, with an increase in the frequency and severity of extreme weather events. Climate projections indicate for Aberdeen and the north east area, this will mean:

- Average temperatures will increase in all seasons (H), with the greatest increase in summer (M). What is considered a heatwave or extremely hot summer today will occur more frequently in future (M).
- Rainfall is projected to become more seasonal, with an increase in average winter and autumn rainfall (M). Average summer rainfall may decrease (L). Heavy rainfall events may occur more frequently in winter, spring, and autumn (M). An increase in summer heavy rainfall events is uncertain (L)
- Snow is projected to be less frequent in coastal locations like Aberdeen with rising temperature (H), although by how much is complicated by increased winter precipitation (L).
- The growing season will continue to lengthen due to increasing temperatures in spring and autumn (H).
- Winter storms with extreme rainfall may become more frequent (L), although there is large uncertainty in models.
- Sea level will rise (H). Storm surge conditions may cause wave overtopping and coastal flooding and erosion.

*Assessment of 'Overall Confidence' in scientific evidence for individual statements: High (H), Medium (M) and Low (L).

Sea level rise scenarios are given below.

Sea level rise	2degrees			4 degrees		
	2020	2050	2080	2020	2050	2080
Aberdeen	0.02m	0.09m	0.18m	0.13m	0.32m	0.56m

The UK Climate Change Risk Assessment 2017 Evidence report – Summary for Scotland, indicates an increase in future flood risks affecting buildings, transport, energy, digital and communication networks, communities, habitats and heritage.

The National Flood Risk Assessment has considered the flood risk for north east of Scotland river basin regions. Under the UKCP09 high emissions scenario for 2080, average peak river flows for the Dee catchment by 2080 may increase by 24%. This would potentially increase in the number of residential properties at risk of river flooding from approximately 8,400 to 11,000 and the number of non-residential properties from 1,800 to 2,100.

The same scenario on the River Don may increase flows for the Don catchment by 24%. This would potentially increase in the number of residential properties at risk of river flooding from approximately 2,600 to 4,200 and the number of non-residential properties from 530 to 680.

9. Assessment of Site Options According to Flood Risk

The main aim of collecting the evidence in section 1 of the SFRA is to assist in directing development to areas of little or no flood risk wherever possible, referring to the Flood Risk Framework contained in Scottish Planning Policy . The following assessment is for preferred Opportunity Sites in the Main Issues Report and sites likely to be carried forward from the existing LDP.

The flood risk category into which a site falls is identified using the following annual flood probabilities:

- Little or No Risk – annual flooding probability less than 0.1% (1:1000)
- Low to Medium Risk – annual flooding probability between 0.1 and 0.5% (between 1:1000 and 1:200), or site adjacent to but not within a medium to high risk area.
- Medium to high risk – annual probability 0.5% (1:200) or greater.

The table below shows a high-level assessment of flood risk on a site by site basis.

Sources used or referred to during the preparation of this report:

Aberdeen City Council Reports

Committee Report EPI 12 240 'City Wide Flooding Issues' 6 Nov 2012
6th and 7th Flood Prevention Biennial Reports (2008/2009)

Aberdeen City Council GIS resources

Watercourses and Reservoirs
Flood Incidents
Groundwater Vulnerability

SEPA Resources

Flood Extent Maps
National Flood Risk Assessment- Potentially Vulnerable Areas
North East Flood Risk Management Plan

Other sources

UK Groundwater Forum www.ukgroundwater.co.uk

Useful Contacts:

Local Development Plan Team

Strategic Place Planning
Aberdeen City Council
Business Hub 4, Marischal College
Broad Street
Aberdeen AB10 1AB
ldp@aberdeencity.gov.uk
01224 523317

SEPA Aberdeen Office

Inverdee House
Baxter Street
Torry
ABERDEEN, AB11 9QA
Tel: 01224 26662

Ref	Site Name	SEPA Flood Map Fluvial Flooding Category				SEPA Flood Map Coastal Flooding Category				Other Sources		Proposed Use	Summary of Risk and Mitigation
		Minimal	Low-Med or adj, to M-H	Med-High (Undevel)	Med-High (Built Up)	Minimal	Low-Med or adj, to M-H	Med-High (Undevel)	Med-High (Built Up)	Surface Water	Small Watercourses & Culverts		
B01/06	Cordyce School, Dyce			X		X				Y	Y	Residential	The River Don flows outwith the site boundary to the north east of the site, and it is prone to flooding. Any hard development would need to avoid this area. It is noted, however that the river is some distance away from where development would occur. A FRA will be required.
B02/08	WTR Site at Dubford	X				X				N	N	Residential	The site is not currently identified as at risk of flooding according to SEPA Flood Risk maps. However, it is in close proximity to the area at risk of flooding from the Burn of Mundurno and surface water flooding on the opposite side of the Sheilhill Road. The site is slightly elevated from these areas. If the scheme plans to discharge into small burns/watercourse, we would like to have greenfield run off rate, and store up to the 1:200 yr. event
B02/22	North Denmore	X				X				N	N	Residential	No flood risks identified on the SEPA flood map and no flooding incidents in the area. If the scheme plans to discharge into small burns/watercourse, we would like to have greenfield run off rate, and store up to the 1:200 yr. event
B02/25	Balgownie Area 4	X				X				N	N	Residential	No known risks of natural or man-made flooding on the site – not likely to be a significant constraint. If the scheme plans to discharge into small burns/watercourse, we would like to have greenfield run off rate, and store up to the 1:200 yr. event
B03/13	Summerfield House, Eday Road	X				X				Y	Y	Residential	According to SEPA's Indicative Flood Risk Map, the north of the site is shown as being at risk from flooding from surface water. However, there have been no flooding incidents recorded on the site. The Springhill Burn is located just on the eastern boundary of the site, this may be prone to flooding so hard development should avoid this area. We would look for a complete surface water separation form the combined system. We would want to see 1:200yr storage on site if the intention is to connect surface water to the Denburn. We would consider a reduced requirement - based on funding towards regional suds or a joined-up surface water separation scheme with other areas in the location
B03/19	Woodend Hospital				X	X				Y	Y	Residential	SEPA Flood Maps show there are low chances of surface flooding to the north and also to the south where North Burn of Rubislaw runs. The Burn is prone to flooding and there have been a high level of flooding incidents further downstream, therefore hard development would need to avoid this area. ACC would look for a complete surface water separation form the combined system. We would want to see 1:200yr storage on site if the intention is to connect surface water to the Denburn. We would consider a reduced requirement - based on funding towards regional suds
B03/20	Old Skene Road	X				X				N	N	Residential	According to SEPA Indicative Flood Risk Map, there is no evidence of flood risk on the site. There have been no flooding incidents recorded on the site. However, there is flooding downstream of the local watercourse . ACC would be looking for 1:200yr storage of the site to discharge in to the watercourse, based on flood risk. There would be no option to reduce this unless and alternative route for the water course can be found. We would require proof that there is no downstream effect.
B04/01	Granitehill North	X				X				Y	N	Residential	SEPA flood maps show there is a 0.1% chance of surface flooding on a small section to the north of the site. ACC would look for a complete surface water separation form the combined system. We would want to see 1:200yr storage on site if the intention is to connect surface water to the Scatter Burn tributary We would require proof that there is no downstream effect due to flooding issues there.
B04/02	Granitehill Central	X				X				Y	N	Residential	SEPA flood maps show there is a 0.5% chance of surface flooding on a section to the south of the site. ACC would look for a complete surface water separation form the combined system. We would want to see 1:200yr storage on site if the intention is to connect surface water to the Scatter Burn tributary We would require proof that there is no downstream effect due to flooding issues there.

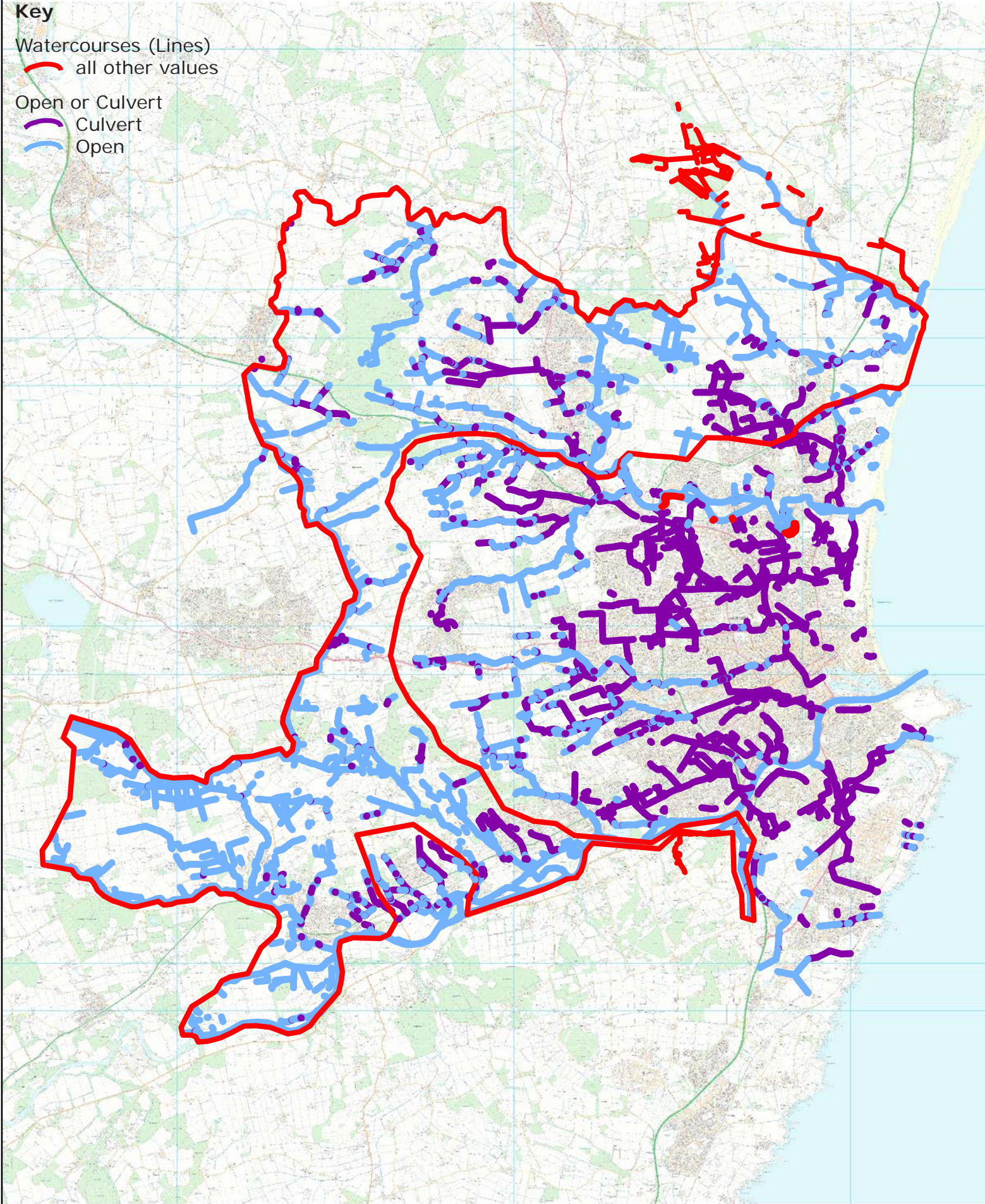
B06/01	152 Don Street, Old Aberdeen	X				X				Y	N	Residential	The northern part of the site along Lord Hays Road suffers from surface water flooding. ACC would look for a complete surface water separation form the combined system. We would want to see 1:200yr storage on site if the intention is to connect surface water to the small burns or water courses.
B07/02	Raeden (eastern part)	X				X				N	N	Residential	No known risks of manmade or natural flooding on the site. If the scheme plans to discharge into small burns/watercourse, we would like to have greenfield run off rate, and store up to the 1:200 yr. event.
B08/02	Frederick Street	X				X				N	Y	Residential	The SEPA flood maps show flood risk on site. There is one flooding incident recorded approx. 75 from the site. This was due to blocked pipe work. A culverted drain crossed the site east to west at the southern edge. If the scheme plans to discharge into small burns/watercourse, we would like to have greenfield run off rate, and store up to the 1:200 yr. event.
B08/04	Urquhart Building, City Hospital	X				X				N	N	Residential	There are no known risks of manmade or natural flooding on the site. If the scheme plans to discharge into small burns/watercourse, we would like to have greenfield run off rate, and store up to the 1:200 yr. event.
B11/01	Garthdee Road	X				X				N	N	Residential and Open Space	Some isolated areas of surface water flood risk in the adjacent area, but none in the site itself. ACC would be looking for 1:200yr storage of the site to discharge in to the watercourse, based on flood risk. This site may provide an opportunity for Surface water separation and SUDS to help reduce surface water flood risk in the future.
B11/02	Kaimhill Outdoor Sports Centre	X				X				N	N	Residential and Open Space	There are no known risks of manmade or natural flooding on the site. If the scheme plans to discharge into small burns/watercourse, we would like to have greenfield run off rate, and store up to the 1:200 yr. event.
B01/10 and B0	Cordyce School			X		X				Y	Y	Healthcare Facility and/or Health and Fitness Village	The River Don flows outwith the site boundary to the north east of the site, and it is prone to flooding. Any hard development would need to avoid this area. It is noted, however that the river is some distance away from where development would occur. A FRA is required.
B03/01	Kingsford			X		X				Y	Y	Stadium and Training Facilities	SEPA Flood Maps show there is 10% chance of surface water flooding to the north and northwest of the site. Brodiach Burn runs along the western boundary of the site. Hard development would need to avoid this area. Flooding and drainage issues for this proposal are covered by the conditions attached to the planning consent.
B03/18	Area west of Orchard Brae School	X				X				N	Y	Healthcare Facility	According to SEPA Indicative Flood Risk Map, the site is not at risk of flooding. There have also not been any recorded flooding incidents on site. There is a small culvert that runs along the north east of the site and along the centre.
B04/03	Mastrick Clinic	X				X				N	N	Uses that would support the Mastrick neighbourhood centre.	There are no known risks of manmade or natural flooding on the site. If the scheme plans to discharge into small burns/watercourse, we would like to have greenfield run off rate, and store up to the 1:200 yr. event.
B08/03	Resource Centre City Hospital	X				X				N	N	Retail, commercial or office use	There are no known risks of manmade or natural flooding on the site. If the scheme plans to discharge into small burns/watercourse, we would like to have greenfield run off rate, and store up to the 1:200 yr. event.
Brownfield	Former Bucksburn Primary School	X				X				N	N	0.94ha for housing or other compatible uses	There are no known risks of manmade or natural flooding on the site. However, the Howes Road adjacent to the site is at risk from surface and fluvial flooding in association with the Bucks Burn. If the scheme plans to discharge into small burns/watercourse, we would like to have greenfield run off rate, and store up to the 1:200 yr. event.
CCMP	CCMP Intervention Areas											Mixed Uses	This sites pose sewer flood risk as well as surface water flood risk. ACC would require a detailed DIA's showing how the sites reduce the sewer flood risk within the city. We would want green field to run off rates and up to 1:200uyr on site storage for these sites

Map 1 - Watercourses in Aberdeen City

Key

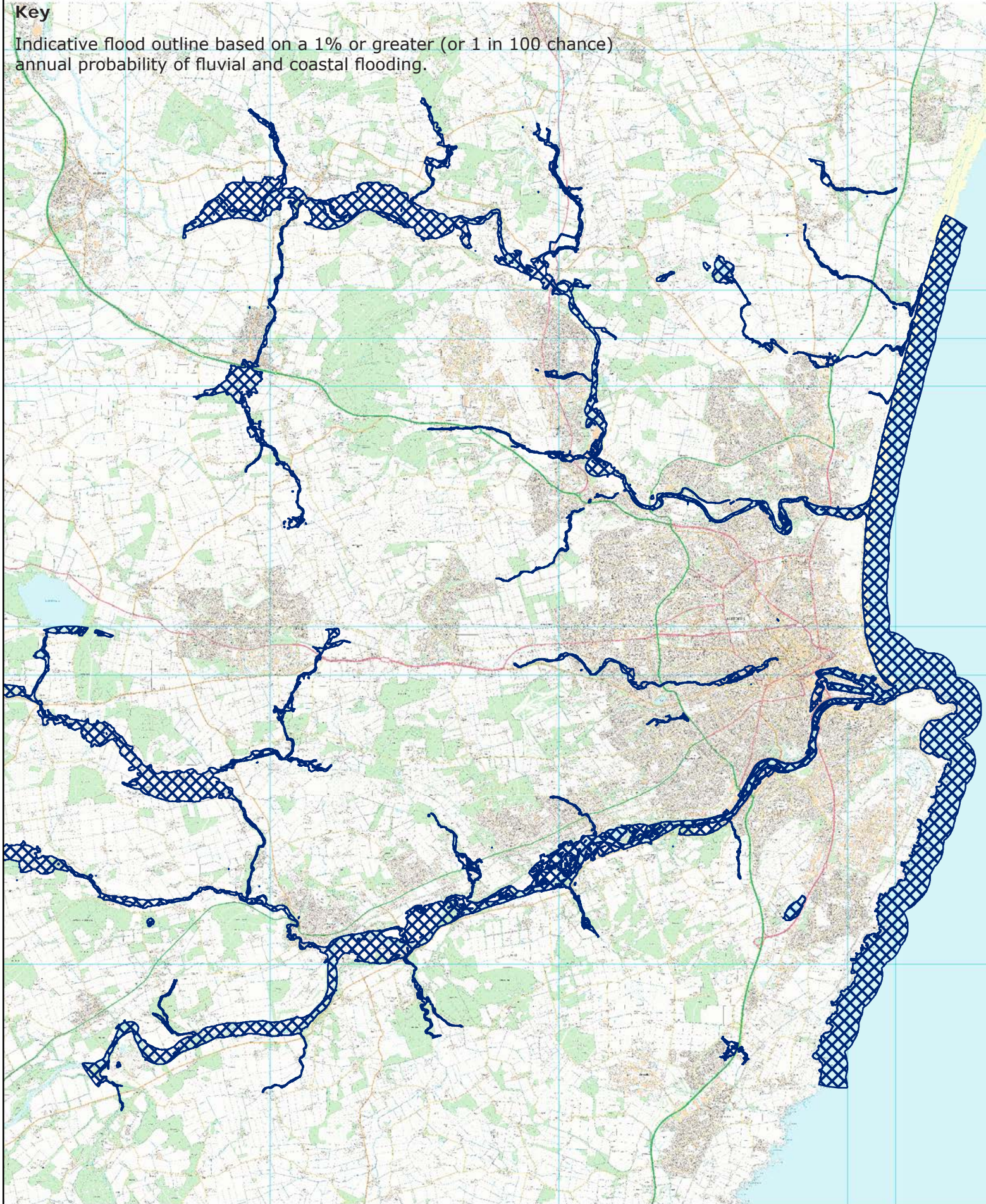
Watercourses (Lines)
all other values

Open or Culvert
Culvert
Open



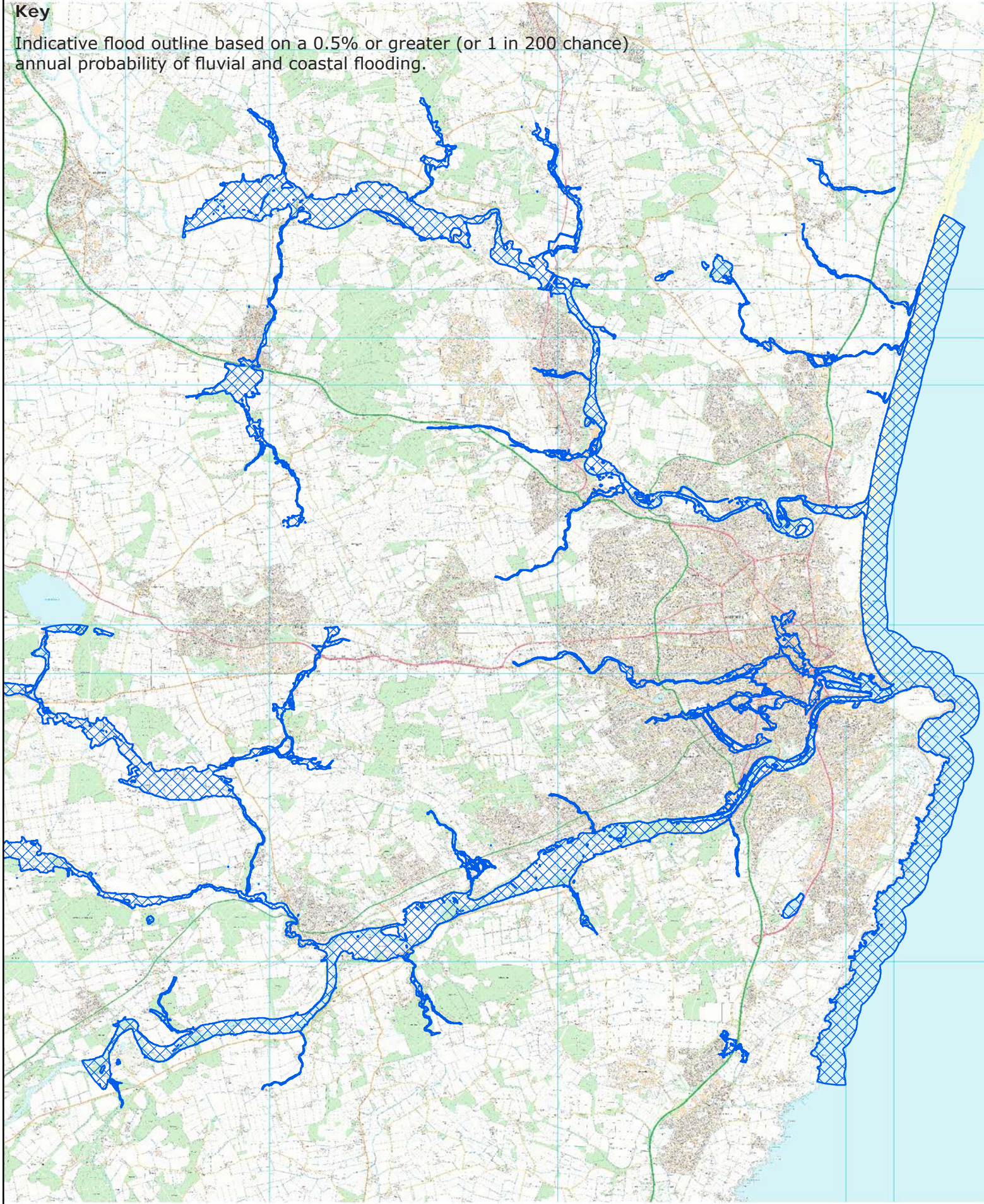
Map 2 - River and Coastal Flood Risk - 10% Annual Probability

Key
Indicative flood outline based on a 1% or greater (or 1 in 100 chance) annual probability of fluvial and coastal flooding.



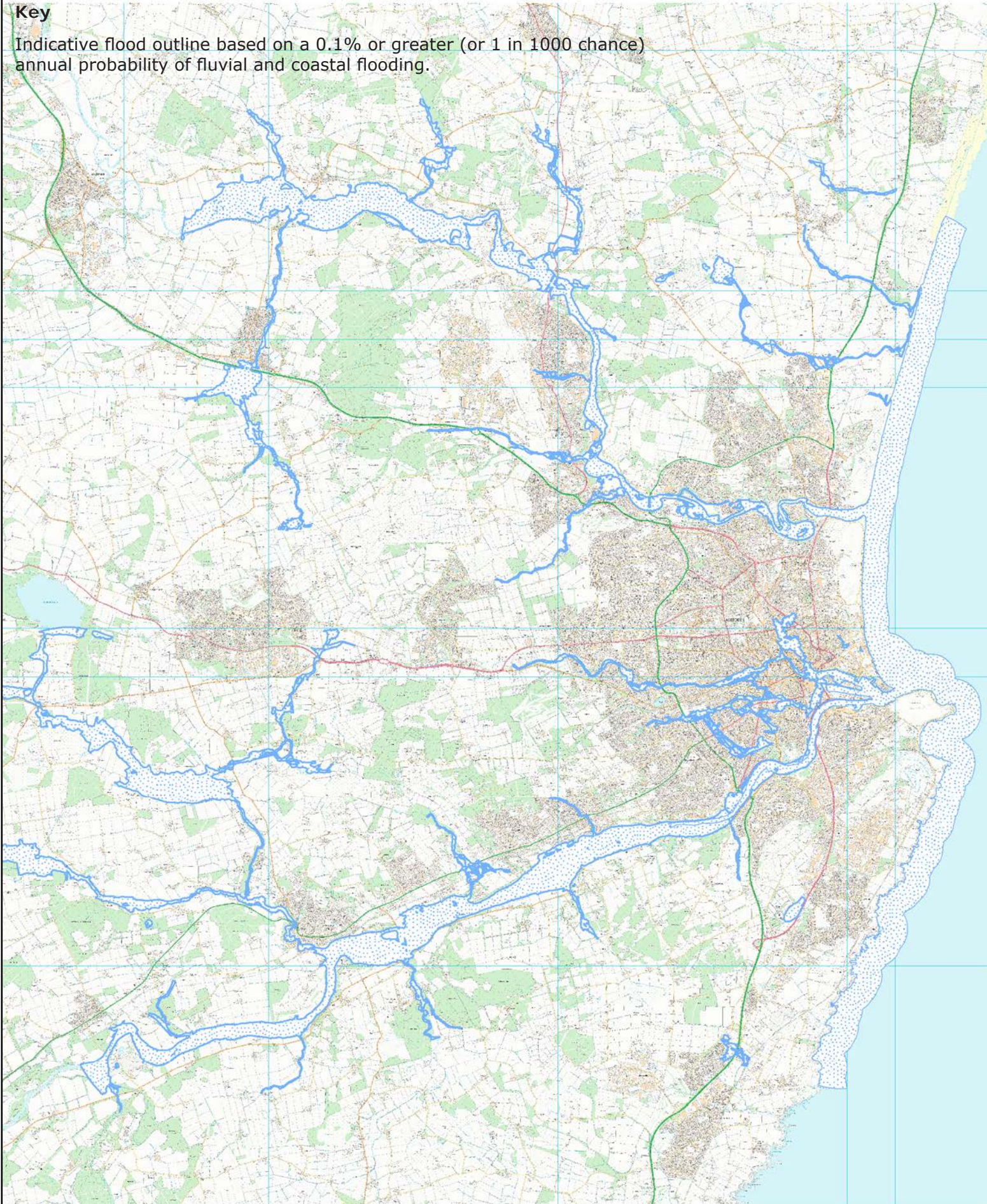
Map 3 - River and Coastal Flood Risk - 0.5% Annual Probability

Key
Indicative flood outline based on a 0.5% or greater (or 1 in 200 chance) annual probability of fluvial and coastal flooding.



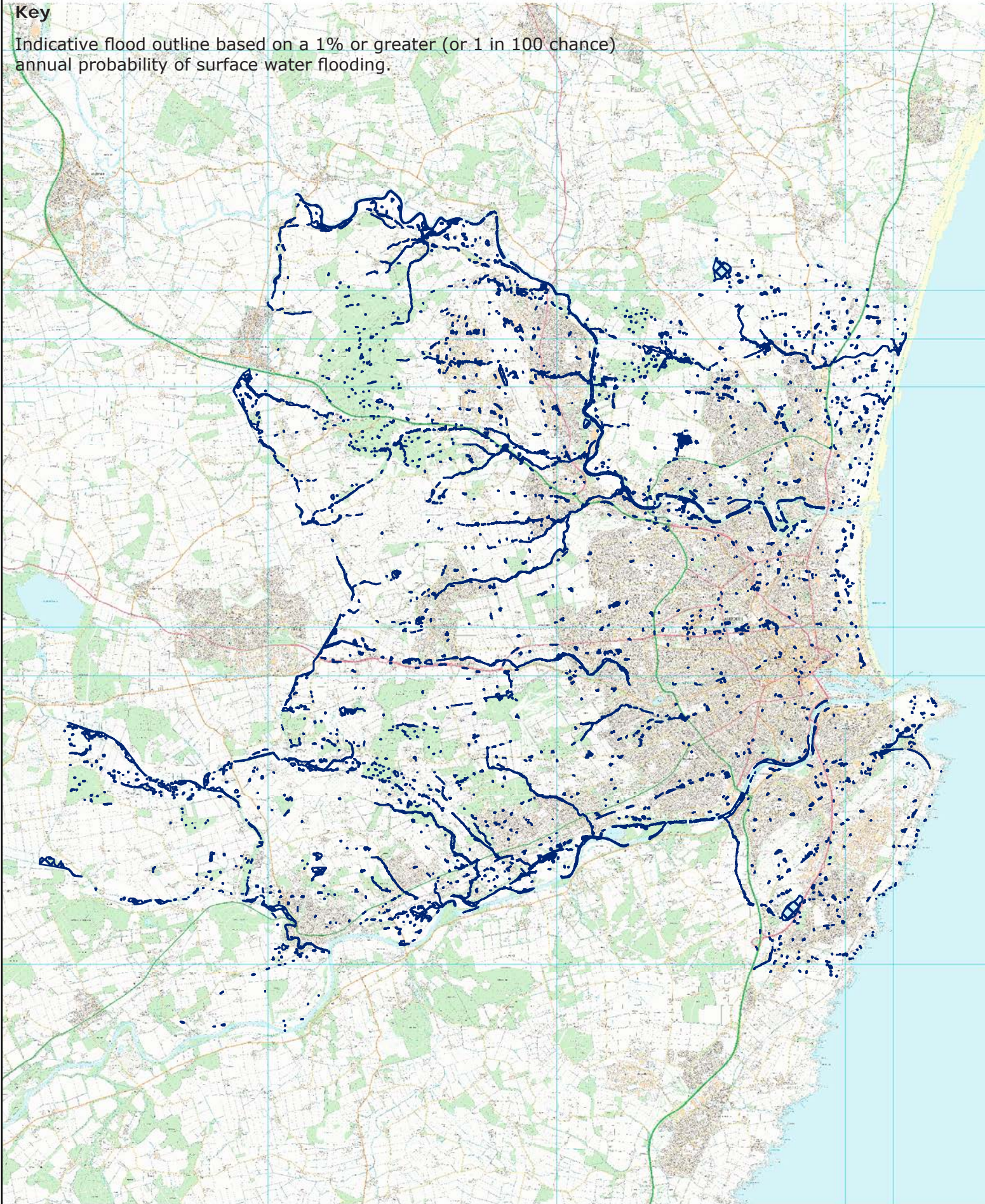
Map 4 - River and Coastal Flood Risk - 0.1% Annual Probability

Key
Indicative flood outline based on a 0.1% or greater (or 1 in 1000 chance) annual probability of fluvial and coastal flooding.



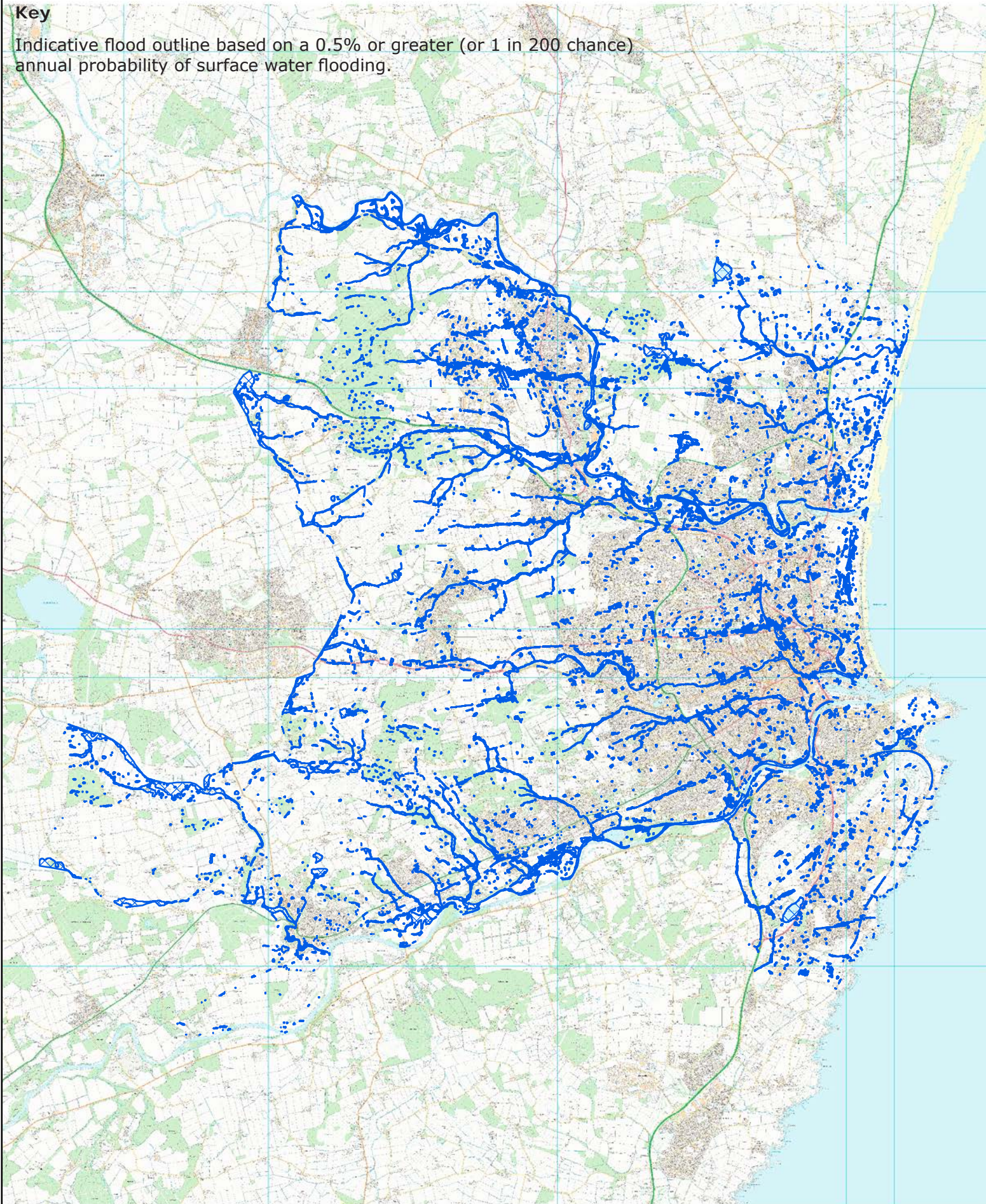
Map 5 - Surface Water - High Annual Probability

Key
Indicative flood outline based on a 1% or greater (or 1 in 100 chance) annual probability of surface water flooding.



Map 6 - Surface Water - Medium Annual Probability

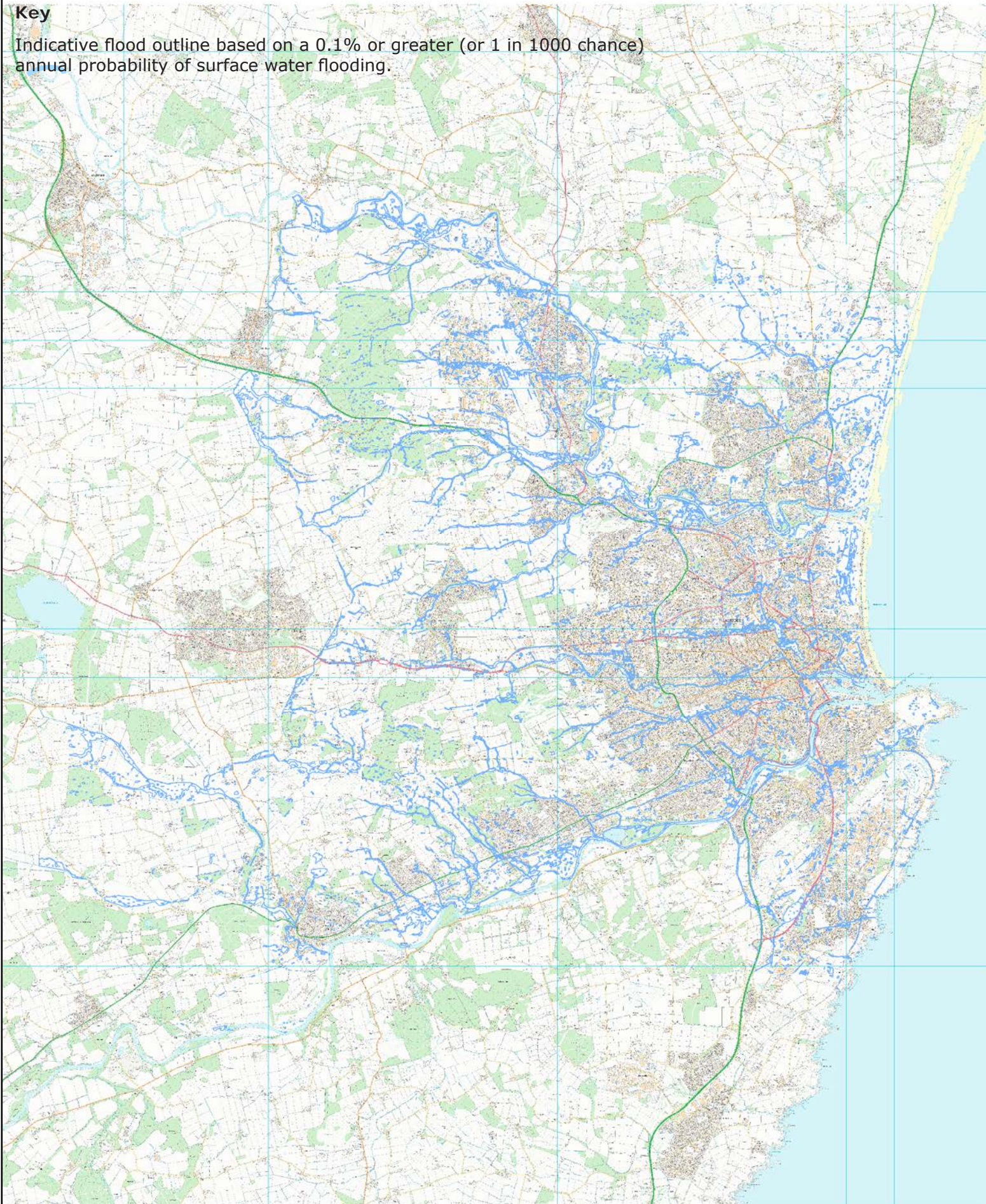
Key
Indicative flood outline based on a 0.5% or greater (or 1 in 200 chance) annual probability of surface water flooding.



Map 7 - Surface Water - Low Annual Probability

Key

Indicative flood outline based on a 0.1% or greater (or 1 in 1000 chance) annual probability of surface water flooding.

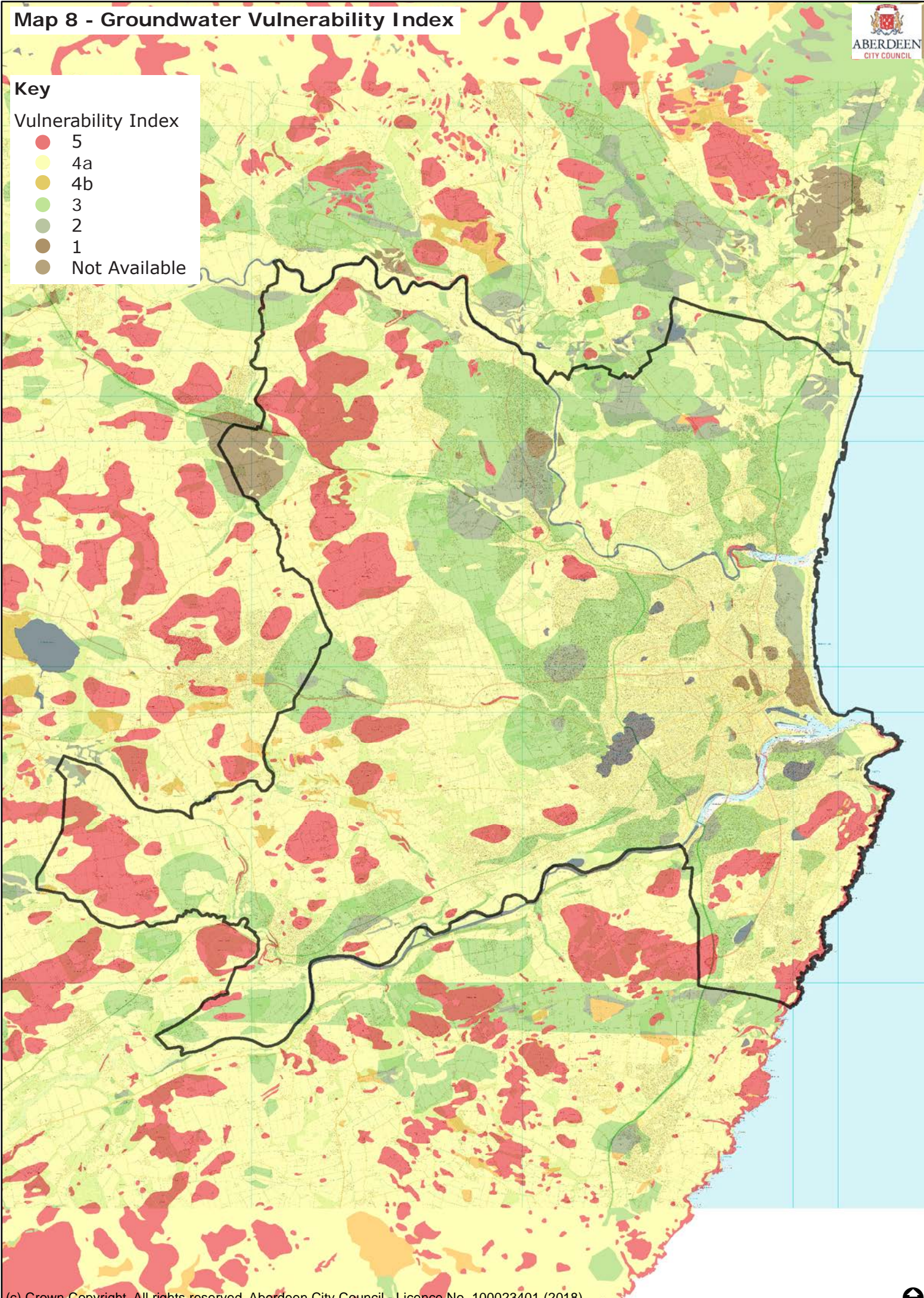


Map 8 - Groundwater Vulnerability Index

Key

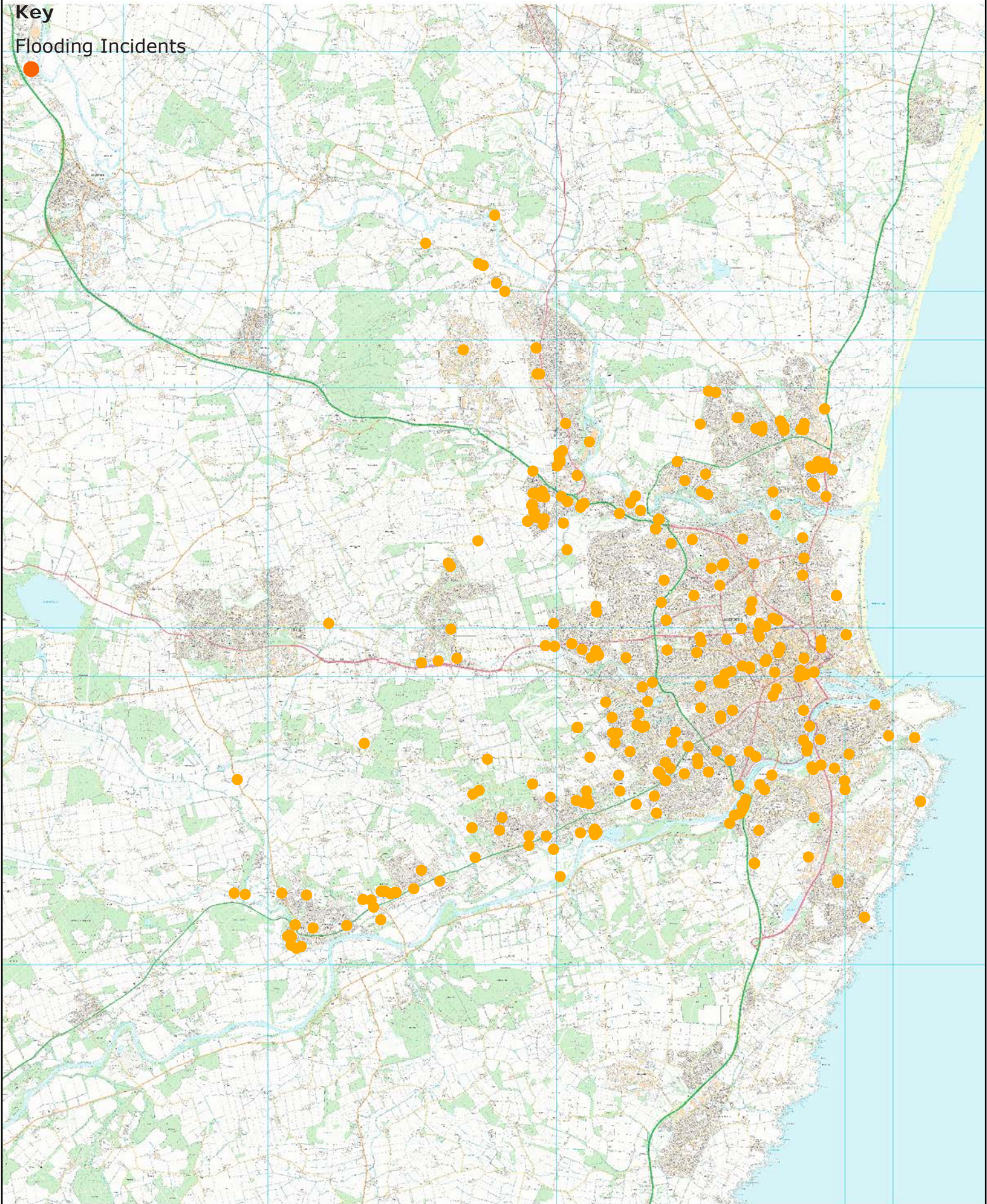
Vulnerability Index

- 5
- 4a
- 4b
- 3
- 2
- 1
- Not Available



Map 9 - Flooding Incidents

Key
Flooding Incidents



Map 10 - Reservoirs

Key
Reservoirs

