Indicative locations for local television multiplexes

Initial technical assessment

Research Document

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Contents

Section 1

Introduction

In July 2011, the Government published a new framework for local television which set out proposals to create a number of local television service licences supported by a single multiplex provider. That document explains in detail the nature of the proposed framework, the legislative provisions the Government proposes to implement and how the licensing process will be developed following publication of a range of potential local television locations.

Government has now published a consultation seeking views on potential locations for licensed local television services, and the order of licence awards. To coincide with this publication, Ofcom is providing information on the locations where local broadcast services might be technically possible together with the numbers of households that we predict may be able to receive those services, and maps showing indicative coverage.

It is important to note that Ofcom has not yet been granted the necessary powers to conduct a local TV licensing process. The Government's framework document suggested that such legislation would be laid in due course, but until such time Ofcom is acting in a technical advisory capacity only. This document does not provide a list of locations where local TV licences will definitely be advertised, nor does it request expressions of interest or applications for local TV services. It is merely a technical assessment of where services might be possible. Should legislation be laid which grants Ofcom the powers to conduct a local TV licensing process, we would expect to consult on our approach prior to inviting applications for any such services.

Section 2

Explanation of method and assumptions

2.1 Method

Terrestrial television services are broadcast by a network of approximately 50 main transmitters and over 1,000 smaller relay transmitters. The list of locations we are publishing has been obtained by considering around 70 of those transmitters that serve the largest number of people. These transmitter sites are a necessary starting point because households are already pointing their aerials towards them.

Assessment of spectrum

We commissioned an assessment of the available spectrum at each of these transmitters. Most of these transmitters will broadcast six UK-wide multiplexes (each carrying a number of television services) at the completion of digital switchover. The six multiplexes require six transmission channels at each transmitter site from the 31 channels available to TV broadcasting. Although this leaves 25 channels unused at each transmitter site, many are in use at adjacent transmitters and cannot therefore be used for broadcasting at sufficiently high powers to achieve useful coverage without unacceptable interference occurring.

The assessment therefore attempted to identify the best unused frequency that could be sufficiently clear to permit the broadcasting of an additional local multiplex. Notional antenna patterns were then developed that took into account the requirement not to cause undue interference to the other digital television multiplexes.

Naming of locations

Coverage maps have been produced based on the type of transmitter arrangement that might be used by local television multiplexes. From these maps, we have picked the largest settlement in each location that is served by the transmitter and taken its name as the principal settlement for that area. These are indicated as the ***Primary Location*** in the table in Section 3. Where a transmitter serves several towns or cities, we have also listed the larger settlements served in each location – these appear in the ***Coverage includes*** column.

‘Petalling’

In a few cases, the coverage that could be achieved by a transmitter is very extensive and serves several cities. An example is the Winter Hill transmitter that serves most of the Granada ITV region in the north-west of England. In these cases, we have modelled the potential targeting of coverage using a technique we have named ‘petalling’. This enables specific targeting of distinct locations within the transmitter coverage area. The advantage of using petalling is that separate local services can be carried in each petal. In the case of Winter Hill, separate petals could provide different local TV services for Manchester, Liverpool and Preston.

Indicative coverage maps

The coverage maps we have produced provide an indication of the kind of coverage that might be achieved by local multiplexes. The assessment we have made of possible locations is, however, based on a purely theoretical analysis of transmitter sites and the available

spectrum. The actual coverage achieved in each location will depend on how close the final technical arrangement matches our assumptions and we have listed in Section 2.2 below some of the principal assumptions made in the planning. These indicative coverage maps for each location are contained in Annex 1.

Population estimates

Section 3 includes estimates for each location of the number of households that might be able to receive the local services, if they were broadcast on these new multiplexes. It is not possible to provide an exact figure for the number of households that receive their television services from any particular transmitter and it is therefore difficult to be precise about how many households could receive the local multiplexes. As guidance, we have provided two measures:

Gross population represents the total number of households that could receive the local multiplex if their aerials are pointing towards the appropriate transmitter. In practice, the gross coverage of adjacent transmitters overlaps to some extent which means that households have a choice of which direction to point their aerials. Gross coverage is therefore almost always an overestimate of the number of households using a particular transmitter as some households within the gross coverage area can be expected to be watching a different transmitter. Gross coverage is nevertheless useful as it provides an upper limit on the maximum possible number of households served. Because the gross coverage of adjacent transmitters overlaps, for areas where two transmitters are proposed the gross population figure represents the gross coverage of the larger transmitter only.

DPSA is an attempt to provide a more realistic estimate of the number of households that might be able to receive the local multiplex than gross population. The DPSA (Digital Preferred Service Area) is a prediction of the areas where a particular transmitter is likely to provide better signals than other transmitters. In those areas, it is reasonable to expect that households have aerials pointing at the transmitter in question and could therefore receive the local multiplex broadcast from that transmitter. The DPSA method is a numerical prediction and cannot, however, take account of viewer preferences where households sometimes choose to receive services from a different transmitter. No allowance has been made in the figures for the proportion of households that make use of alternative platforms such as cable or satellite. In locations where two transmitters are proposed, the DPSA coverage figure reflects the contribution of both transmitters.

Our initial assessment shows that the network of transmitters in Section 3 could achieve total coverage (DPSA) of approximately 15 million homes.

2.2 Assumptions and caveats

In carrying out the assessment, we have had to make a number of assumptions. The most significant are set out here.

We have assumed that separate local multiplex broadcasting antennas would be installed at each transmitter, mounted at around half the height of the transmitter mast.

We do not at this stage have information about whether the main transmitting antennas used by the six UK-wide multiplexes (and generally situated at the top of masts) could be shared by the local multiplexes. We have therefore adopted a cautious approach to modelling the antenna so as not to overstate the possible coverage that could be achieved.

A notional local antenna arrangement has been developed for each site to ensure that the local multiplexes do not cause interference to other DTT multiplexes and comply with the

UK's international frequency usage obligations. Physical space for the new local multiplex antenna will need to be found on the transmitter mast. Should this antenna be higher or lower in practice than the height we have assumed there may be an increase or decrease in the coverage that could be achieved.

If the local multiplex can share the main antenna, it would probably achieve more extensive coverage than that shown in the maps.

A detailed site-by-site assessment and commercial negotiation would be required to determine the feasibility of the local multiplexes sharing antennas with the UK-wide multiplexes. Sharing the main antenna will definitely not be possible in some cases as they will not meet the necessary pattern restrictions.

For example, if the local services were to share the main antenna in London and Newcastle, approximately 1.5 million and 28,000 additional households could be covered respectively. This would not however be possible for Birmingham as the local transmitter has to operate with a more restrictive pattern than the UK-wide multiplexes and cannot therefore share the main broadcasting antenna.

A robust signal mode has been chosen to maximise coverage

The power of the local TV transmitters has to be kept to modest levels to prevent undue interference being caused to the UK-wide multiplexes. A rugged signal mode[1] has been assumed in coverage planning that enables good coverage to be achieved while offering sufficient capacity to carry around three video services. If a different signal mode is ultimately adopted, the coverage achieved by the local multiplexes is likely to be different to that shown.

2.3 Other factors that could affect coverage

Influence of domestic aerial direction

The coverage plots contained in Annex 1 have been derived using the same coverage criteria as are used for planning digital switchover. The plots indicate in purple the maximum coverage from each transmitter where households are predicted to be able to receive the local multiplex, this is called 'gross' coverage.

As explained above, it is very unlikely that all households in the gross coverage area have aerials pointing towards the transmitter. Consequently the number of households that could actually receive the local multiplexes and the area covered actually covered in practice would be somewhat smaller. No comprehensive database exists of where aerials are pointing in any particular area and the only way to obtain reliable information is to carry out a rooftop survey.

Influence of domestic aerial group

Traditionally domestic aerials have been designed to work over only a part of the total range of UHF channels; these are called 'grouped aerials'. The grouped aerial approach was sensible as the frequencies used by the historic four analogue television services were usually close together, and the task of designing aerials was made easier by tailoring their response to these relatively narrow channel groups.

[1] DVB-T, QPSK, rate 2/3, guard interval 1/32

At digital switchover, some of the digital programme services from some transmitters will make use of transmission channels that lie outside the existing analogue aerial group for a particular area. Households in those areas may need to replace their aerials with a wideband design to be able to receive all of the digital programme services reliably. Wideband aerials can receive services on any of the UHF channels and many aerials that have been installed in the last 10 to 15 years are of this type. A considerable number of grouped aerials do however remain in use.

To maximise the likelihood that households will be able to receive the local multiplexes, we have attempted to find transmission channels that are within, or close to, the existing aerial group. This has not been possible in all cases and the ***Aerial compatibility*** column in Section 3 provides guidance on the areas where at least some households may have aerials that are not best suited to receiving the local multiplexes. We adopted the following categories:

a) *In group*: The local multiplex channel falls within the analogue aerial group. Households that have an aerial meeting the standard assumptions[2] that points towards the appropriate transmitter should be able to receive the local multiplex.

b) *Just outside*: The local multiplex channel is within a few channels of the analogue aerial group. Although not designed to work on these channels, a grouped aerial can still be expected to perform reasonably well, although some households may not be able to receive the local multiplex as a result of their aerial's performance tailing off.

c) *Outside with others*: The local multiplex is outside the aerial group, but so are some of the other digital programme services. Households therefore have a strong motivation to replace their aerials with a wideband type if they would like to receive all of the programme services. It is unrealistic to expect that all have done so though and some households may therefore not be able to receive the local multiplex.

d) *Out of group*: The local multiplex is out of analogue aerial group and some, perhaps many, households may have difficulty receiving the local multiplex unless they have replaced their aerials with a wideband design. In most of these areas, DTT services did operate out of group for many years prior to digital switchover although they have moved back into group at switchover. This would have provided an incentive to households to install wideband aerials, but not all would have done so.

Impact on other DTT multiplexes

The planning methodology adopted during the assessment and design of notional transmission arrangements for the local multiplexes has been developed to result in only minimal impact on the coverage of the UK-wide multiplexes. However, the method employed and the extent of any impact on the other multiplexes have yet to be agreed with the other multiplex operators.

[2] A good quality aerial is used that is mounted outdoors at 10m above the ground.

Section 3

Detailed location data

3.1 Column headings

Below is an explanation of the column headings used in the tables overleaf.

Heading	Meaning
Primary location	The largest settlement identified as being served by each local multiplex.
Coverage includes	Other larger settlements that are also potentially served by a local multiplex.
Gross population	The maximum number of households that could receive the local multiplex. For locations where two transmitters are proposed, the gross coverage reflects the larger transmitter only.
DPSA population	A more conservative estimate of the number of households that could receive a local multiplex than gross coverage based on the Digital Preferred Service Area (DPSA) of a transmitter. In locations where two transmitters are proposed, this figure includes the contribution of the secondary transmitter and hence may be larger than gross coverage alone.
Transmitter	The name of the transmission site from which the local multiplex is broadcast.
Channel	The portion of Ultra High Frequency (UHF) spectrum occupied by the local multiplex at a particular transmitter.
Aerial compatibility	An assessment of how likely a household is to have an aerial that is suitable for receiving a local service broadcasting on the specified channel. The following categories apply: *In group*: The local multiplex channel sits within the analogue aerial group with a good chance that most households could receive the local multiplex *Just outside*: The local multiplex channel is within a few channels of the analogue aerial group. However, the grouped aerials can be expected to perform reasonably well, although some households may not be able to receive the local multiplex. *Outside with others*: The local multiplex is outside the aerial group, but so are some of the other digital programme services. Households therefore have a motivation to replace their aerials with a wideband type if they would like to receive all of the programme services. Some may not have done so and it is likely that not all households would be able to receive the local multiplex. *Out of group*: The local multiplex is out of analogue aerial group and

	some, or many, households may have difficulty receiving the local multiplex unless they have replaced their aerials with a wideband design. An asterisk (*) indicates that DTT services operated out of group at that transmitter prior to switchover which would have provided an incentive for viewers to install wideband aerials, although not all would have done so.

3.2 List of locations

Primary Location	Coverage includes	Gross population (hh)	DPSA population (hh)	Transmitter	Channel	Aerial compatibility
Aberdeen		130,000	130,000	Durris	30	In group
Ayr	Kilmarnock	170,000	110,000	Darvel	30	In group
Bangor		22,000	17,000	Llanddona	51	In group
Barnstaple		34,000	32,000	Huntshaw Cross and Barnstaple relay	51	In group
Basingstoke		88,000	64,000	Hannington petal 2	51	In group
Bedford	Sandy	64,000	64,000	Sandy Heath	43	Outside with others
Belfast	Lisburn	260,000	250,000	Divis	30	In group
Birmingham	Greater Birmingham area, part of Wolverhampton, Walsall, Dudley	1,200,000	1,200,000	Sutton Coldfield and Brierley Hill relay	51 29	In group/ Out of group
Brighton and Hove		150,000	98,000	Whitehawk Hill	54	In group
Bristol		380,000	330,000	Mendip and Kings Weston relay Ilchester Crescent relay	51 30 30	In group Just outside Just outside
Bromsgrove		83,000	29,000	Bromsgrove	29	In group
Burnley	Nelson, Colne	120,000	82,000	Pendle Forest	30	In group
Cambridge		84,000	83,000	Madingley	40	Outside with others
Cardiff	Newport, Bridgend	500,000	351,000	Wenvoe	51	In group
Carlisle		120,000	91,000	Caldbeck	56	Out of group*
Carmarthen		51,000	40,000	Carmel	55	In group
Derry / Londonderry		40,000	36,000	Londonderry	51	In group

Primary Location	Coverage includes	Gross population (hh)	DPSA population (hh)	Transmitter	Channel	Aerial compatibility
Dover	Parts of Folkestone	52,000	42,000	Dover	57	In group
Dundee	Arbroath, Perth	390,000	150,000	Angus and Tay Bridge relay	48 51	In group In group
Edinburgh	Dunfermline	610,000	290,000	Craigkelly	52	Outside with others
Elgin		50,000	29,000	Knockmore	56	Outside with others
Falkirk	Stirling	460,000	340,000	Black Hill petal 2	56	In group
Glasgow	East Kilbride, Motherwell, Paisley	750,000	660,000	Black Hill petal 1	51	In group
Gloucester	Cheltenham	140,000	130,000	Ridge Hill petal 2	30	In group
Greenock	Dunoon	46,000	34,000	Rosneath VP	48	In group
Grimsby	Parts of Kingston upon Hull	270,000	270,000	Belmont	21	In group
Guildford	Parts of Woking	180,000	53,000	Guildford	51	In group
Haverfordwest		25,000	24,000	Preseli	30	Just outside
Haywards Heath	Heathfield, Uckfield	95,000	64,000	Heathfield	29	Outside with others
Hemel Hempstead	Parts of St Albans	110,000	37,000	Hemel Hempstead	42	In group
Hereford		44,000	43,000	Ridge Hill petal 1	51	Out of group*
Inverness		72,000	50,000	Rosemarkie	52	In group
Keighley		79,000	34,000	Keighley	56	In group
Kidderminster		35,000	22,000	Kidderminster	56	In group
Lancaster	Morecambe, Heysham	140,000	42,000	Lancaster	30	In group

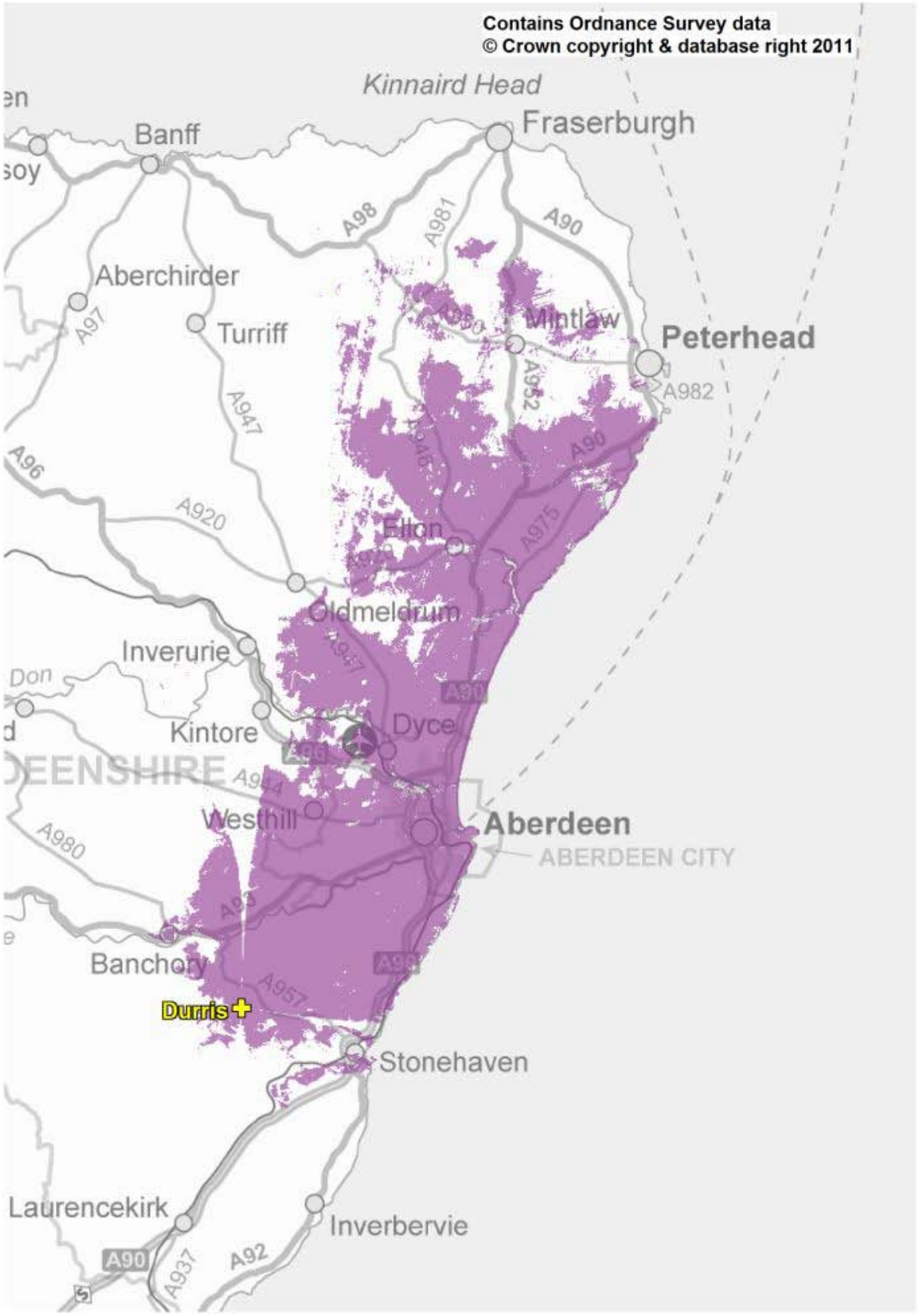
Primary Location	Coverage includes	Gross population (hh)	DPSA population (hh)	Transmitter	Channel	Aerial compatibility
Leeds	Dewsbury, Halifax, Huddersfield, Wakefield	1,100,000	1,000,000	Emley Moor and Beecroft Hill relay	56 56	Just outside In group
Limavady	Parts of Ballymoney, parts of Coleraine	55,000	36,000	Limavady	48	In group
Liverpool	St Helens, Widnes, Wigan, Wirral	880,000	870,000	Winter Hill petal 2 and Storeton relay	56 30	In group In group
London	Greater London area	3,200,000	3,100,000	Crystal Palace	29	In group
Luton		81,000	23,000	Luton	45	Just outside
Maidstone		220,000	140,000	Bluebell Hill	27	Just outside
Malvern		79,000	50,000	Malvern	51	In group
Manchester	Bolton, Bury, Oldham, Rochdale, Salford, Stockport	1,100,000	1,100,000	Winter Hill petal 1 and Saddleworth relay	56 41	In group In group
Middlesbrough	Hartlepool, Stockton on Tees	290,000	220,000	Bilsdale petal 1	24	In group
Mold	Denbigh, Ruthin	89,000	25,000	Moel Y Parc	56	Just outside
Newcastle	Gateshead, South Shields, Sunderland	1,000,000	900,000	Pontop Pike and Fentham relay	56 30	In group In group
Norwich		155,000	149,000	Tacolneston	57	In group
Nottingham		310,000	290,000	Waltham and Nottingham relay	26 50	Outside with others Outside with others

Primary Location	Coverage includes	Gross population (hh)	DPSA population (hh)	Transmitter	Channel	Aerial compatibility
Oxford	Abingdon, Didcot	110,000	110,000	Oxford	51	In group
Plymouth		94,000	100,000	Caradon Hill and Plympton relay	30	In group
Poole		51,000	21,000	Poole	50	In group
Preston	Blackpool	350,000	340,000	Winter Hill petal 3	0	In group
Reading		360,000	140,000	Hannington petal 1	51	In group
Reigate	Parts of Crawley	120,000	74,000	Reigate	51	In group
Salisbury		42,000	31,000	Salisbury	51	In group
Scarborough		44,000	33,000	Olivers Mount	56	In group
Sheffield	Parts of Rotherham	190,000	120,000	Sheffield	55	Outside with others
Shrewsbury		46,000	44,000	The Wrekin petal 2	51	Outside with others
Southampton	Eastleigh, Fareham, parts of Isle of Wight, parts of Portsmouth, Winchester	460,000	250,000	Rowridge	30	In group
Stoke on Trent	Newcastle under Lyme	150,000	120,000	Fenton	29	In group
Stratford upon Avon		68,000	29,000	Lark Stoke	48	Outside with others
Swansea	Llanelli	120,000	73,000	Kilvey Hill	30	In group
Telford	Telford	140,000	73,000	The Wrekin petal A	48	Outside with others
Tonbridge	Parts of Tunbridge Wells	62,000	45,000	Tunbridge Wells	51	In group
York		150,000	71,000	Bilsdale petal 2	24	In group

Annex 1

Location maps

1.1 Aberdeen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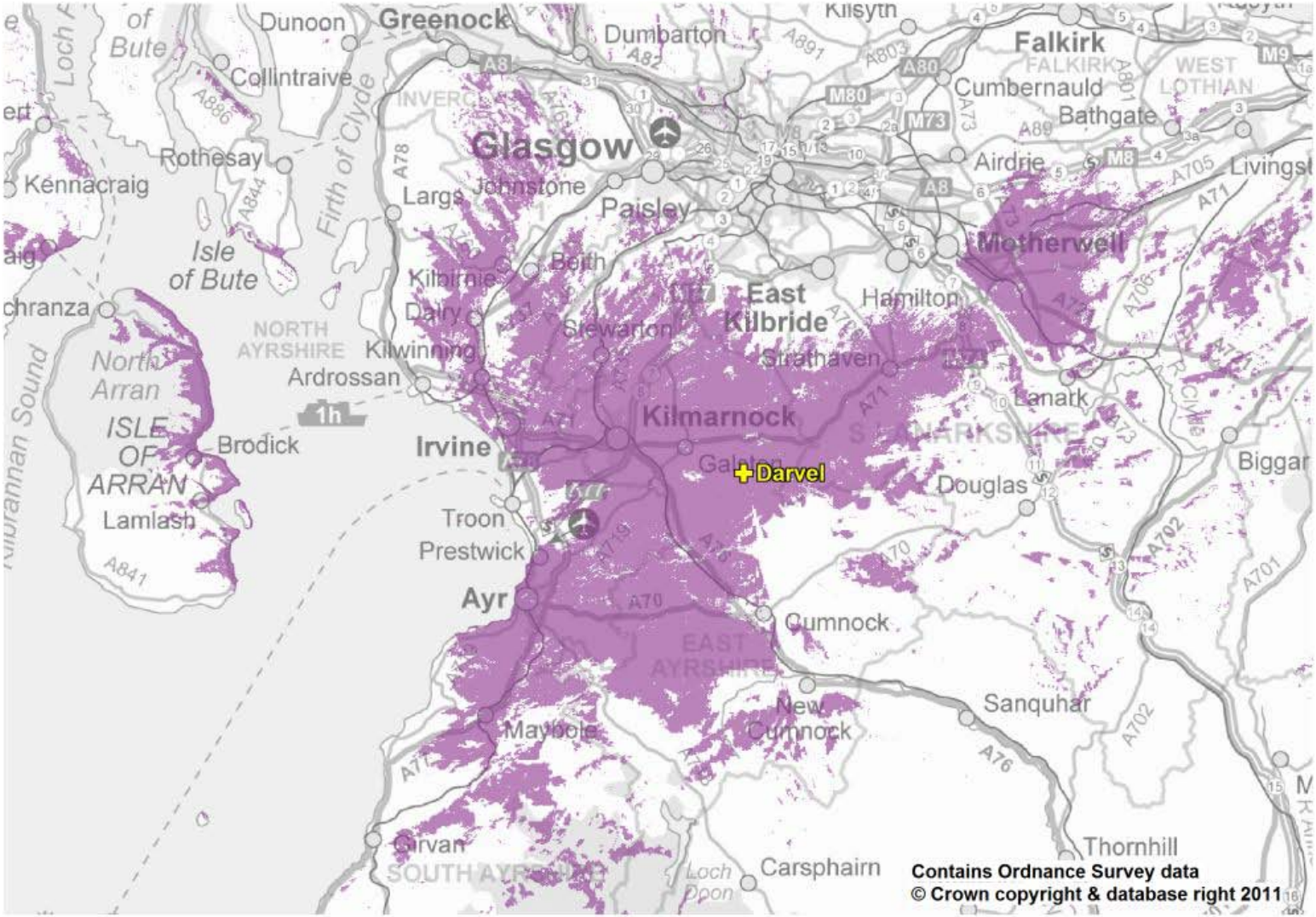
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East Kilbride
Hamilton
Dalry
Stewarton
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Kilwinning
Strathaven
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North Arran
Kilmarnock
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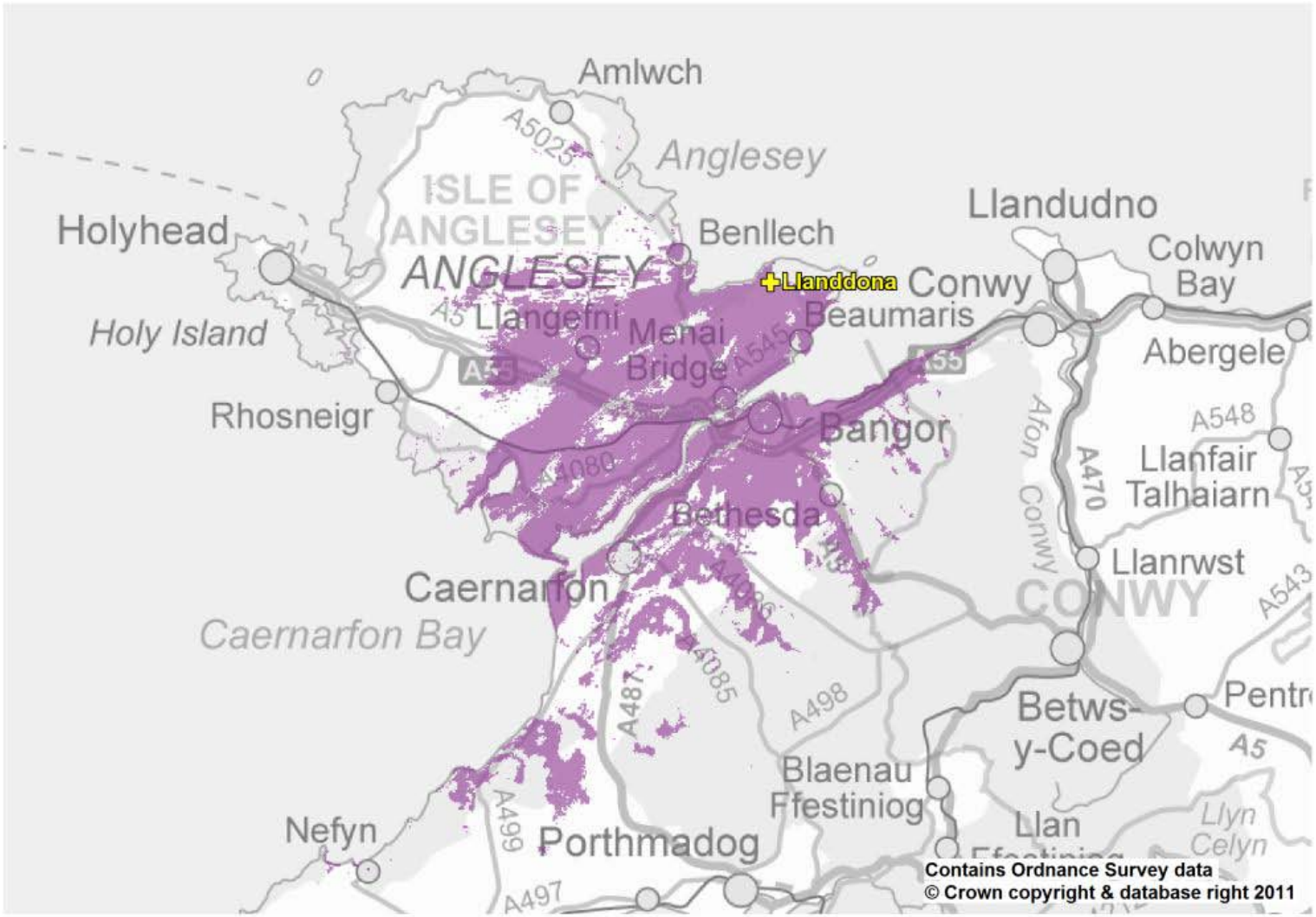
1.3 Bangor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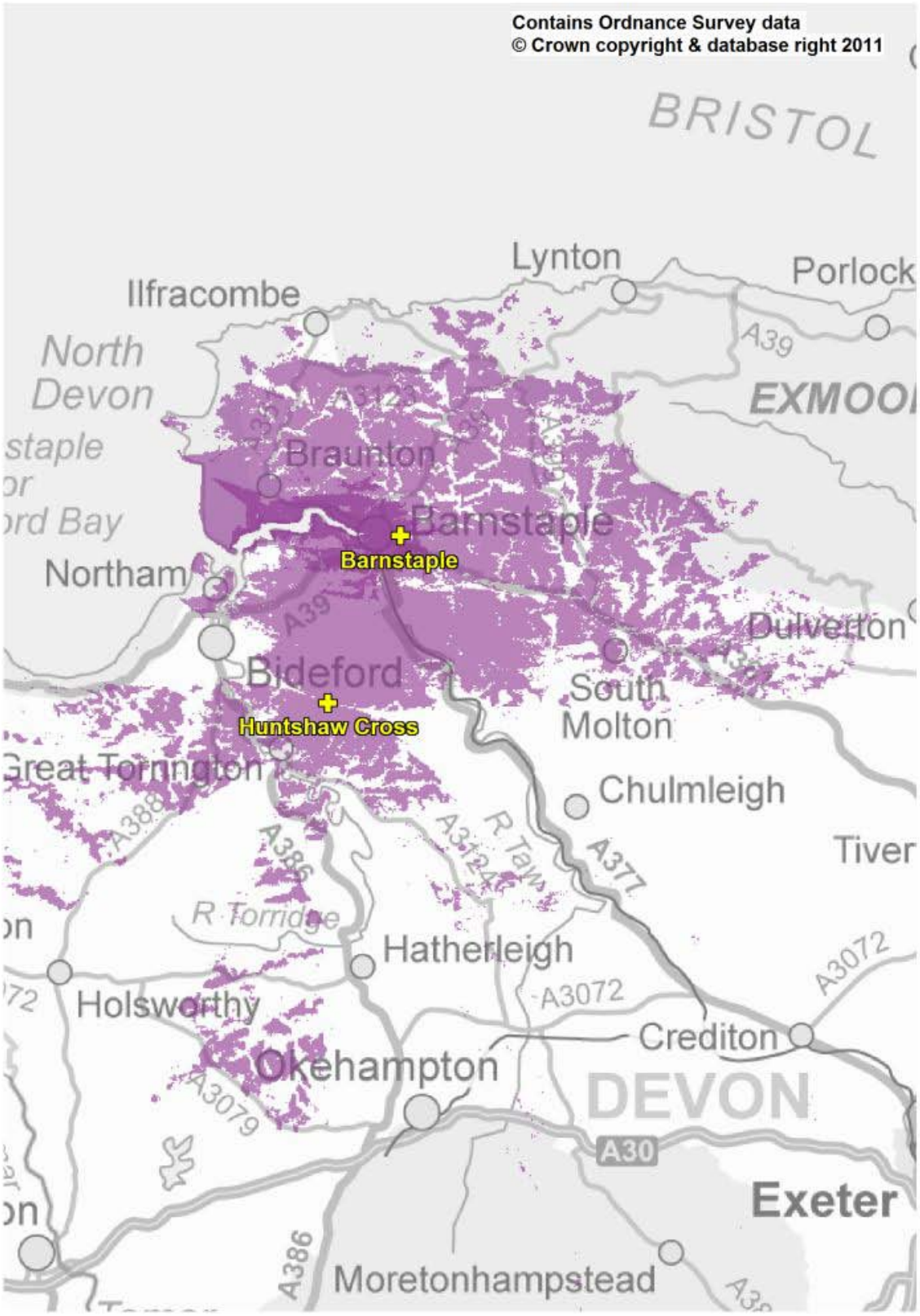
1.4 Barnstaple



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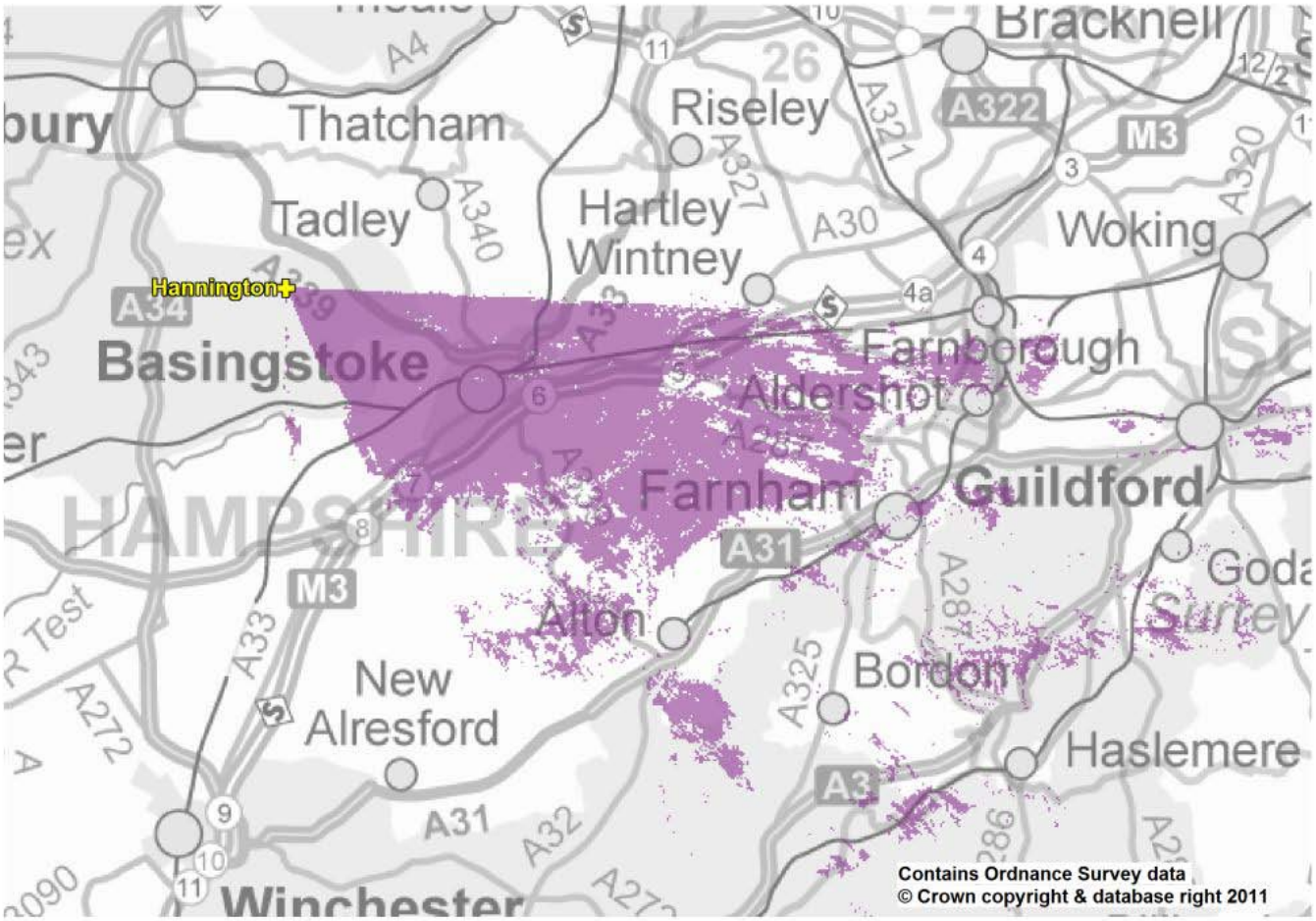

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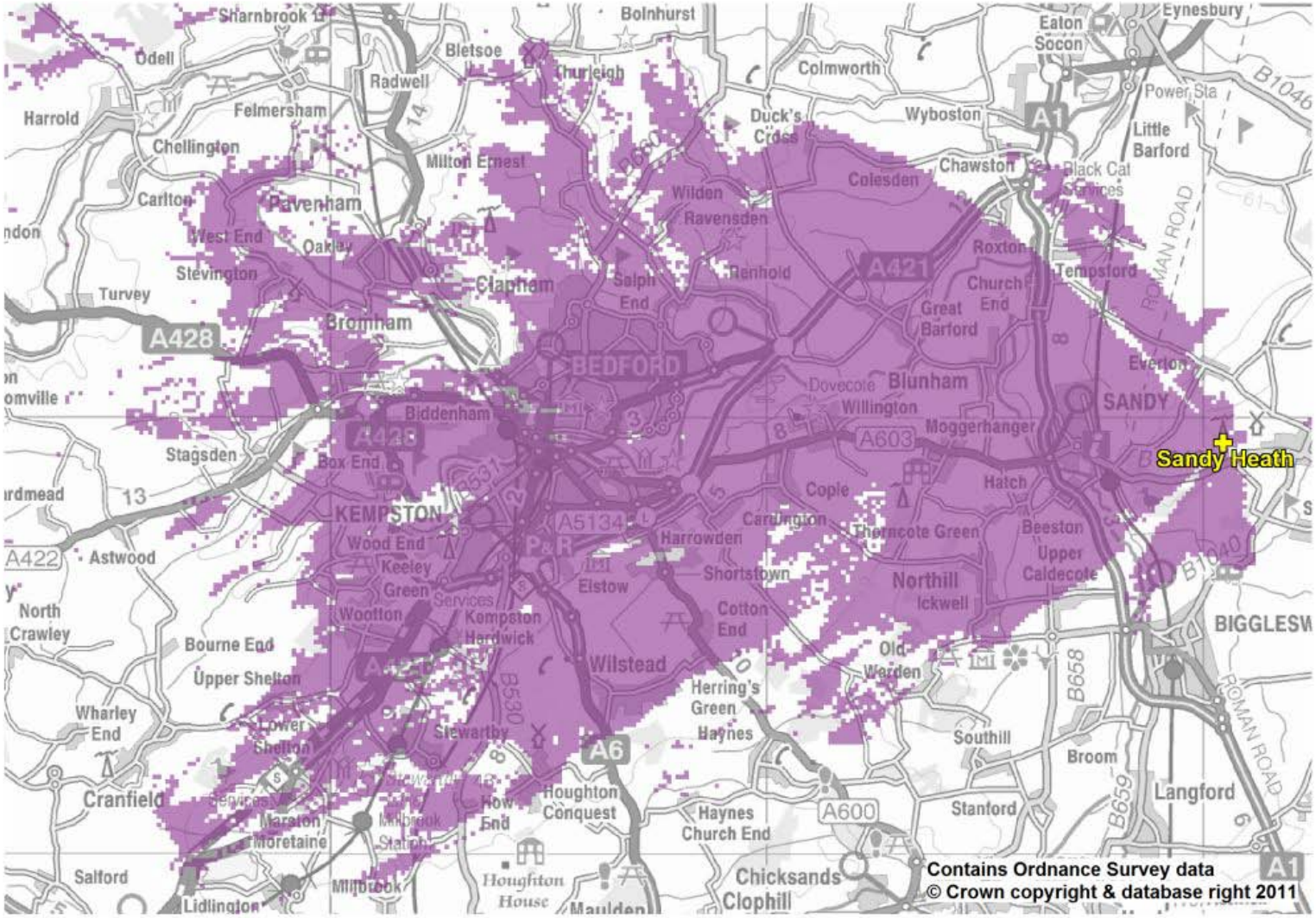
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Shortstown
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Kempston Hardwick
Cotton End
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North Crawley
Bourne End
Upper Shelton
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Herring's Green
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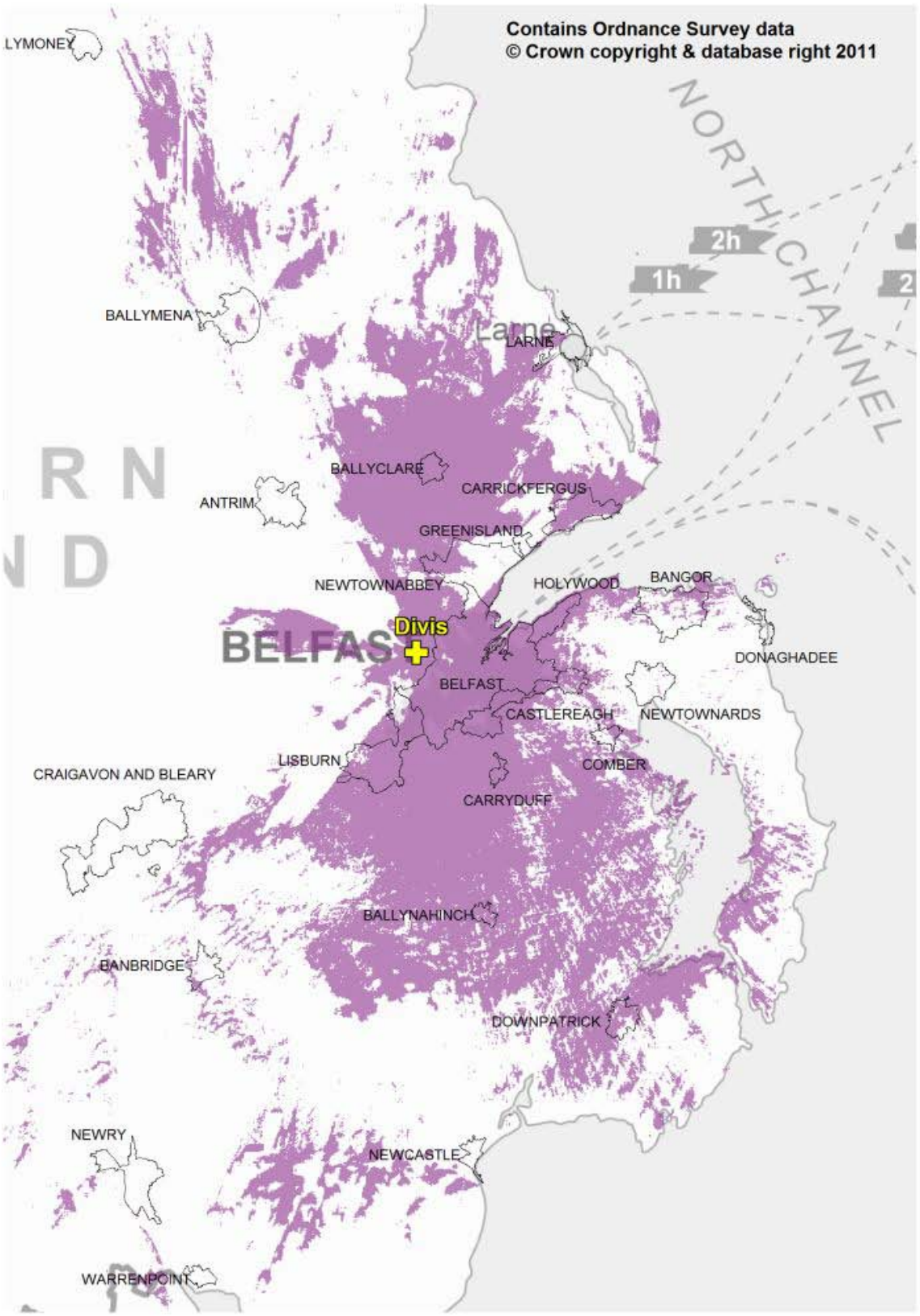
1.7 Belfast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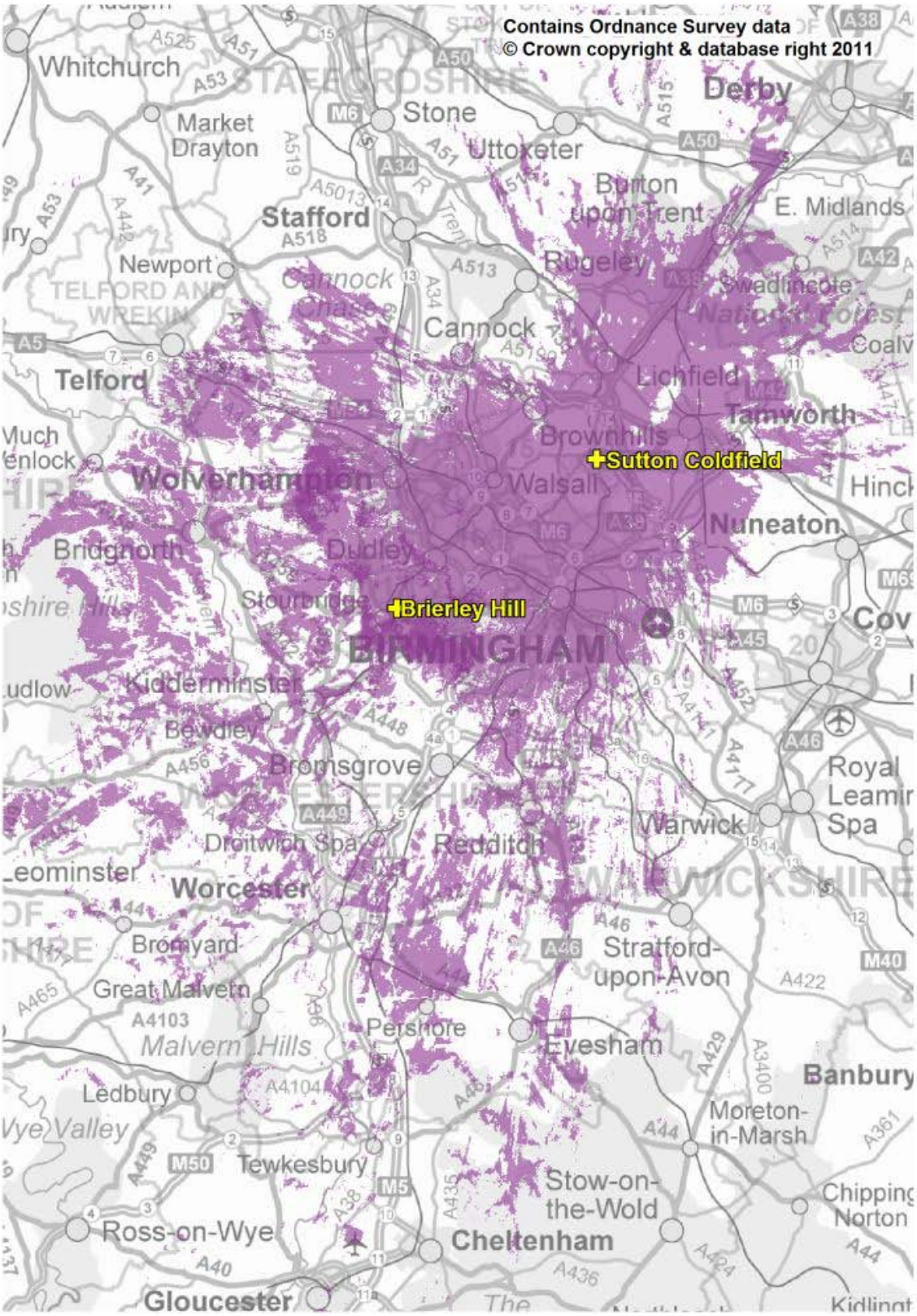

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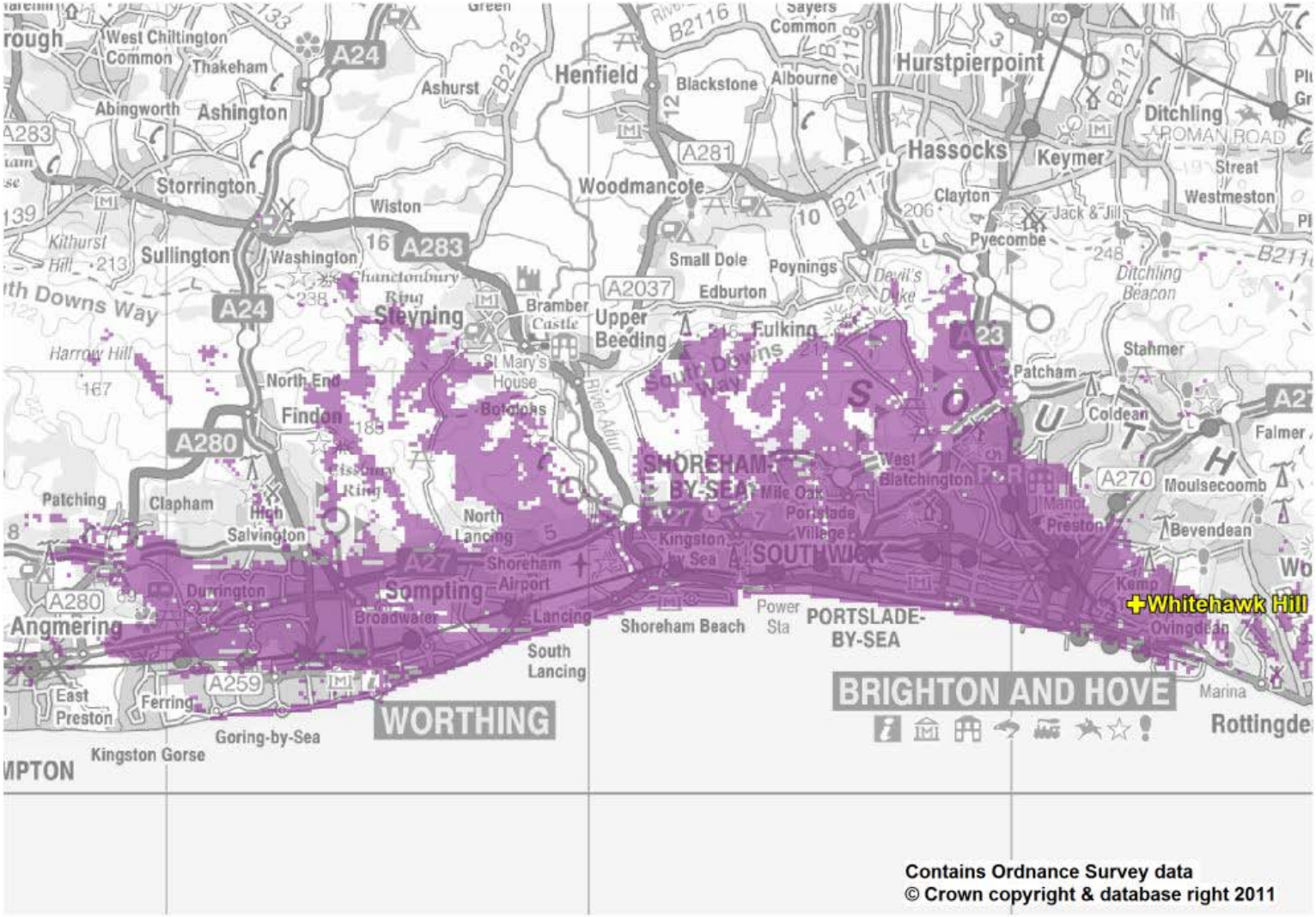

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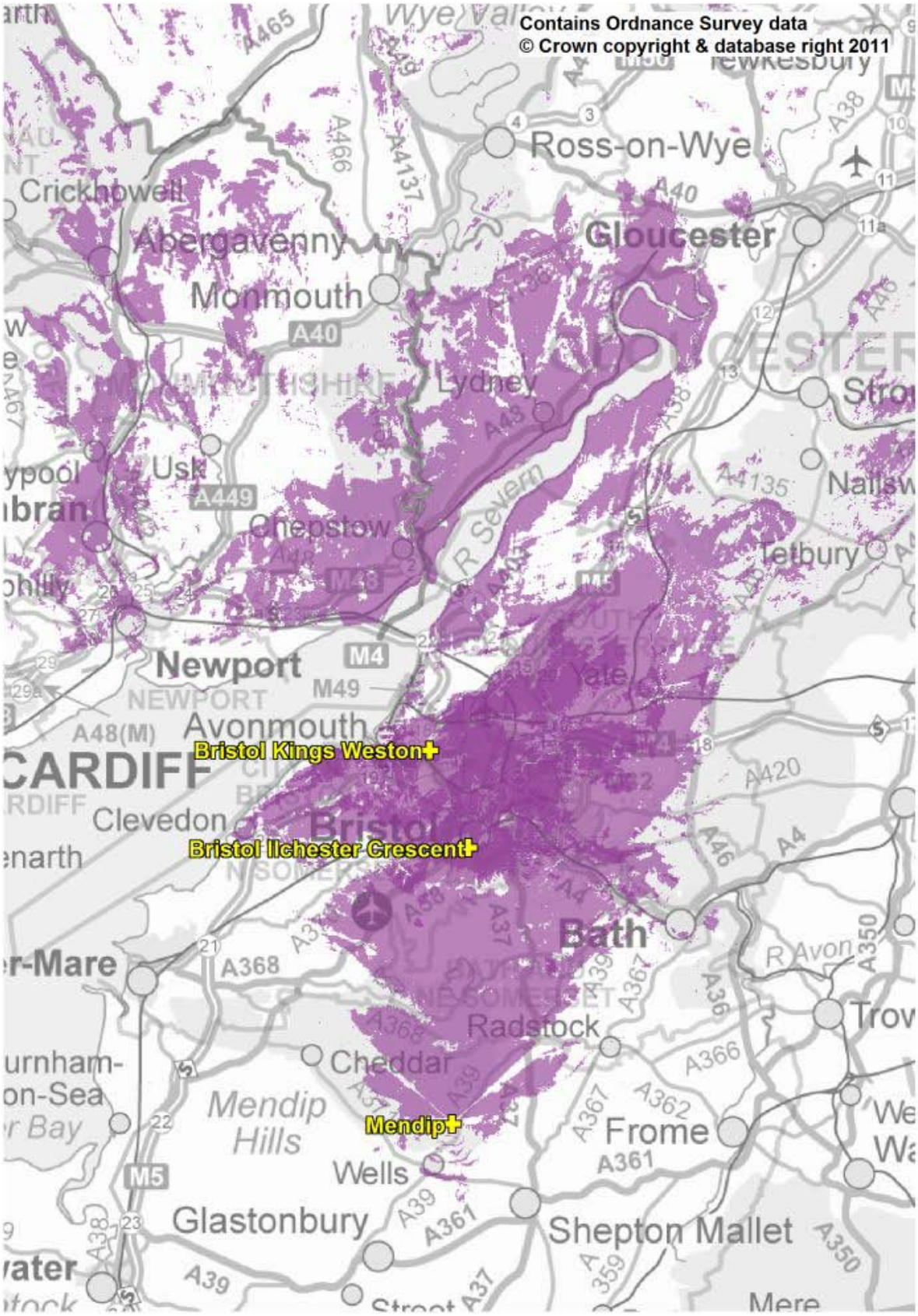
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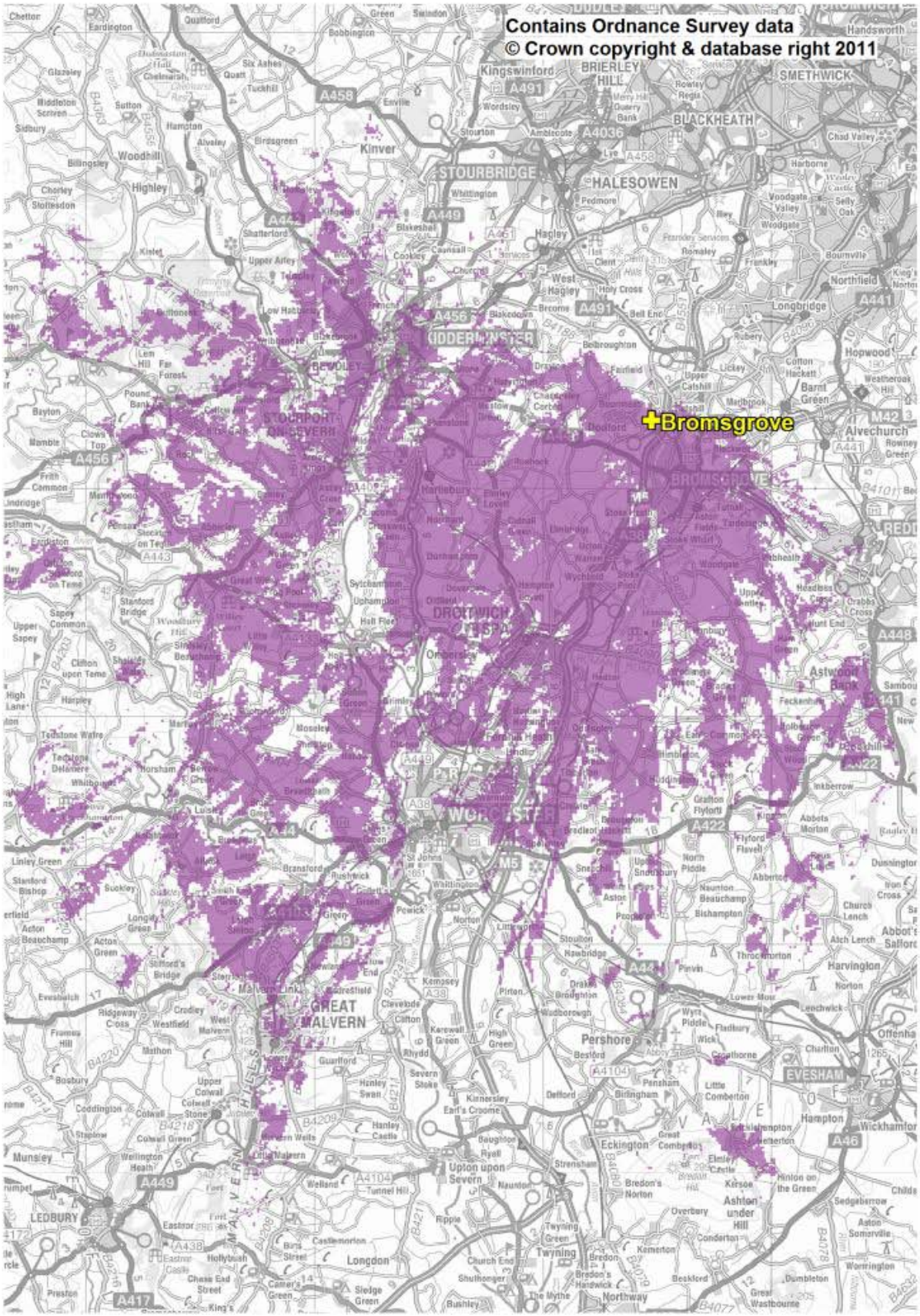
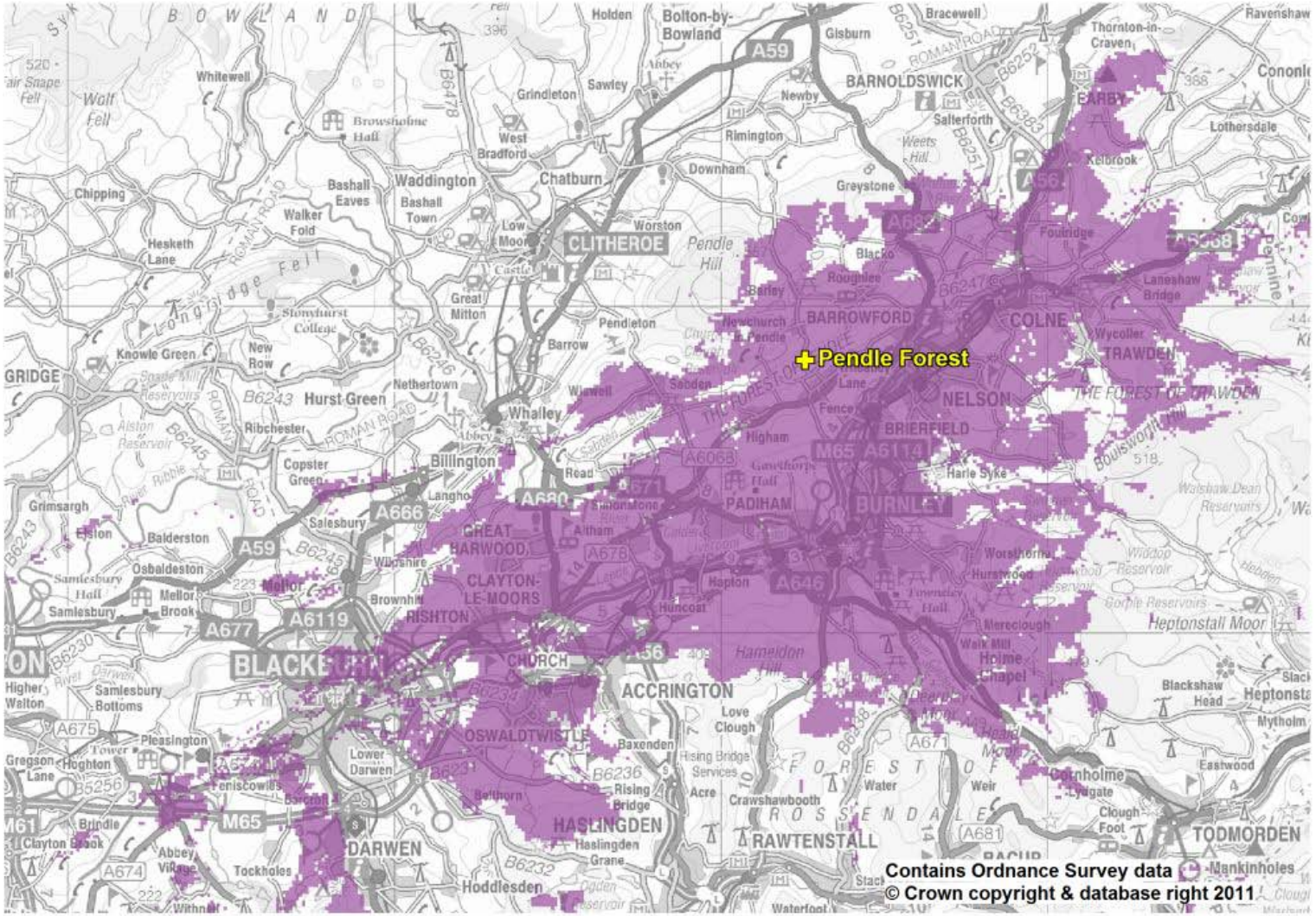
A48(M)
A368
A361
A420
R Severn
R Avon

1.11 Bromsgrove



1.12 Burnley


Pendle Forest
Contains Ordnance Survey data
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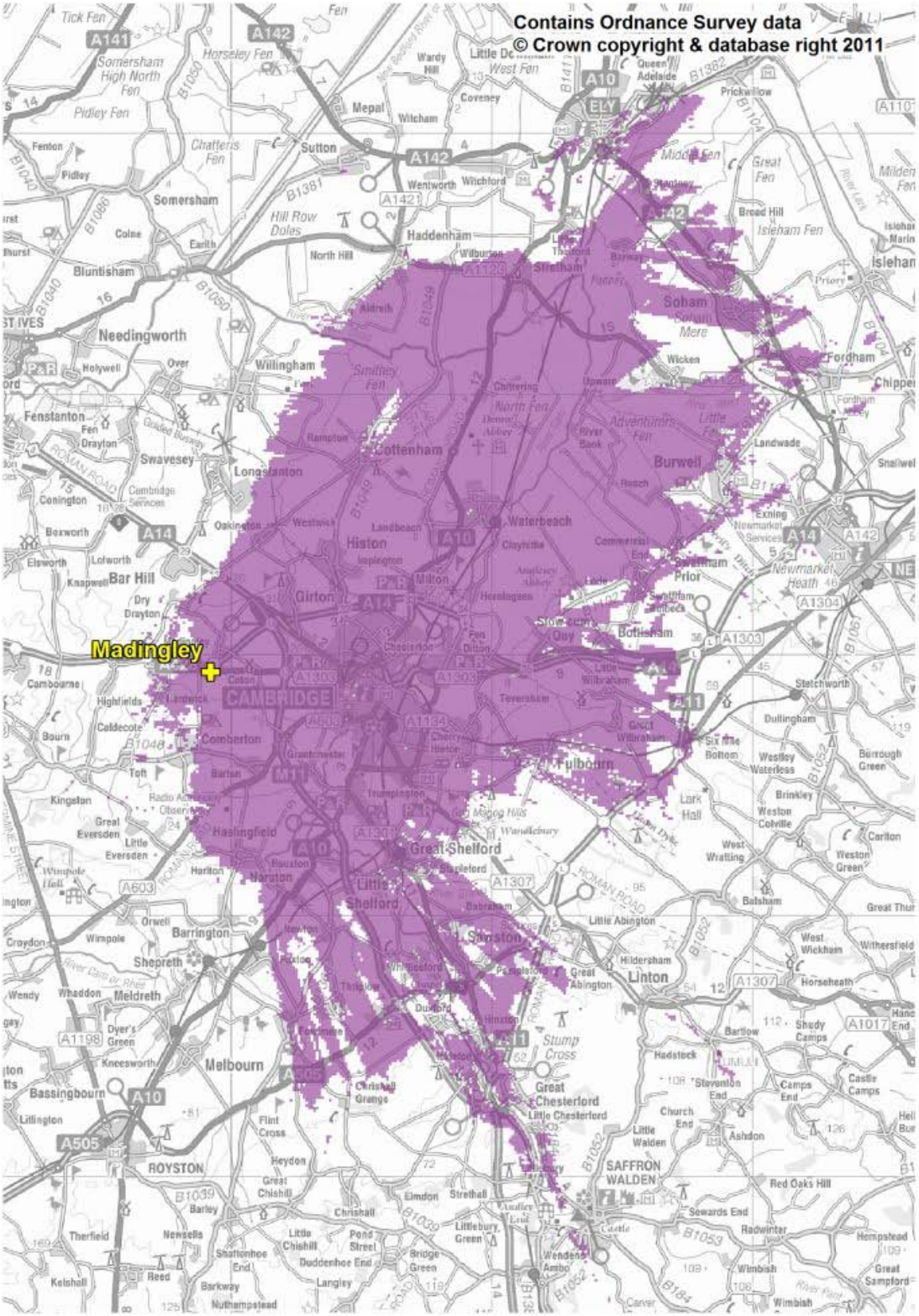
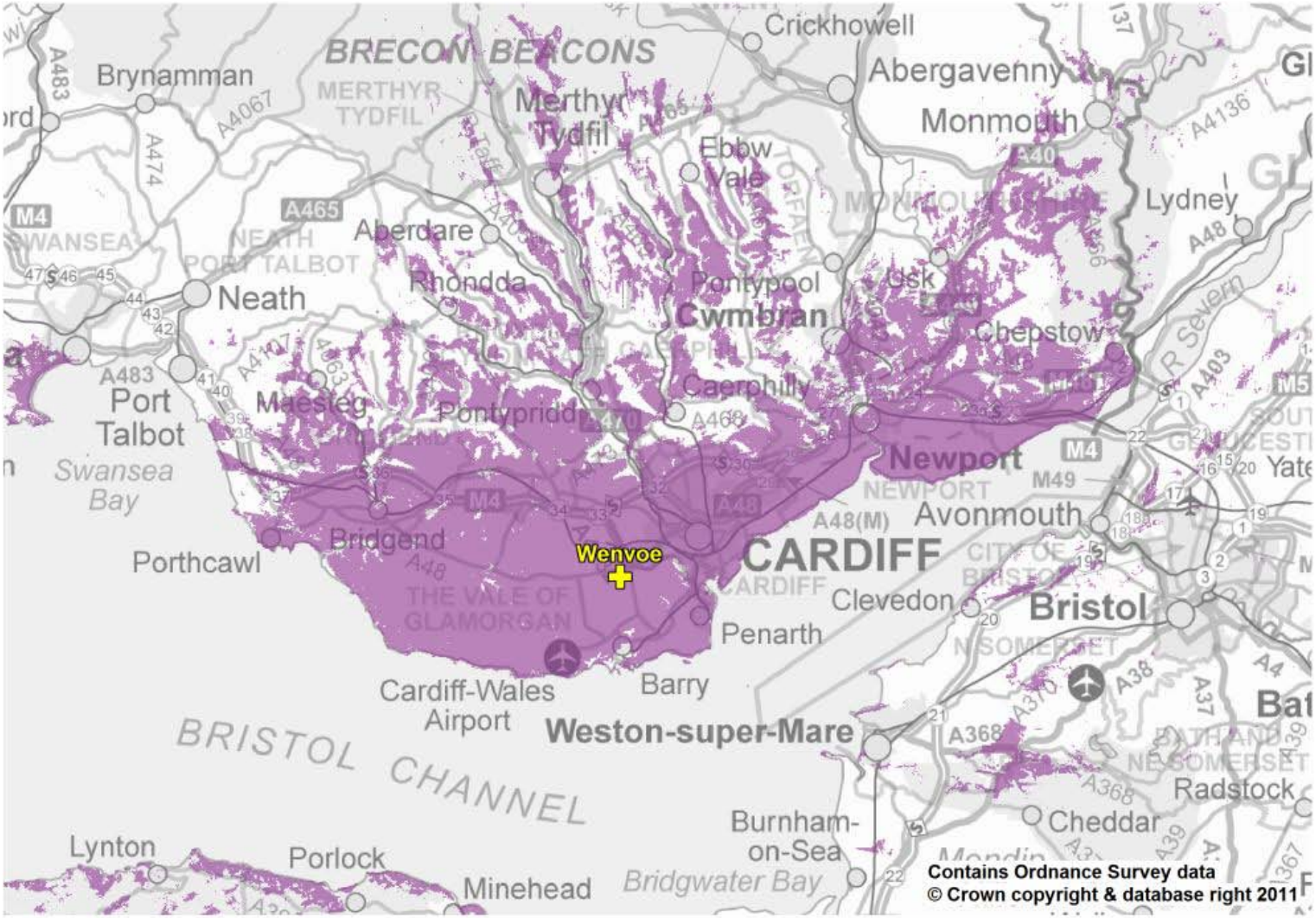
1.13 Cambridge



1.14 Cardiff


Crickhowell
BRECON BEACONS
Brynamman
MERTHYR TYDFIL
Merthyr Tydfil
Abergavenny
Monmouth
Ebbw Vale
Lydney
Aberdare
Rhondda
Pontypool
Cwmbran
Usk
Chepstow
Neath
Port Talbot
Maesteg
Pontypridd
Caerphilly
Newport
Swansea Bay
Avonmouth
Bridgend
Wenvoe
CARDIFF
Porthcawl
Clevedon
Bristol
Penarth
Barry
Cardiff-Wales Airport
Weston-super-Mare
BRISTOL CHANNEL
Radstock
Cheddar
Burnham-on-Sea
Lynton
Porlock
Minehead
Bridgwater Bay
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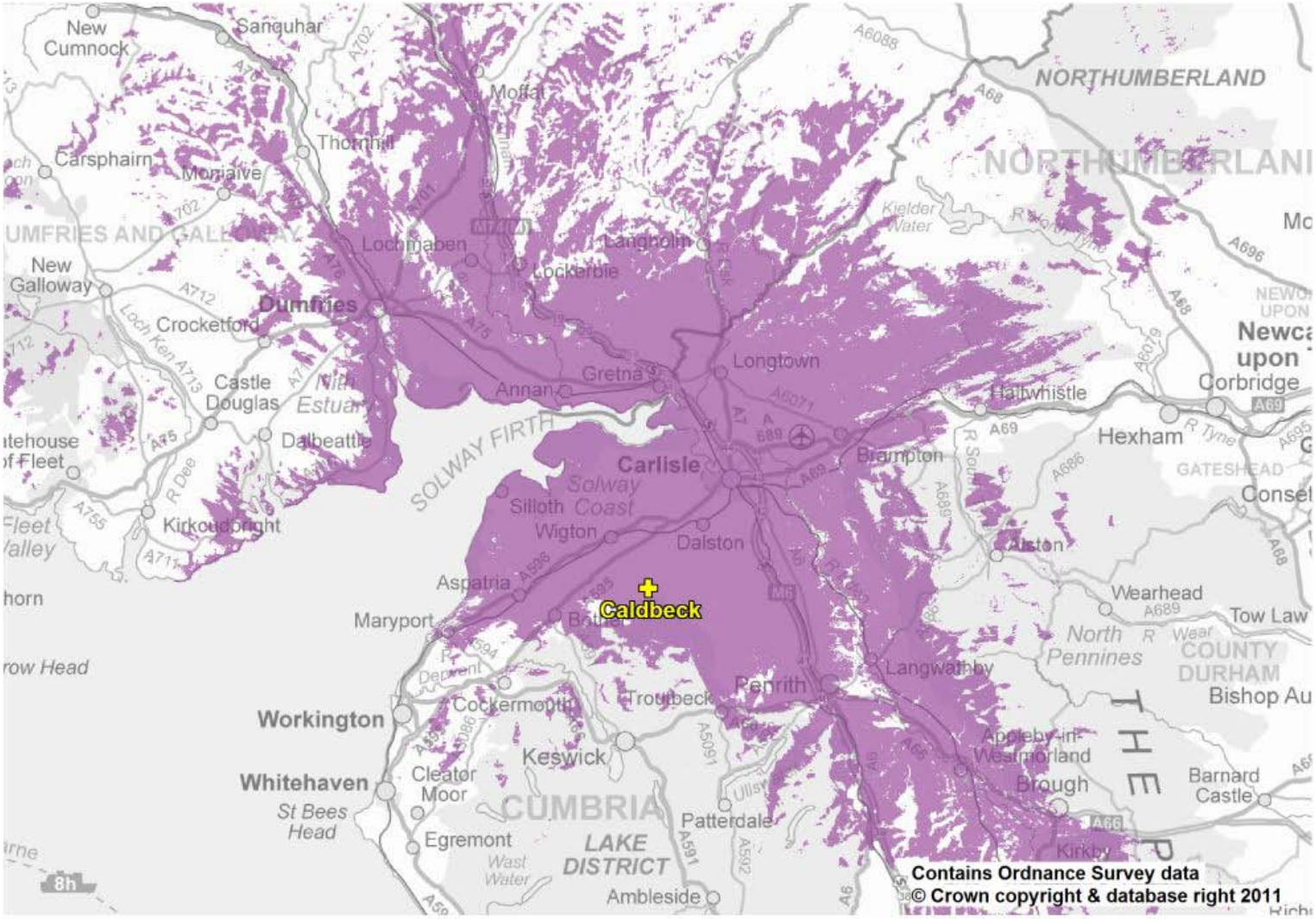
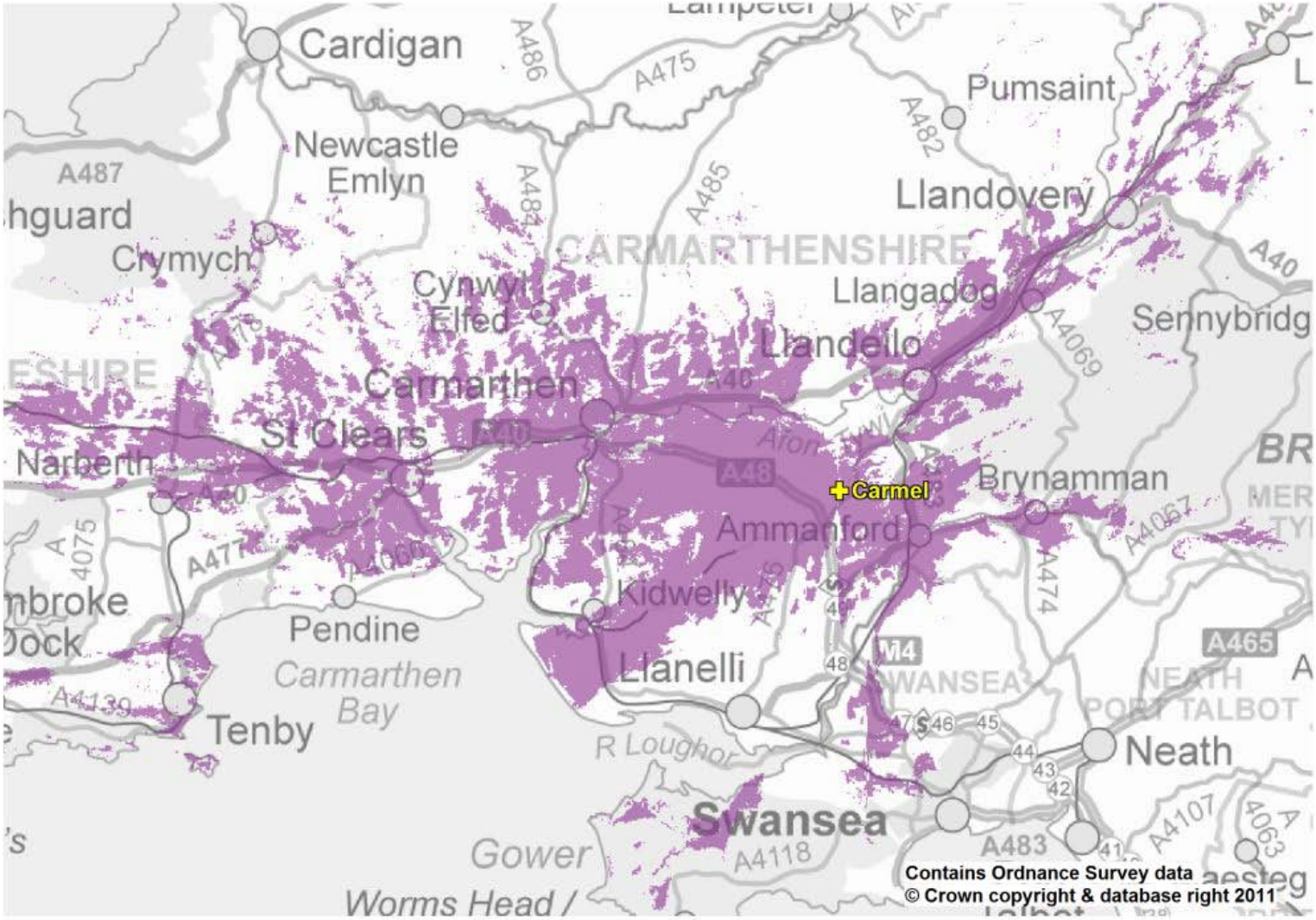
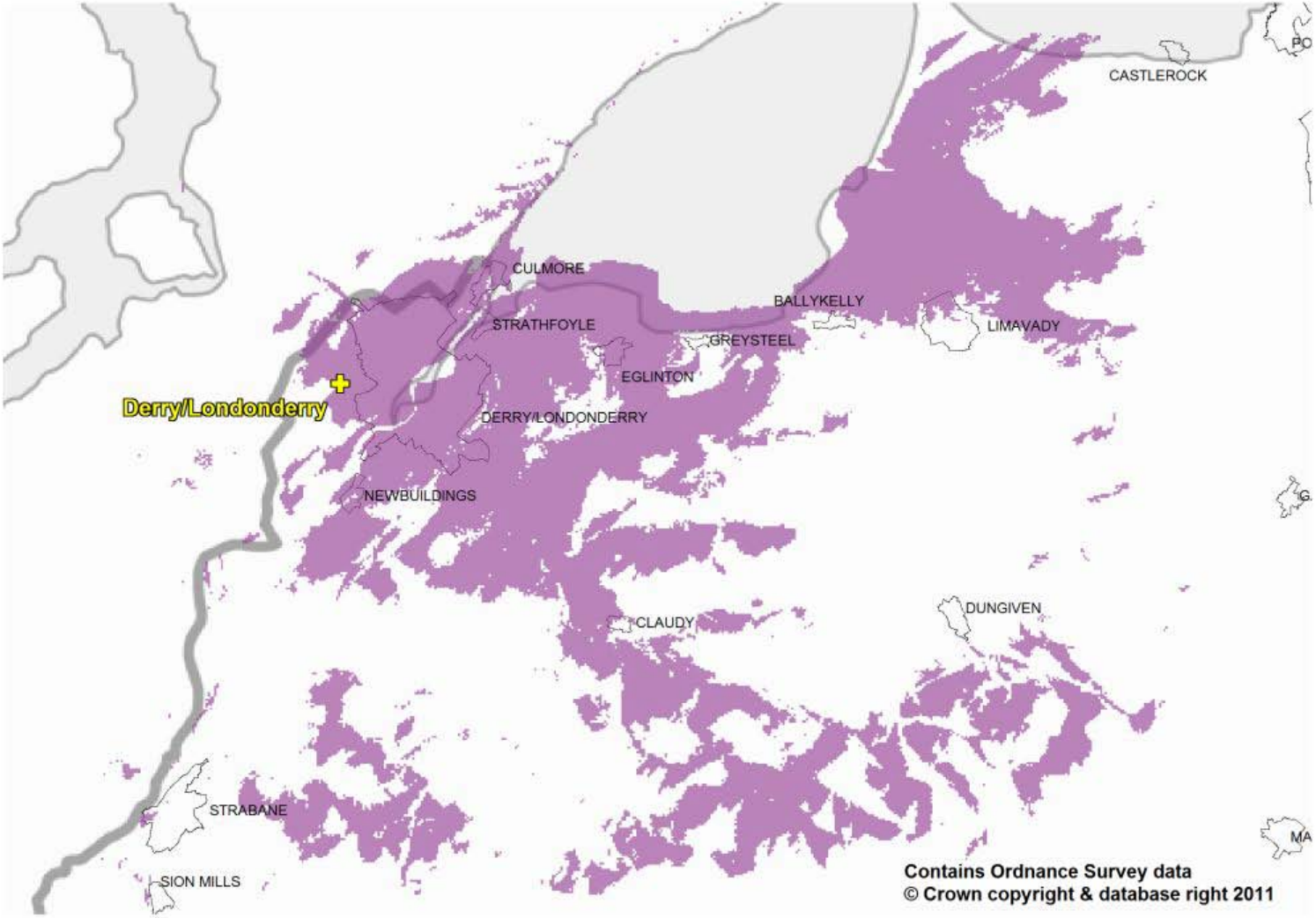
1.15 Carlisle



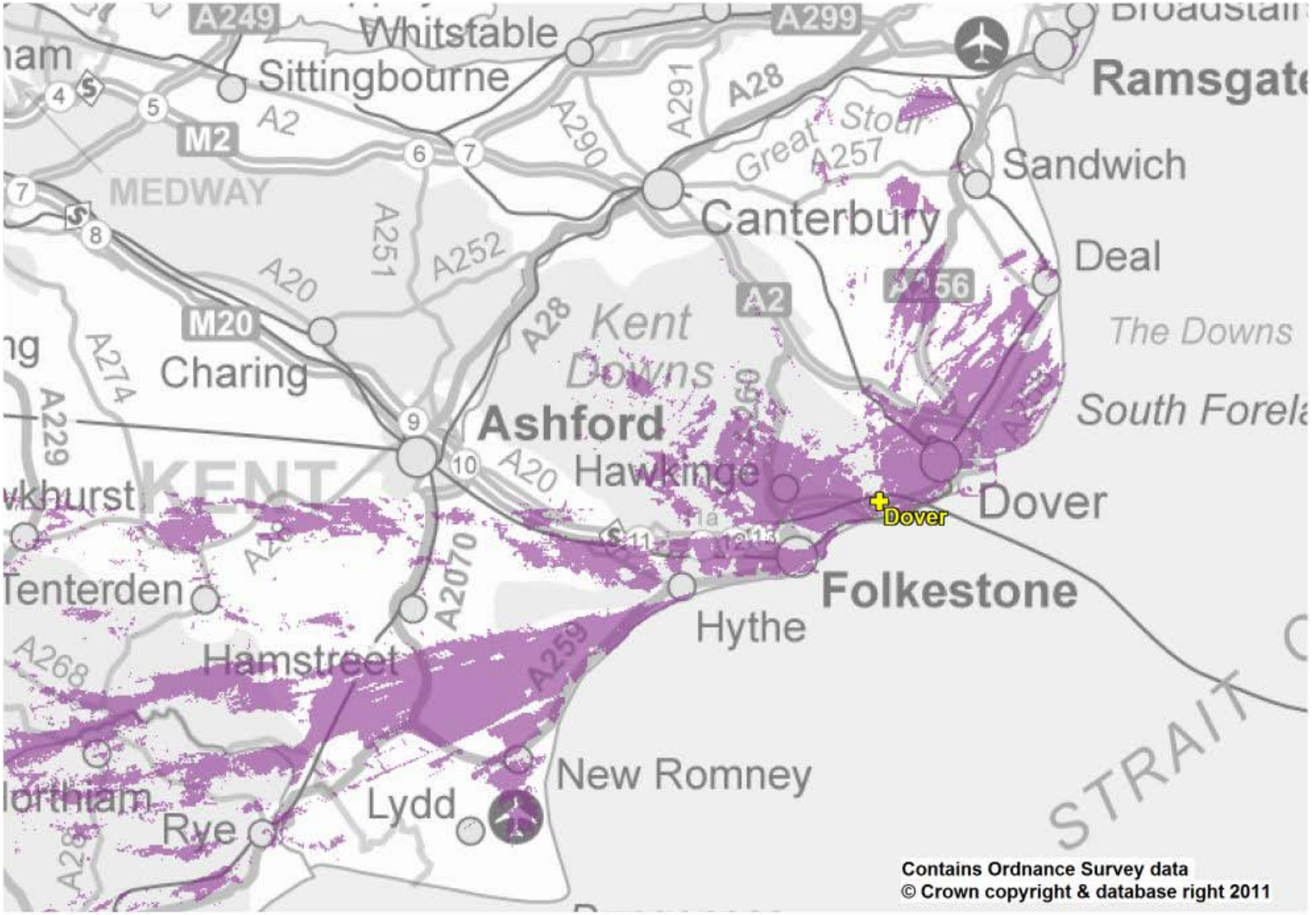
1.16 Carmarthen



1.17 Derry/Londonderry



1.18 Dover


A249
Whitstable
Sittingbourne
A299
Ramsgate
A2
M2
A290
A291
A28
Great Stour
A257
Sandwich
MEDWAY
Canterbury
A251
A252
Deal
A20
A2
M20
Kent Downs
The Downs
Charing
A274
A229
Ashford
South Forela
KENT
Hawkinge
Dover
Dover
Folkestone
Tenterden
A2070
Hythe
A268
Hamstreet
A259
New Romney
Lydd
Rye
STRAIT
Contains Ordnance Survey data
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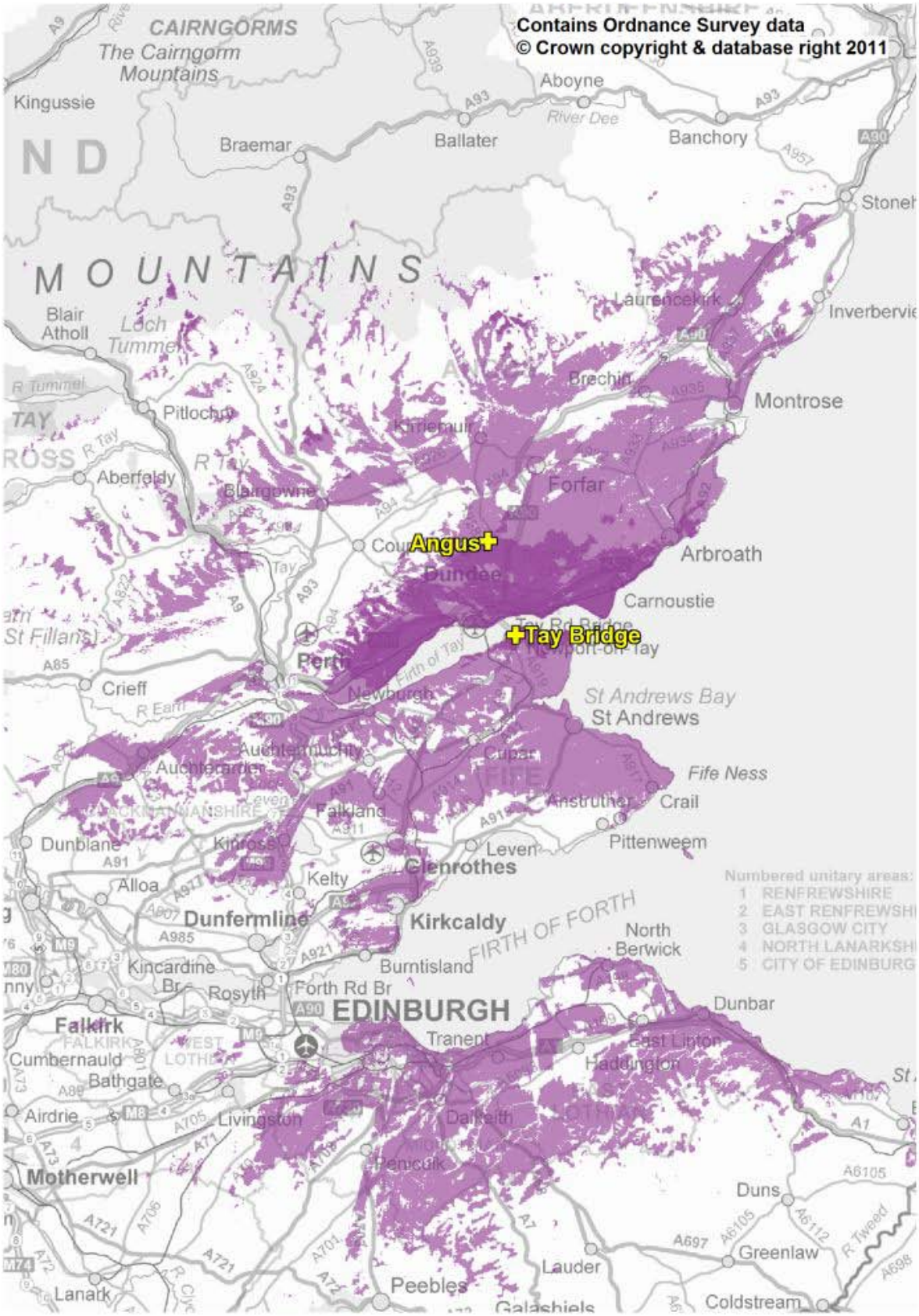
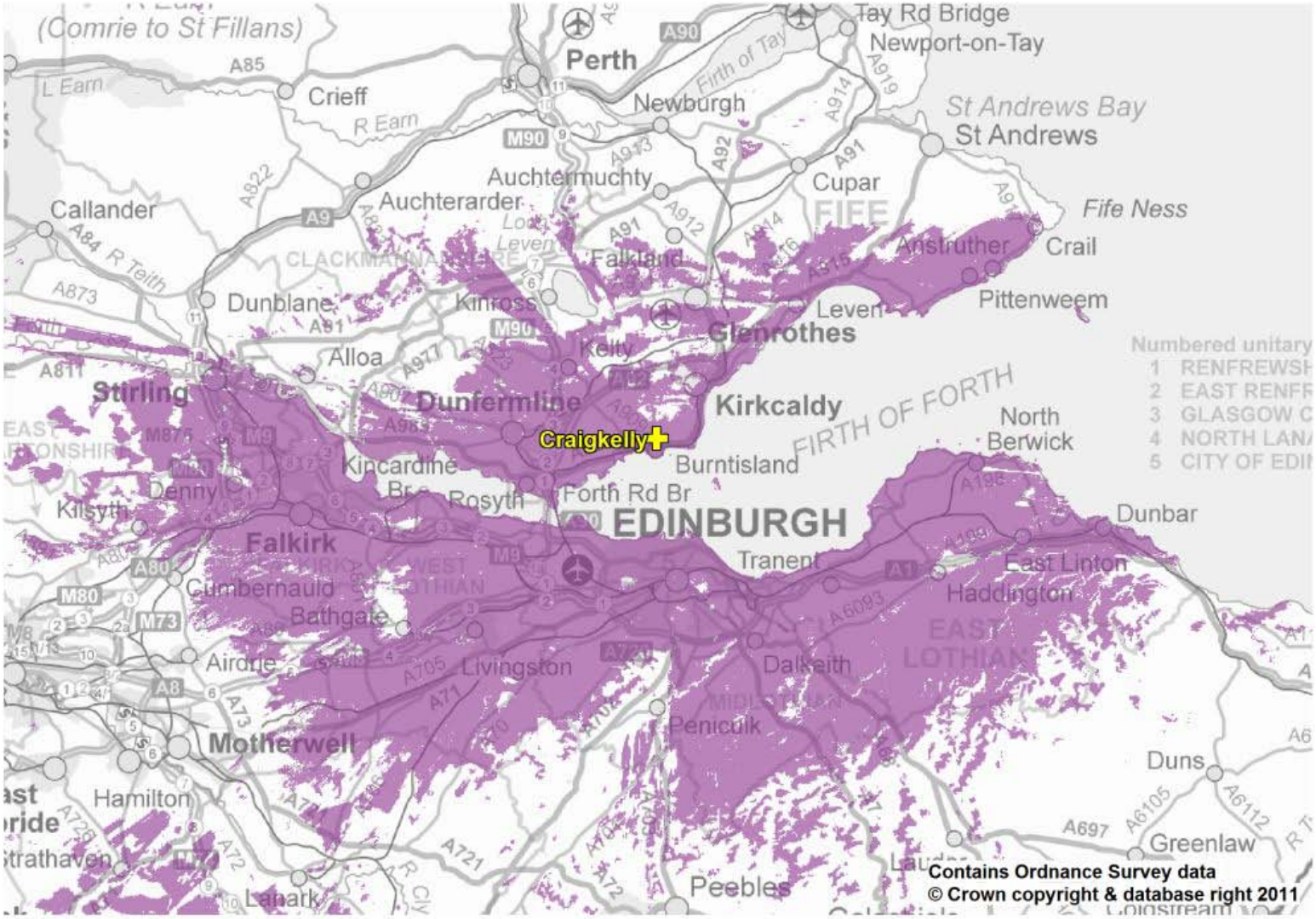
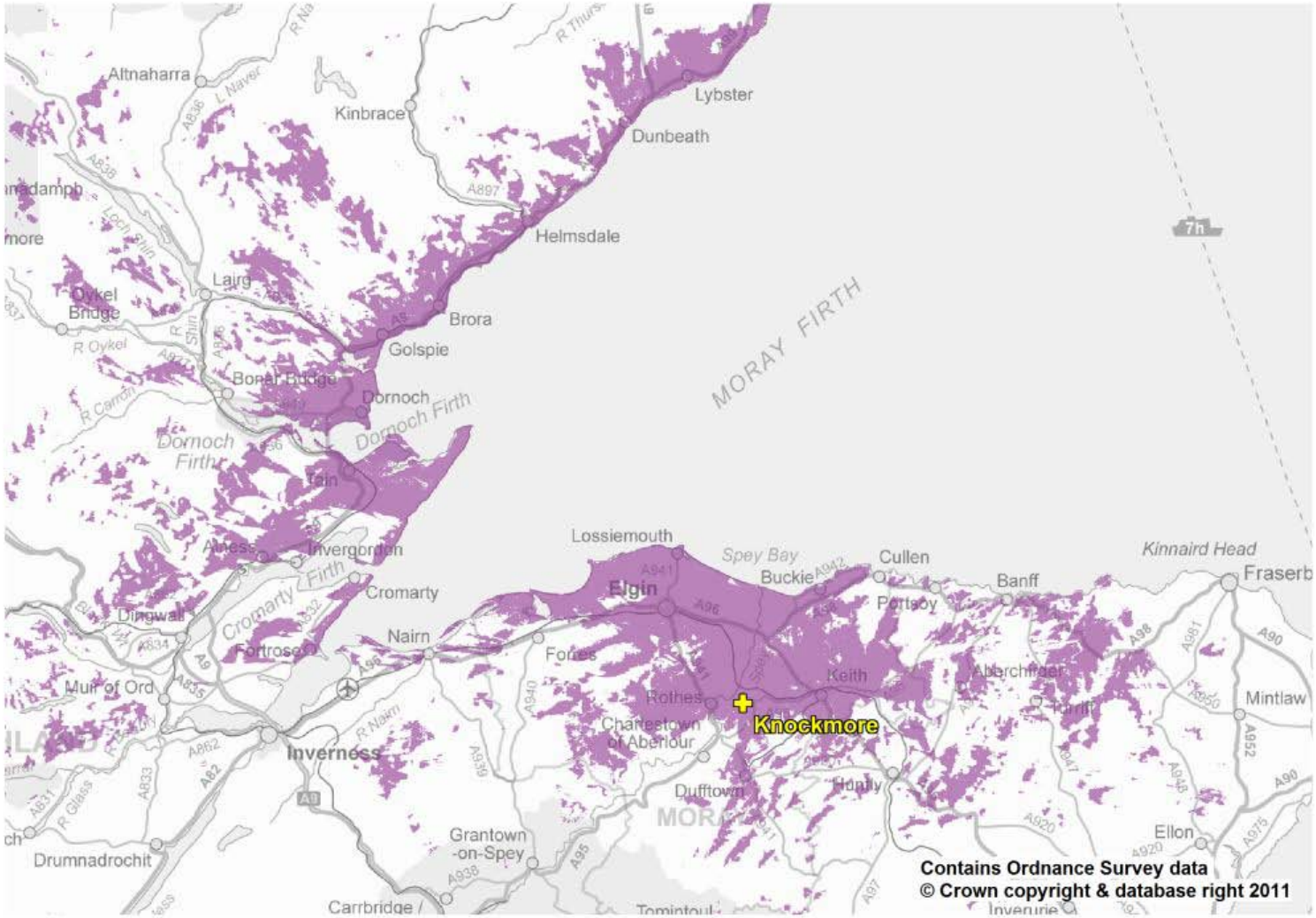
1.19 Dundee


Contains Ordnance Survey data
© Crown copyright & database right 2011
CAIRNGORMS
The Cairngorm Mountains
Kingussie
Braemar
Ballater
Aboyne
Banchory
Stonehaven
MOUNTAINS
Blair Atholl
Loch Tummel
Pitlochry
Aberfeldy
Blairgowrie
Kirriemuir
Brechin
Montrose
Laurencekirk
Inverbervie
Forfar
Angus
Dundee
Arbroath
Carnoustie
Tay Bridge
Perth
Crieff
Newburgh
St Andrews Bay
St Andrews
Fife Ness
Auchterarder
Auchtermuchty
Falkland
Anstruther
Crail
Pittenweem
Dunblane
Kinross
Leven
Glenrothes
Alloa
Kelty
Dunfermline
Kirkcaldy
North Berwick
FIRTH OF FORTH
Kincardine Br
Rosyth
Forth Rd Br
Burntisland
EDINBURGH
Dunbar
Falkirk
Tranent
East Linton
Haddington
Cumbernauld
Bathgate
Airdrie
Livingston
Dalkeith
Penicuik
Motherwell
Duns
Greenlaw
Lauder
Peebles
Coldstream
Lanark
Numbered unitary areas:
1 RENFREWSHIRE
2 EAST RENFREWSHI
3 GLASGOW CITY
4 NORTH LANARKSHI
5 CITY OF EDINBURG

1.20 Edinburgh



1.21 Elgin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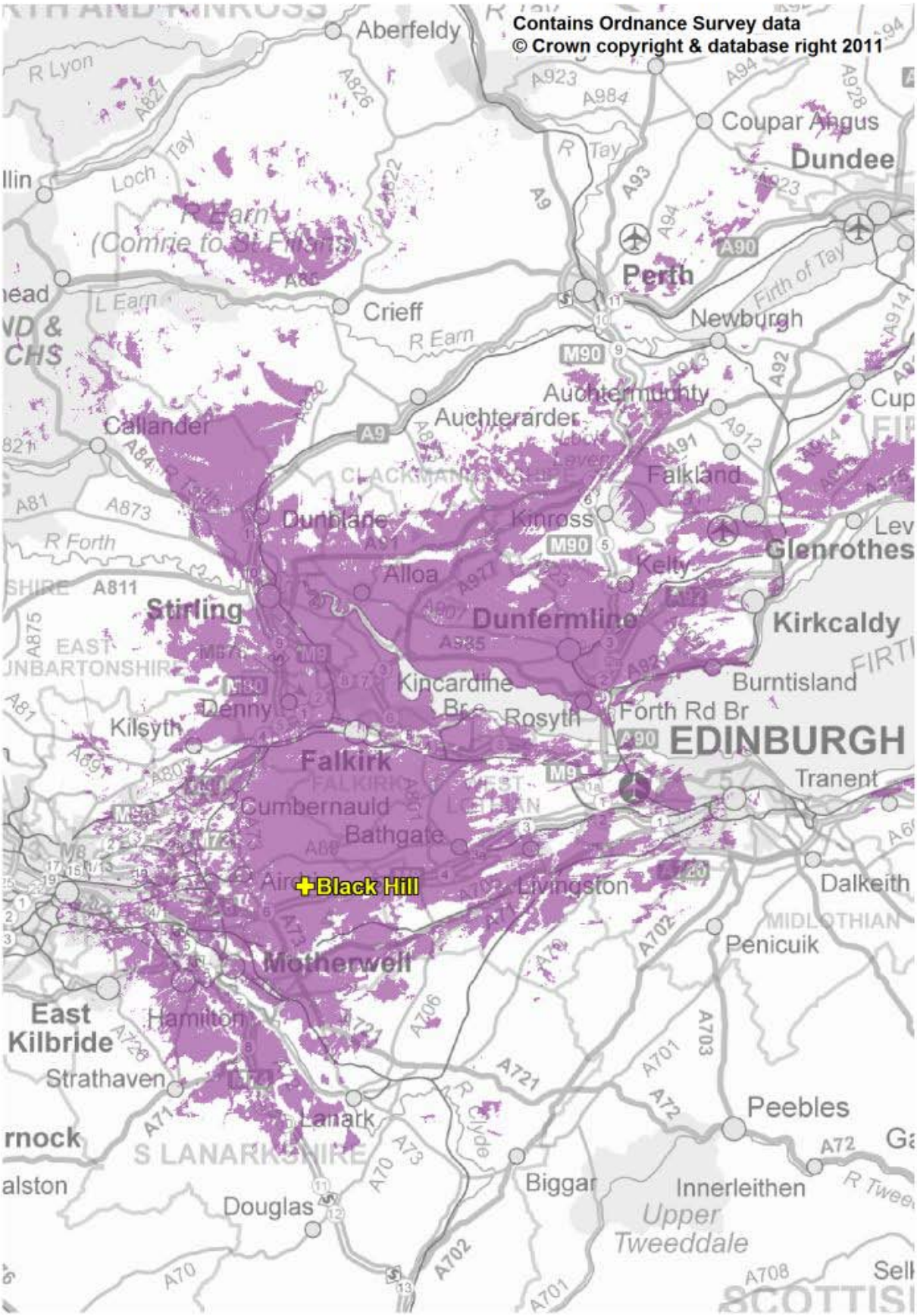
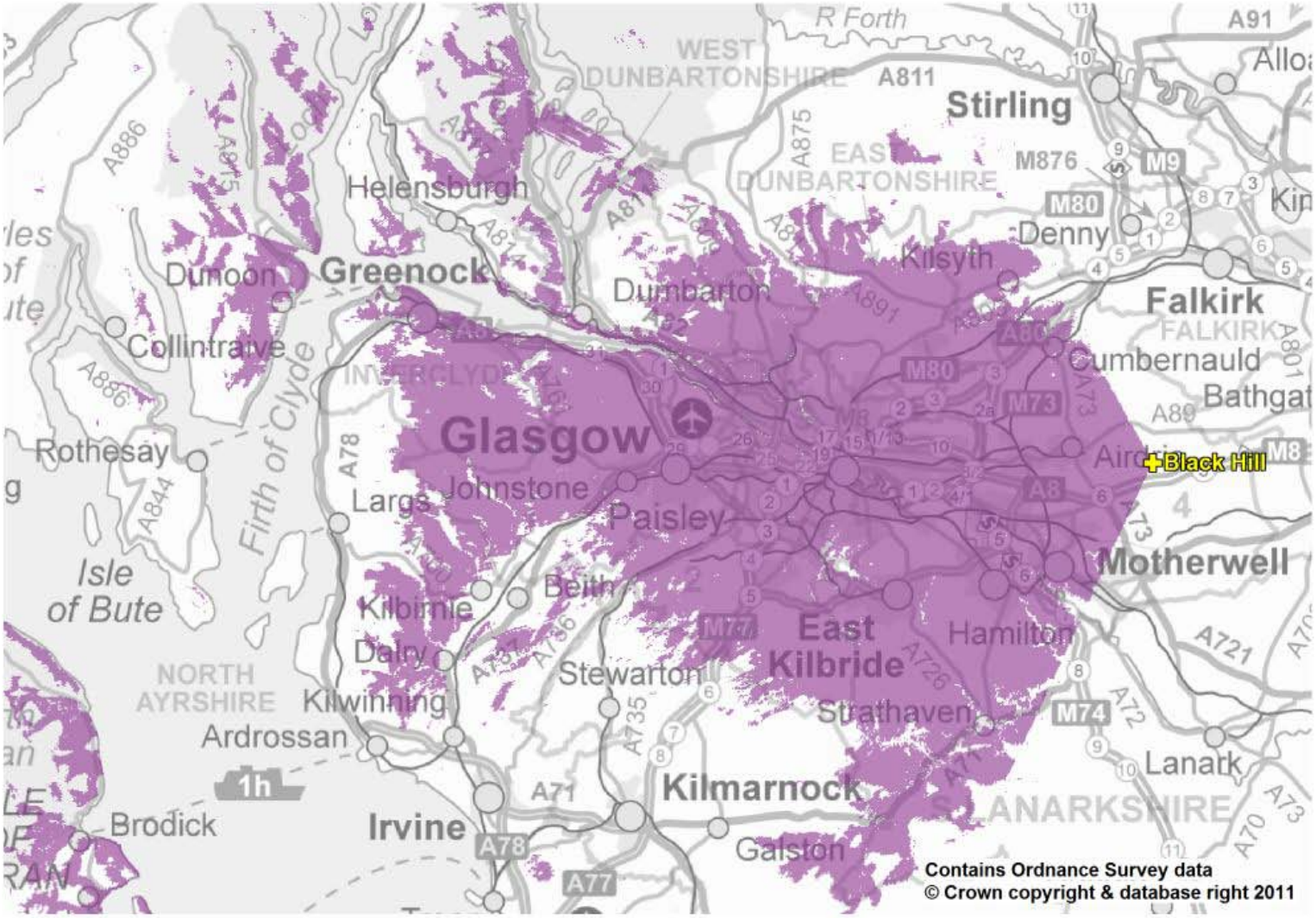
Kinbrace
Lybster
Dunbeath
Helmsdale
Laing
Brora
Golspie
Dornoch
Dornoch Firth
MORAY FIRTH
Tain
Invergordon
Cromarty
Cromarty Firth
Dingwall
Fortrose
Nairn
Lossiemouth
Spey Bay
Cullen
Buckie
Elgin
Banff
Portsoy
Kinnaird Head
Fraserb
Forres
Keith
Rothes
Knockmore
Aberchirder
Mintlaw
Muir of Ord
Inverness
Charlestown of Aberlour
Dufftown
Grantown -on-Spey
Drumnadrochit
Carrbridge
Ellon
Contains Ordnance Survey data
© Crown copyright & database right 2011

1.22 Falkirk


Contains Ordnance Survey data
© Crown copyright & database right 2011
Aberfeldy
Coupar Angus
Dundee
Perth
Crieff
Newburgh
Auchtermuchty
Auchterarder
Callander
Dunblane
Kinross
Falkland
Glenrothes
Alloa
Stirling
Dunfermline
Kirkcaldy
Kincardine
Burntisland
Denny
Rosyth
Forth Rd Br
Kilsyth
EDINBURGH
Falkirk
Tranent
Cumbernauld
Bathgate
Black Hill
Livingston
Dalkeith
Penicuik
Motherwell
East Kilbride
Hamilton
Strathaven
Lanark
Peebles
Biggar
Innerleithen
Douglas
Upper Tweeddale
R Lyon
R Tay
R Earn
R Forth
Firth of Tay
L Earn
Loch Tay
(Comrie to St Fillans)
A9
A90
M90
M9
M8
A91
A92
A93
A94
A811
A873
A84
A82
A701
A702
A703
A721
A72
A73
A70
A71
A706
A708

1.23 Glasgow


R Forth
WEST DUNBARTONSHIRE
A811
Stirling
A91
EAST DUNBARTONSHIRE
M876
M9
M80
Denny
Kilsyth
Helensburgh
Dunoon
Greenock
Dumbarton
Falkirk
FALKIRK
Cumbernauld
Bathgate
Collintraive
Glasgow
M73
A89
Rothesay
Black Hill
M8
Firth of Clyde
A78
Largs
Johnstone
Paisley
Motherwell
Isle of Bute
Beith
Kilbirnie
Dalry
East Kilbride
Hamilton
A721
NORTH AYRSHIRE
Kilwinning
Stewarton
Strathaven
M74
Ardrossan
Lanark
1h
A71
Kilmarnock
Brodick
Irvine
A78
Galston
A77
Contains Ordnance Survey data
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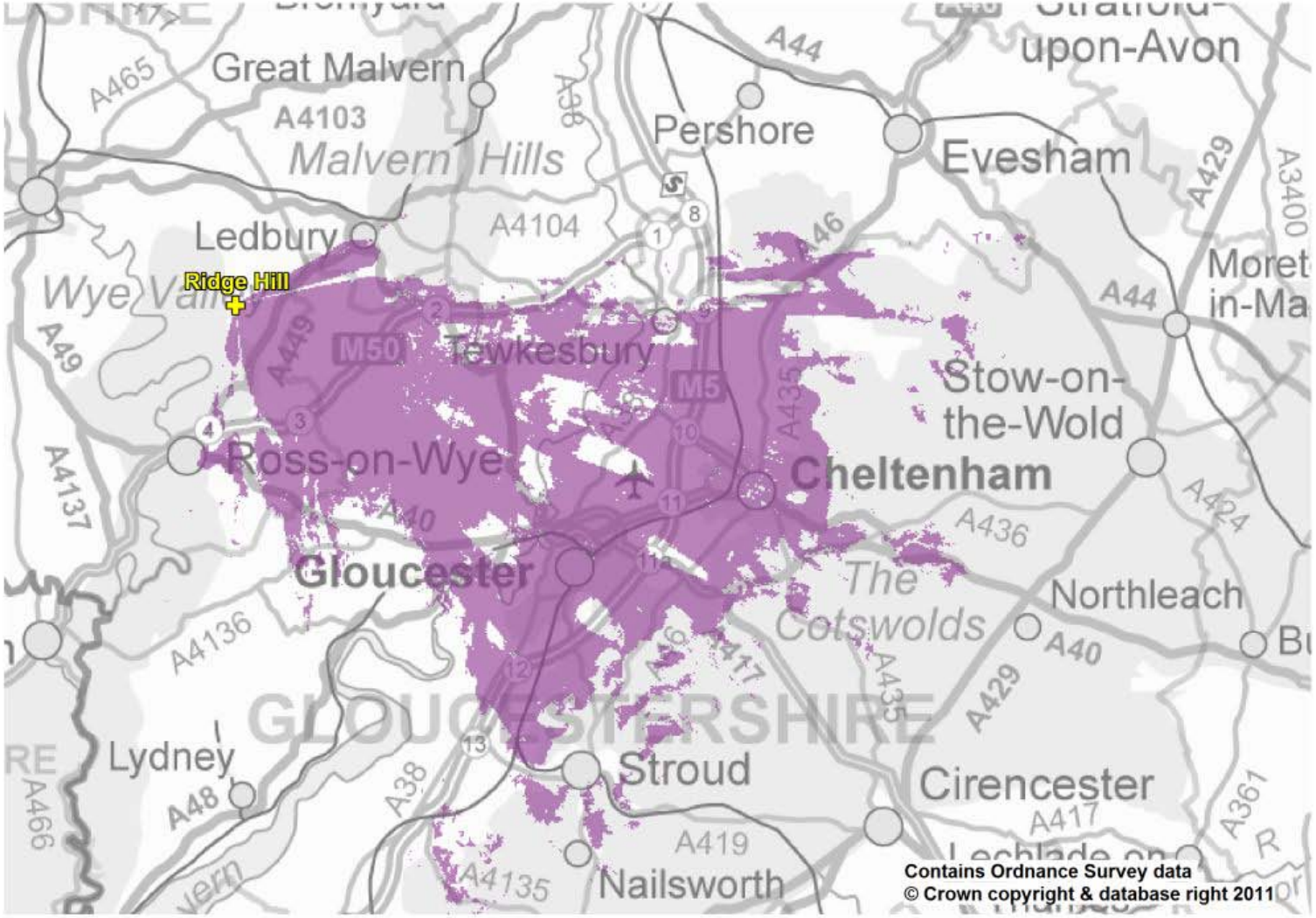
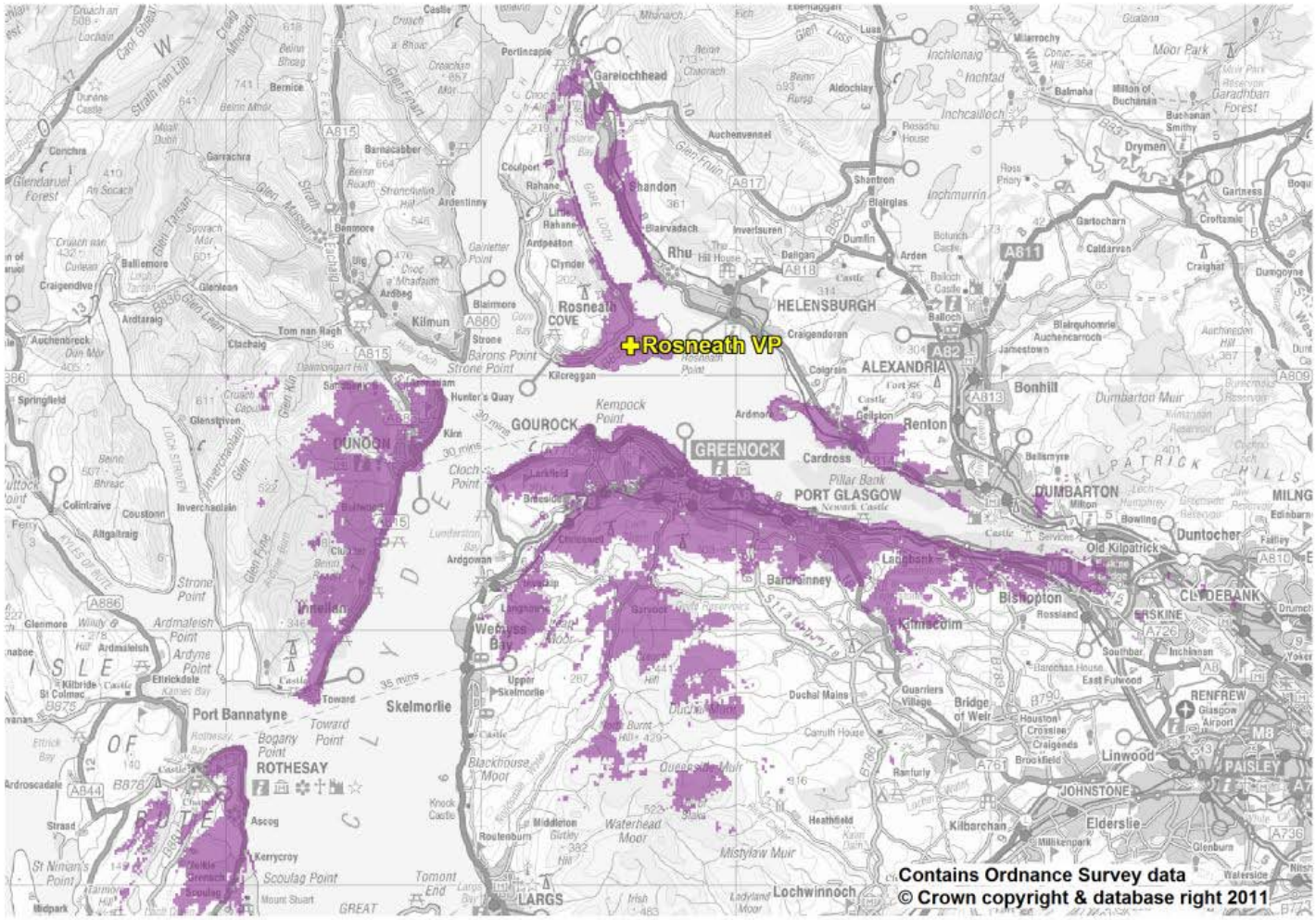
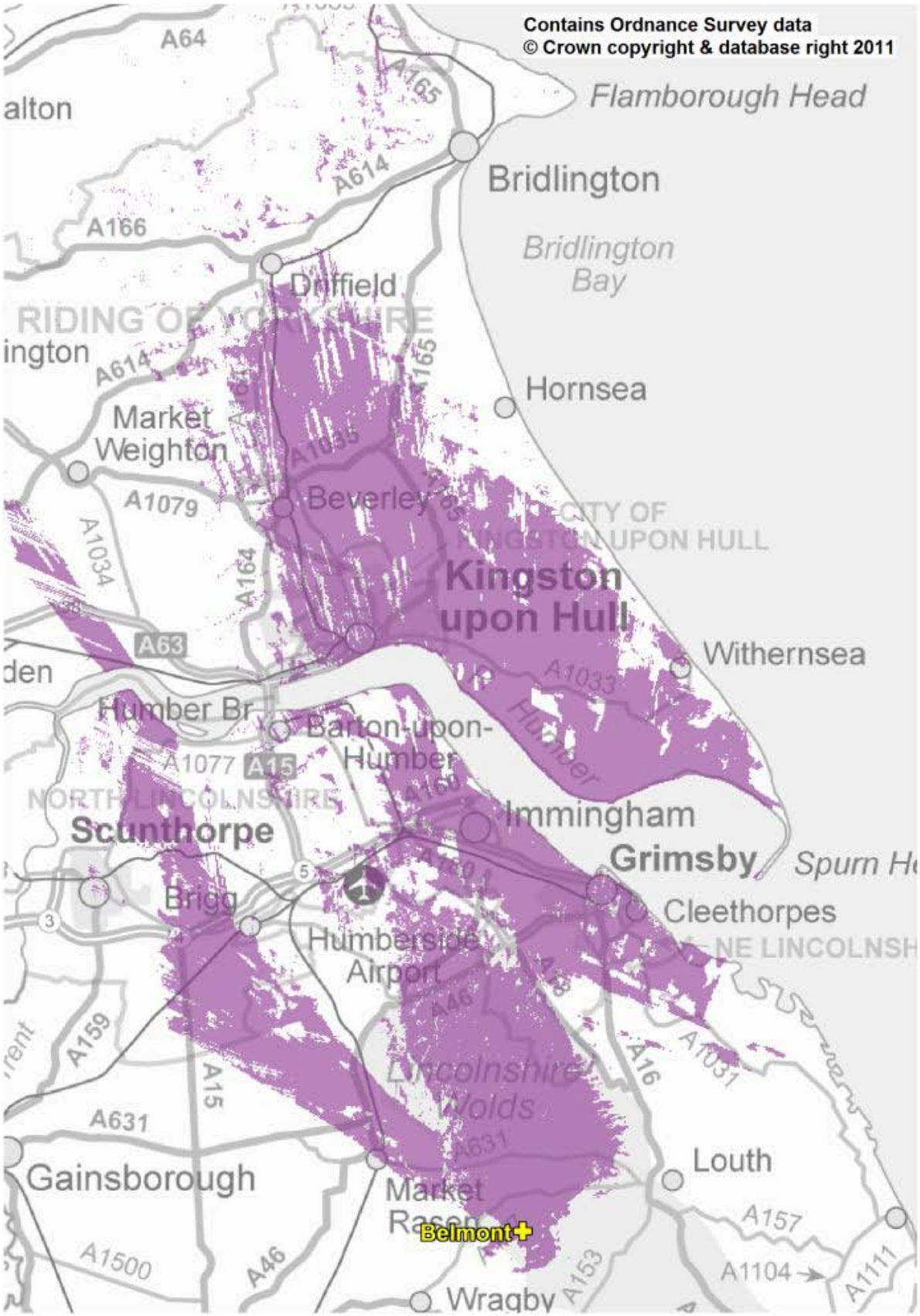
1.24 Gloucester



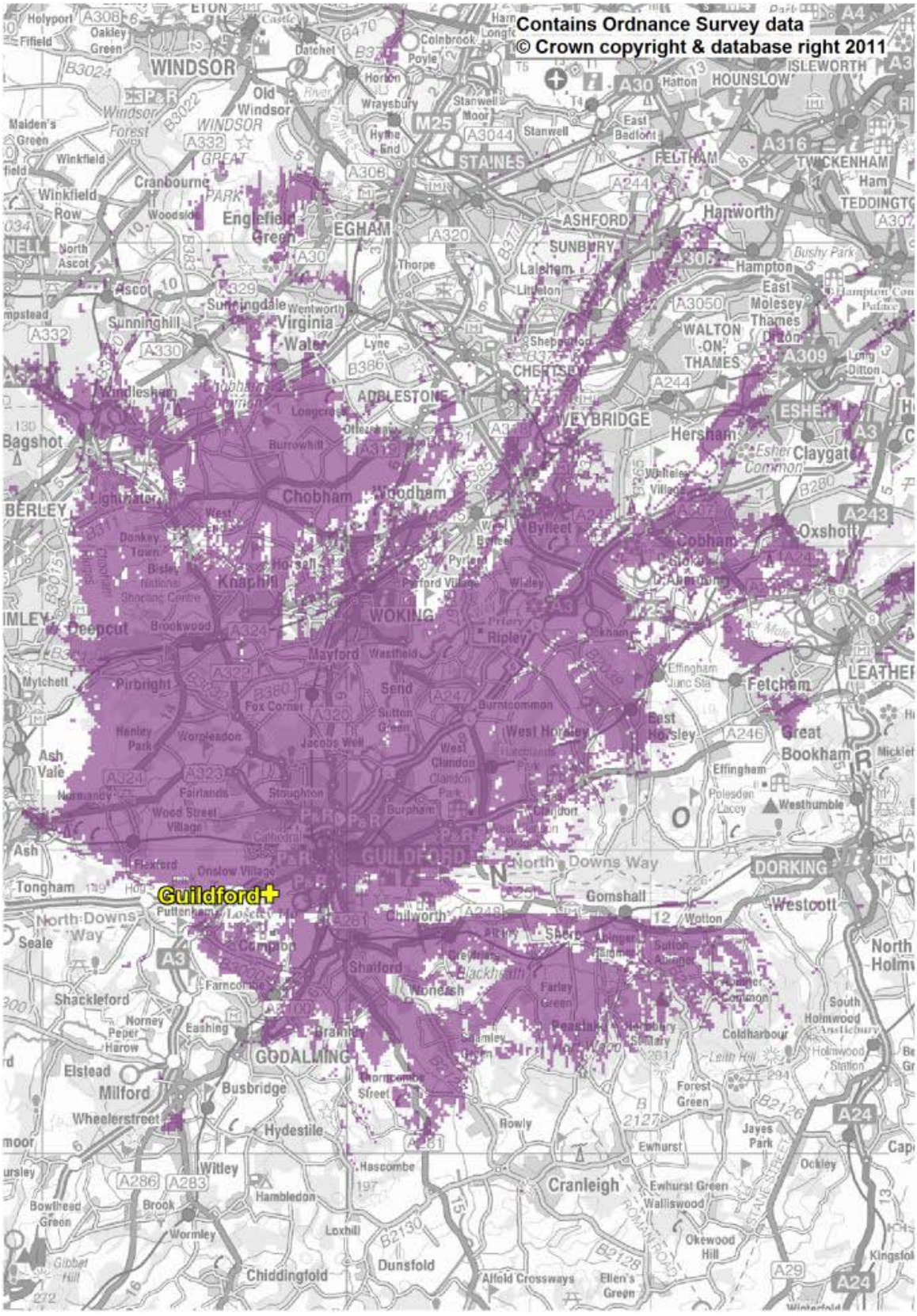
1.25 Greenock



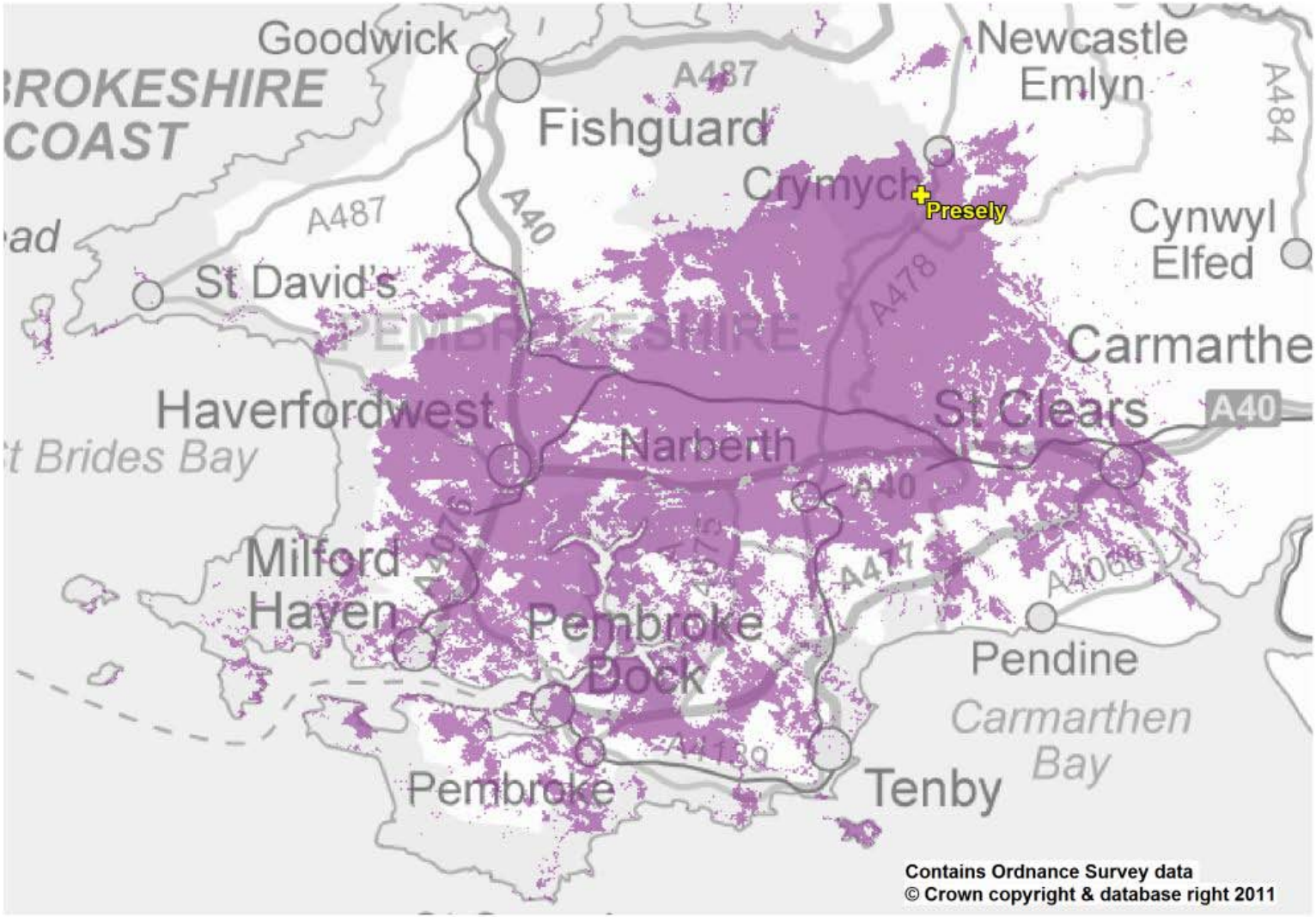
1.26 Grimsby


Contains Ordnance Survey data
© Crown copyright & database right 2011
Flamborough Head
Bridlington
Bridlington Bay
Driffield
Hornsea
Market Weighton
Beverley
Kingston upon Hull
Withernsea
Barton-upon-Humber
Immingham
Grimsby
Cleethorpes
Scunthorpe
Brigg
Humberside Airport
Gainsborough
Louth
Market Rasen
Belmont
Wragby
A64
A614
A166
A165
A1079
A1034
A164
A63
A1077
A15
A1033
A1035
A159
A631
A46
A16
A1031
A157
A1104
A1111
A1500
A153

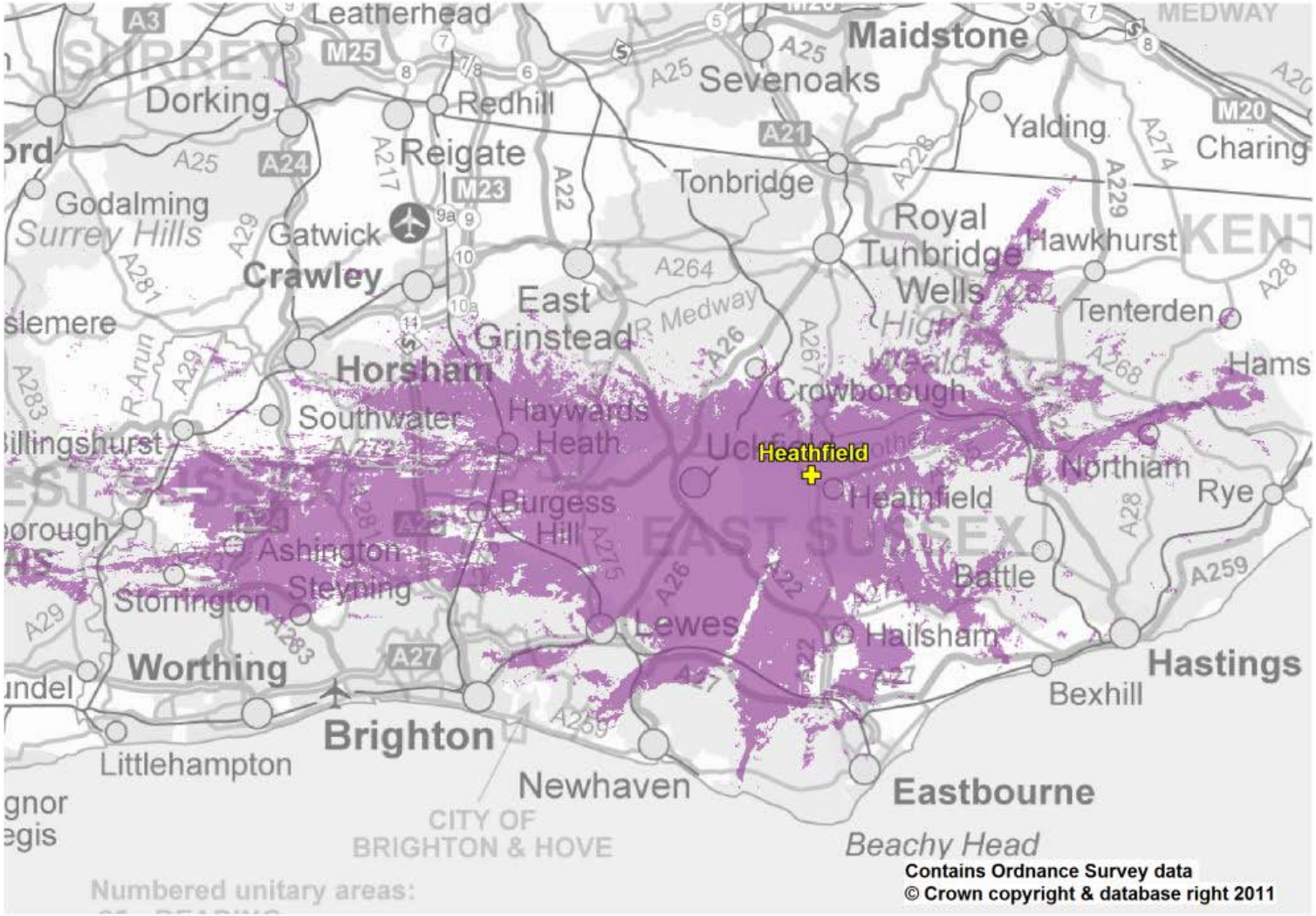
1.27 Guildford



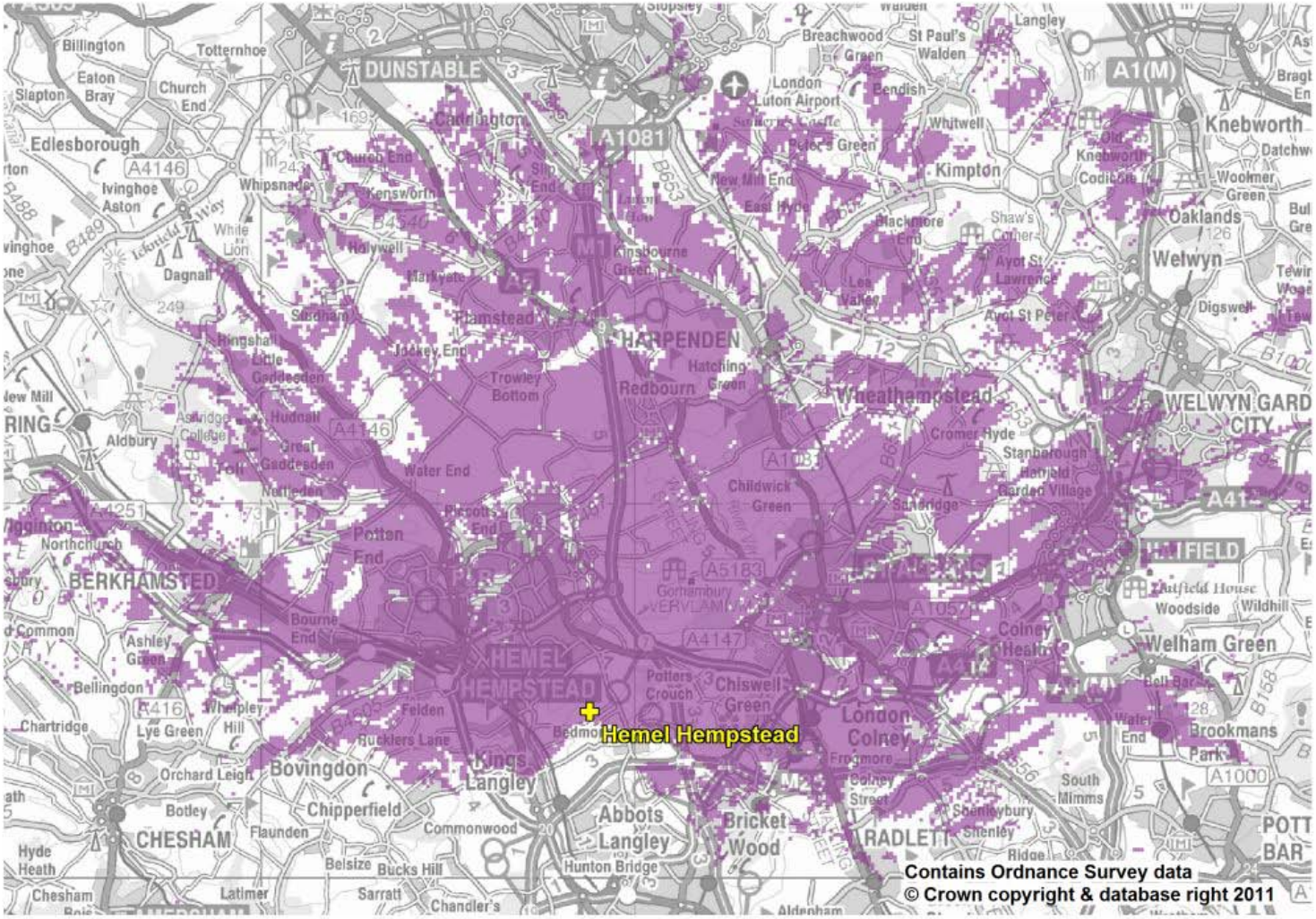
1.28 Haverfordwest



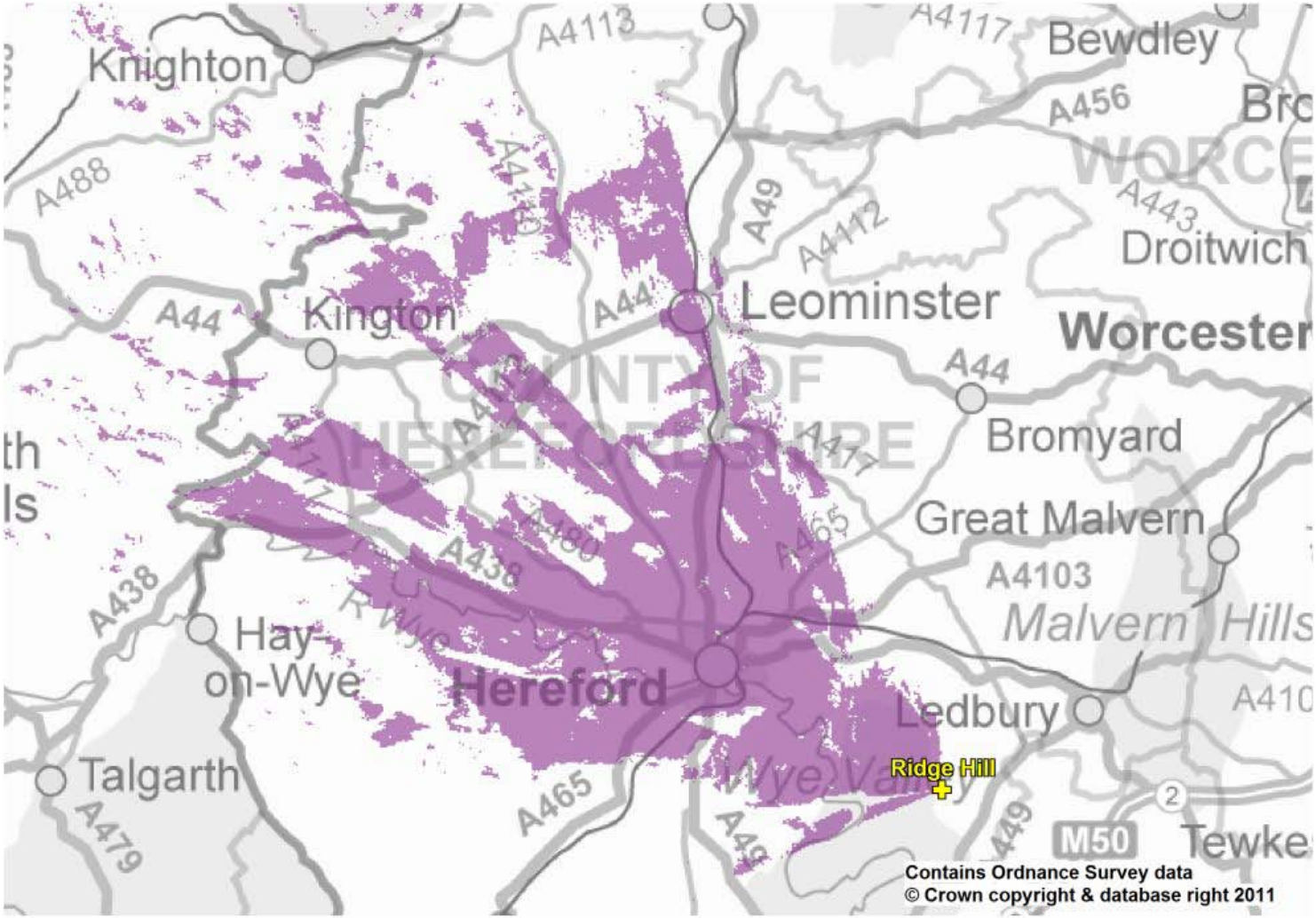
1.29 Haywards Heath



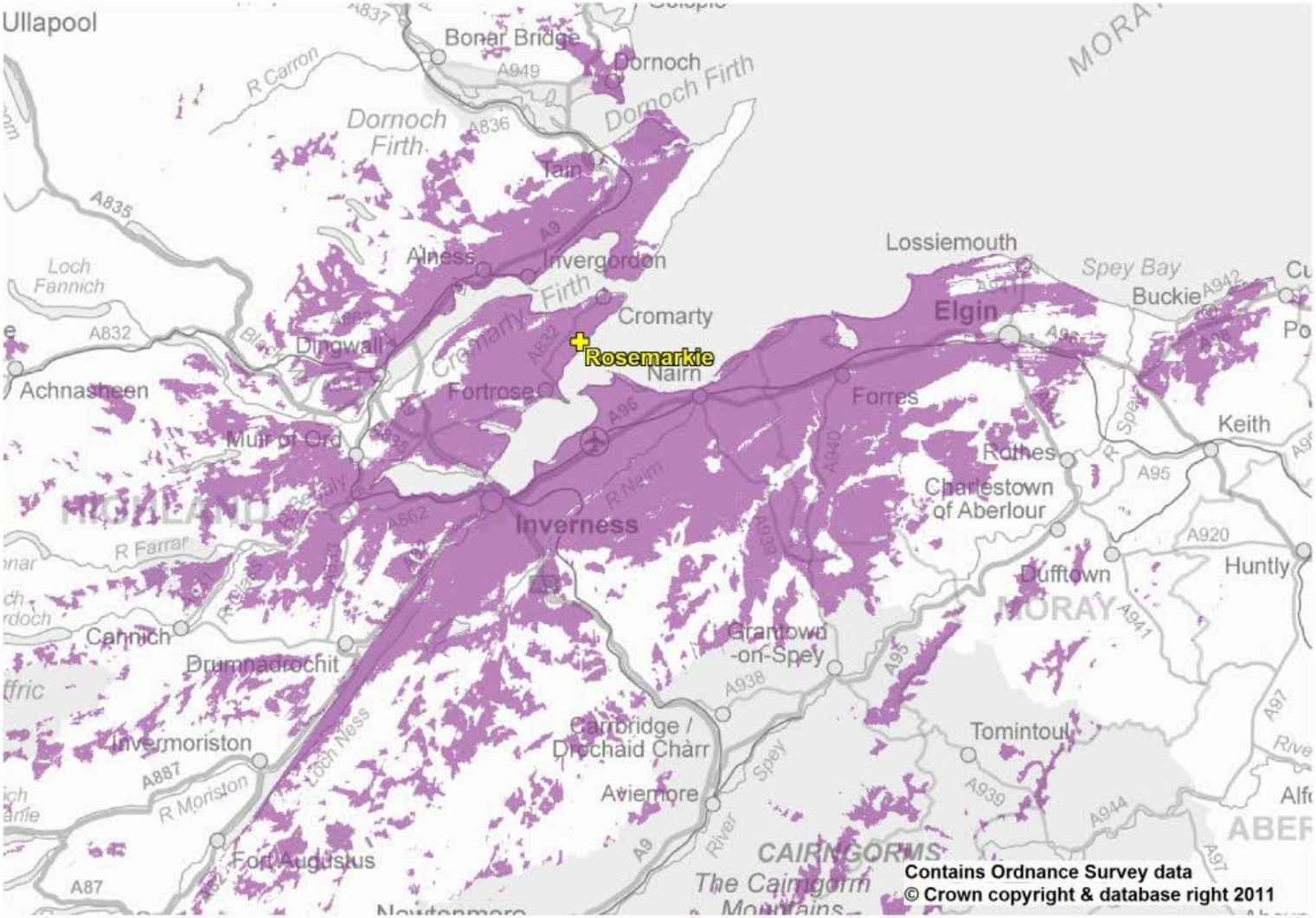
1.30 Hemel Hempstead



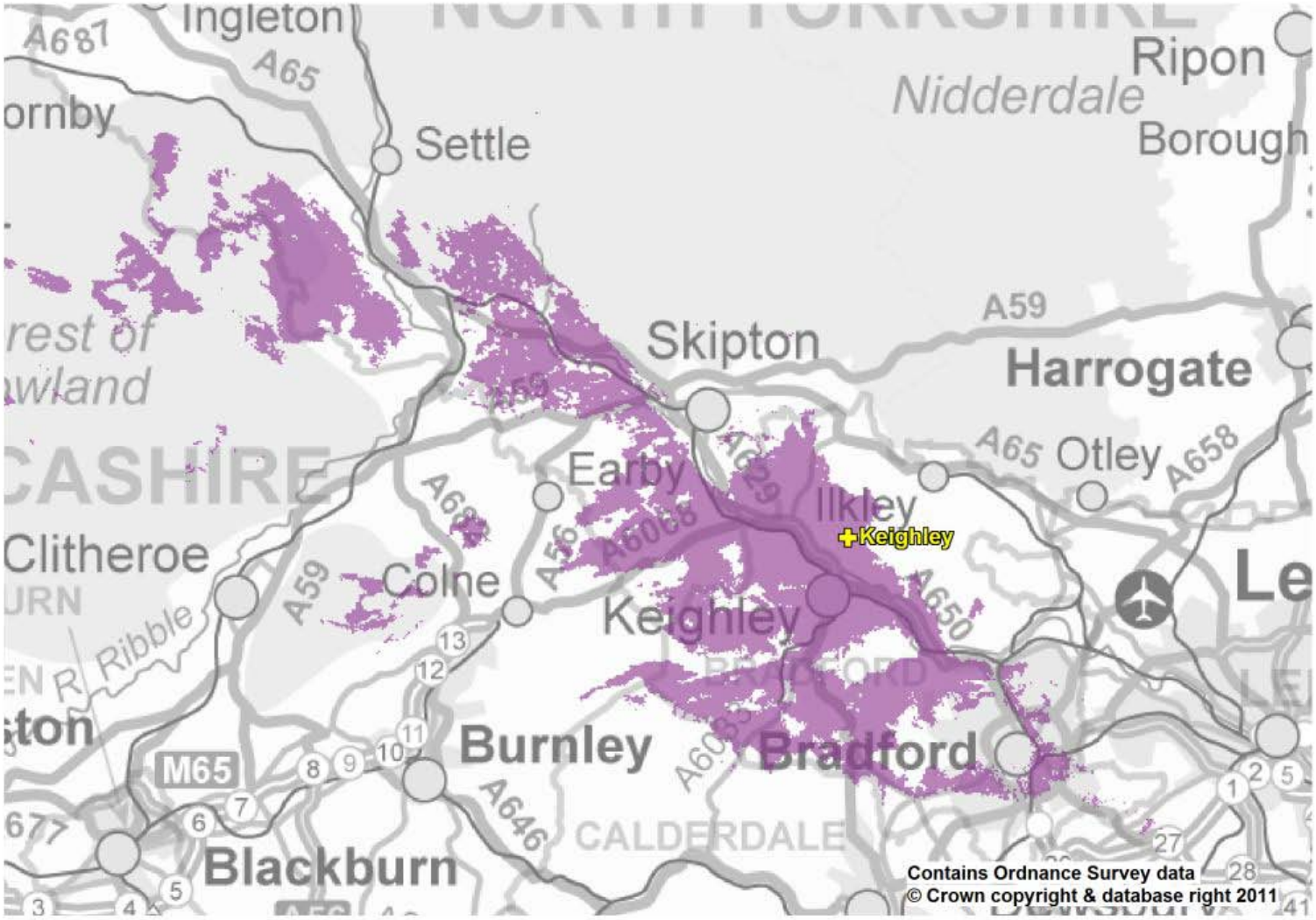
1.31 Hereford



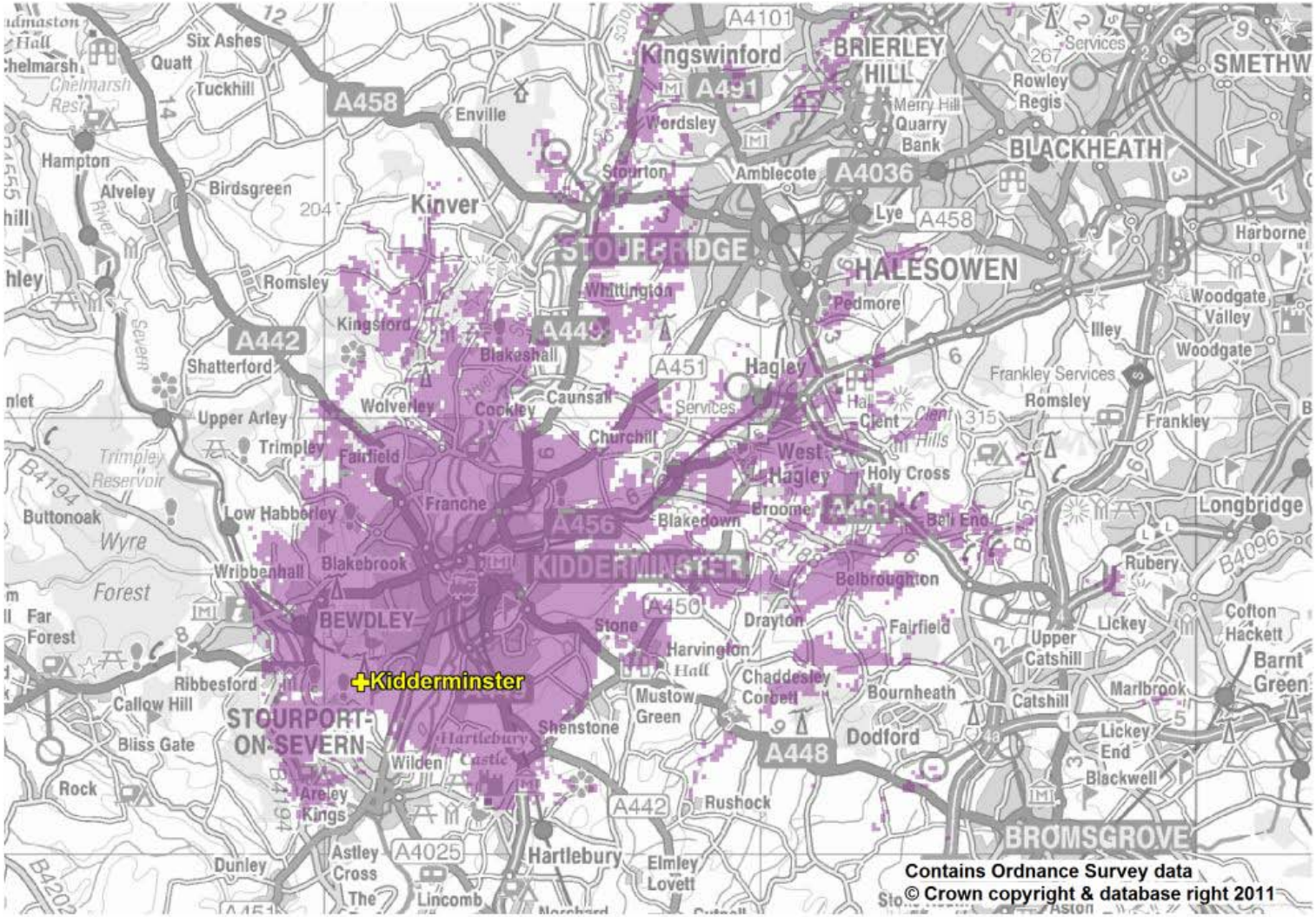
1.32 Inverness



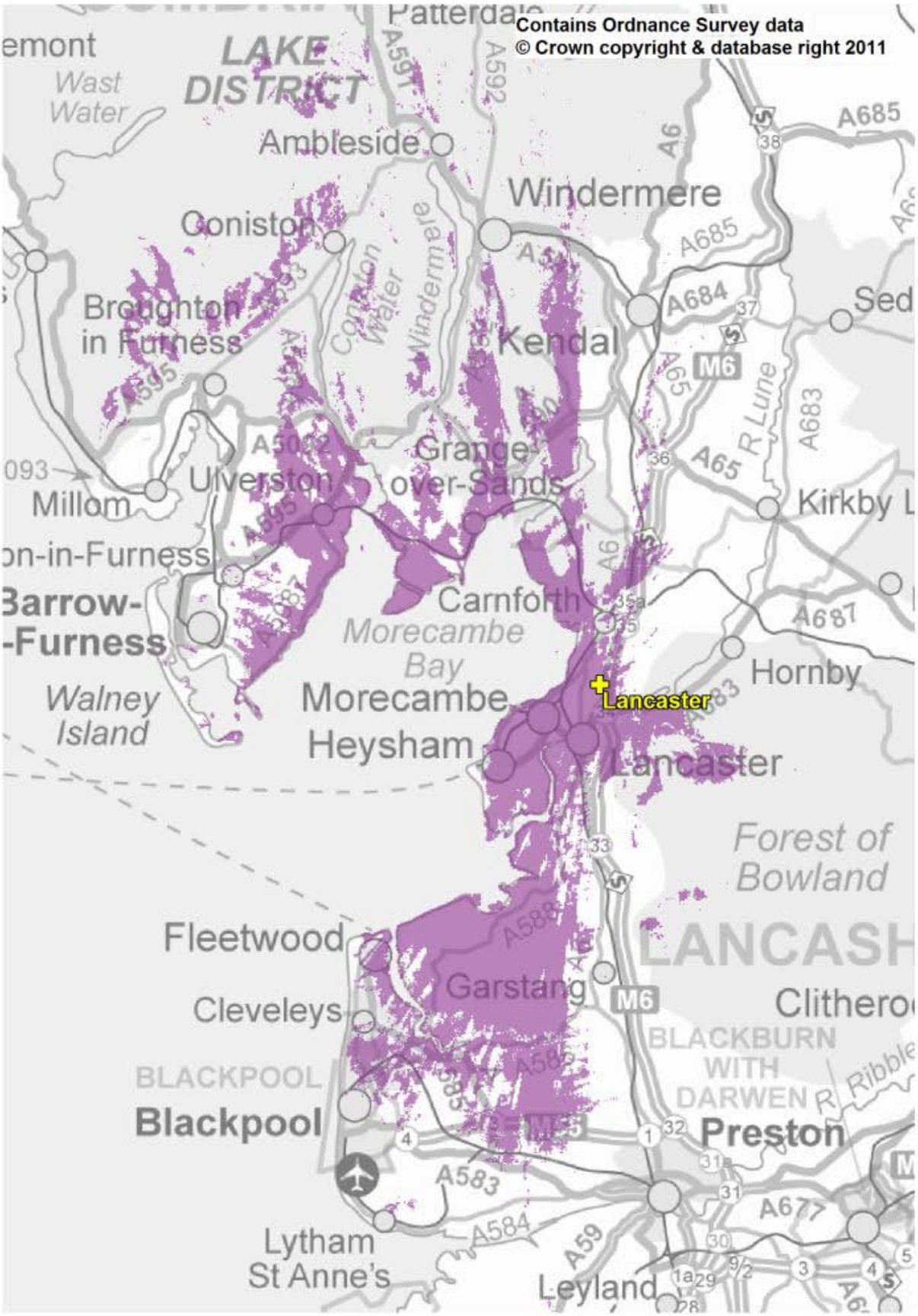
1.33 Keighley



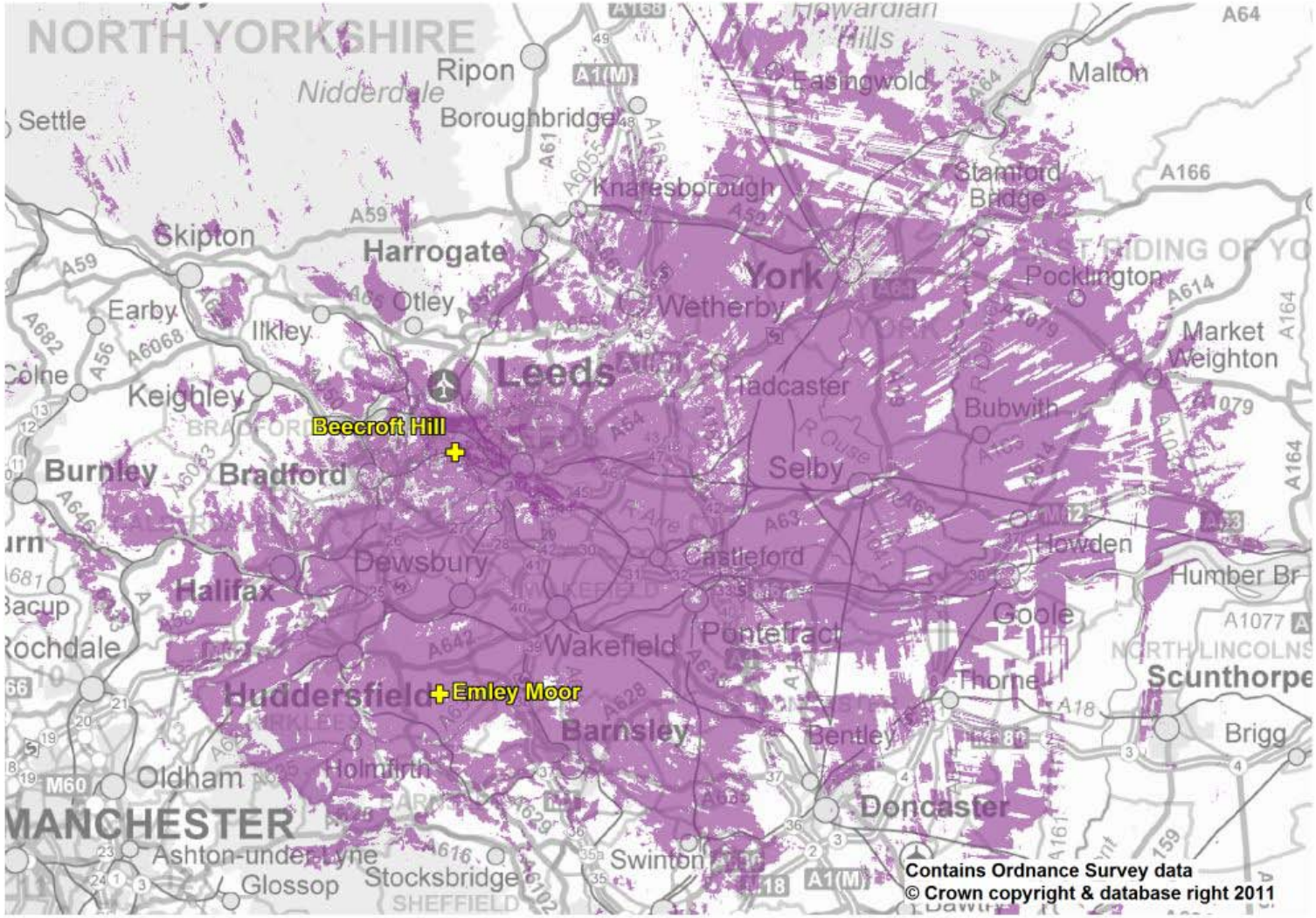
1.34 Kidderminster



1.35 Lancaster



1.36 Leeds


NORTH YORKSHIRE
Ripon
Nidderdale
Settle
Boroughbridge
Malton
Easingwold
Knaresborough
Stamford Bridge
Skipton
Harrogate
York
Pocklington
Earby
Otley
Wetherby
Ilkley
Market Weighton
Colne
Keighley
Leeds
Tadcaster
Bubwith
Beecroft Hill
Burnley
Bradford
Selby
Howden
Dewsbury
Castleford
Humber Br
Halifax
Goole
Rochdale
Wakefield
Pontefract
Huddersfield
Emley Moor
Thorne
Scunthorpe
Barnsley
Bentley
Brigg
Oldham
Holmfirth
Doncaster
MANCHESTER
Ashton-under-Lyne
Swinton
Glossop
Stocksbridge
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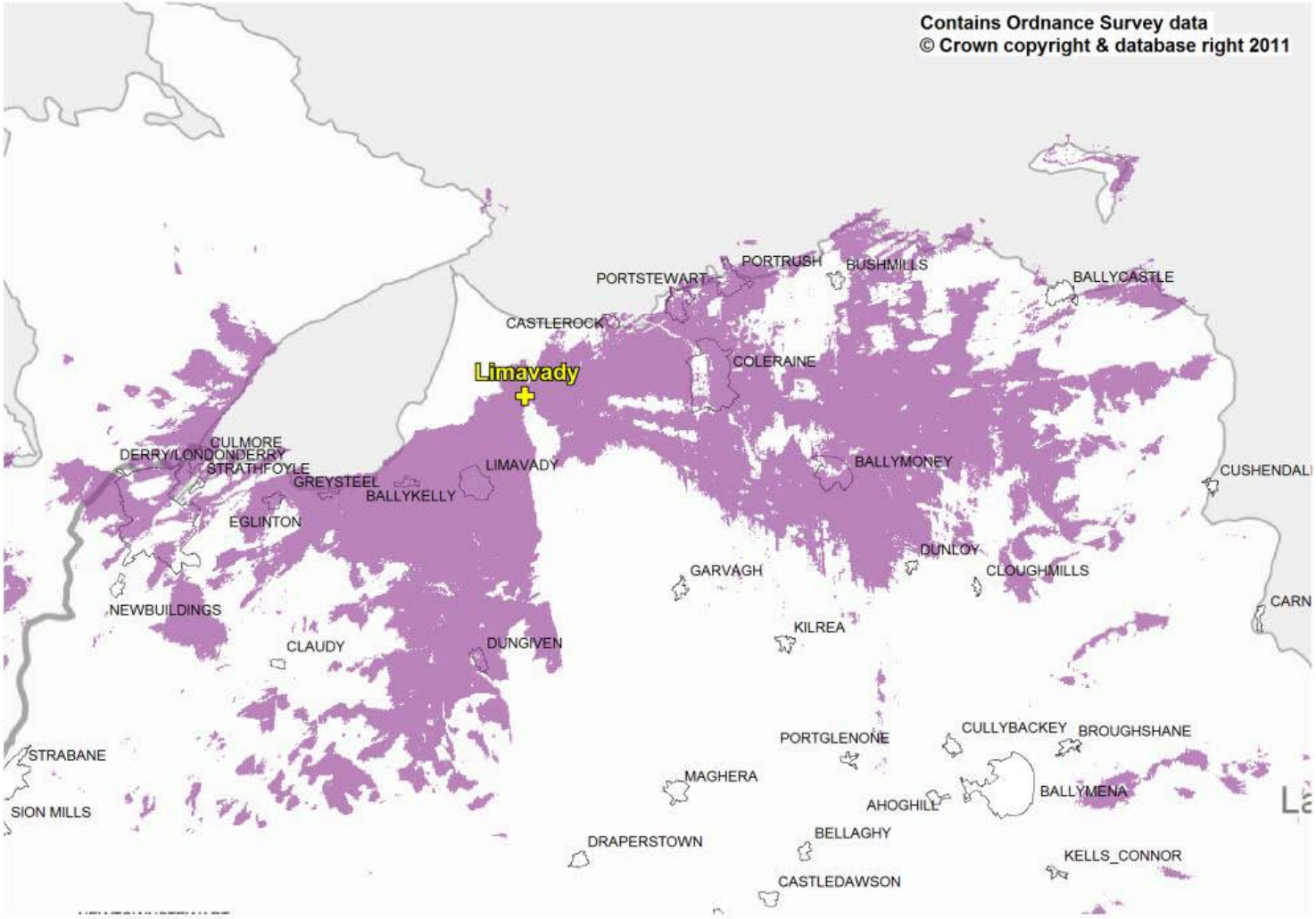
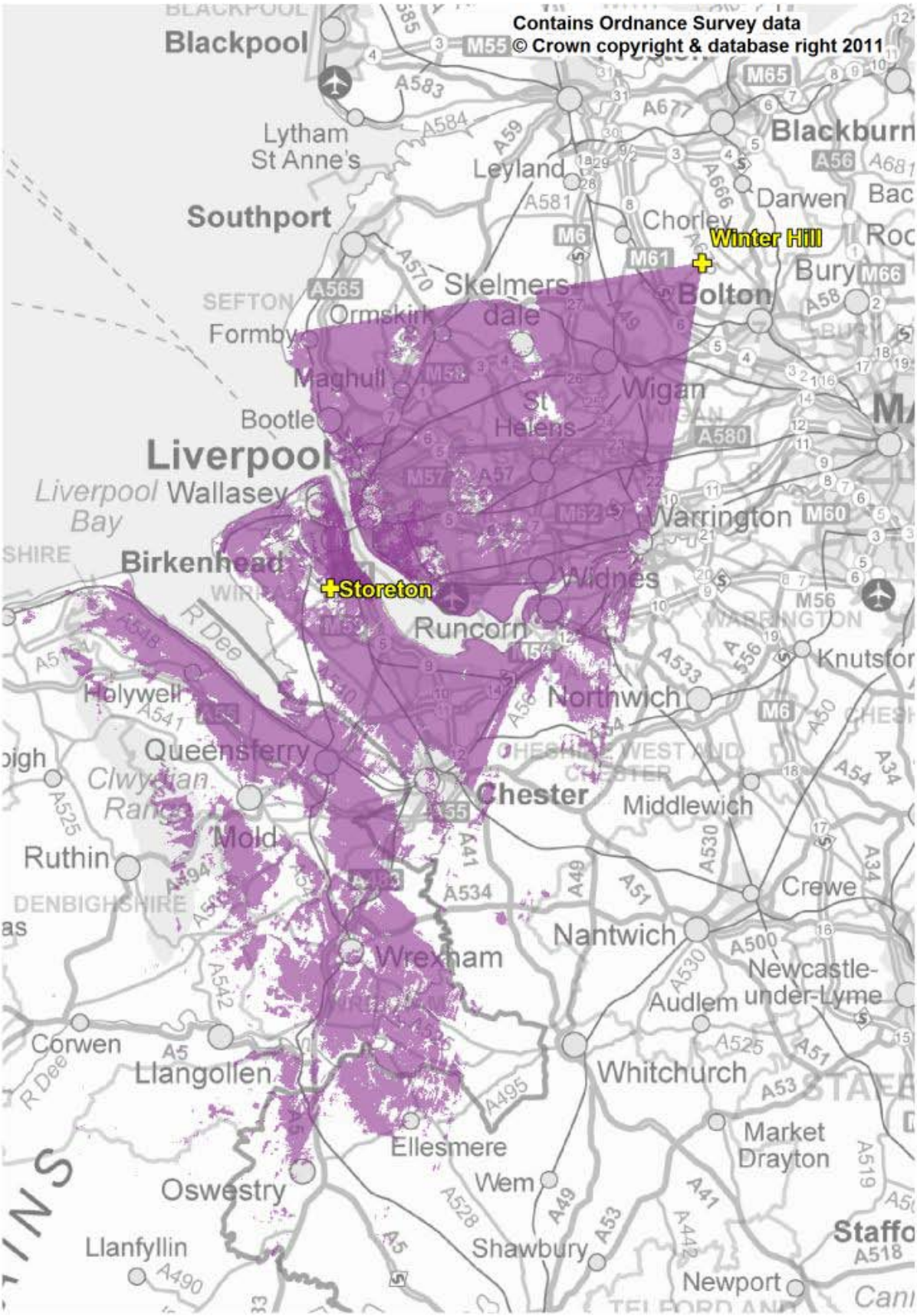
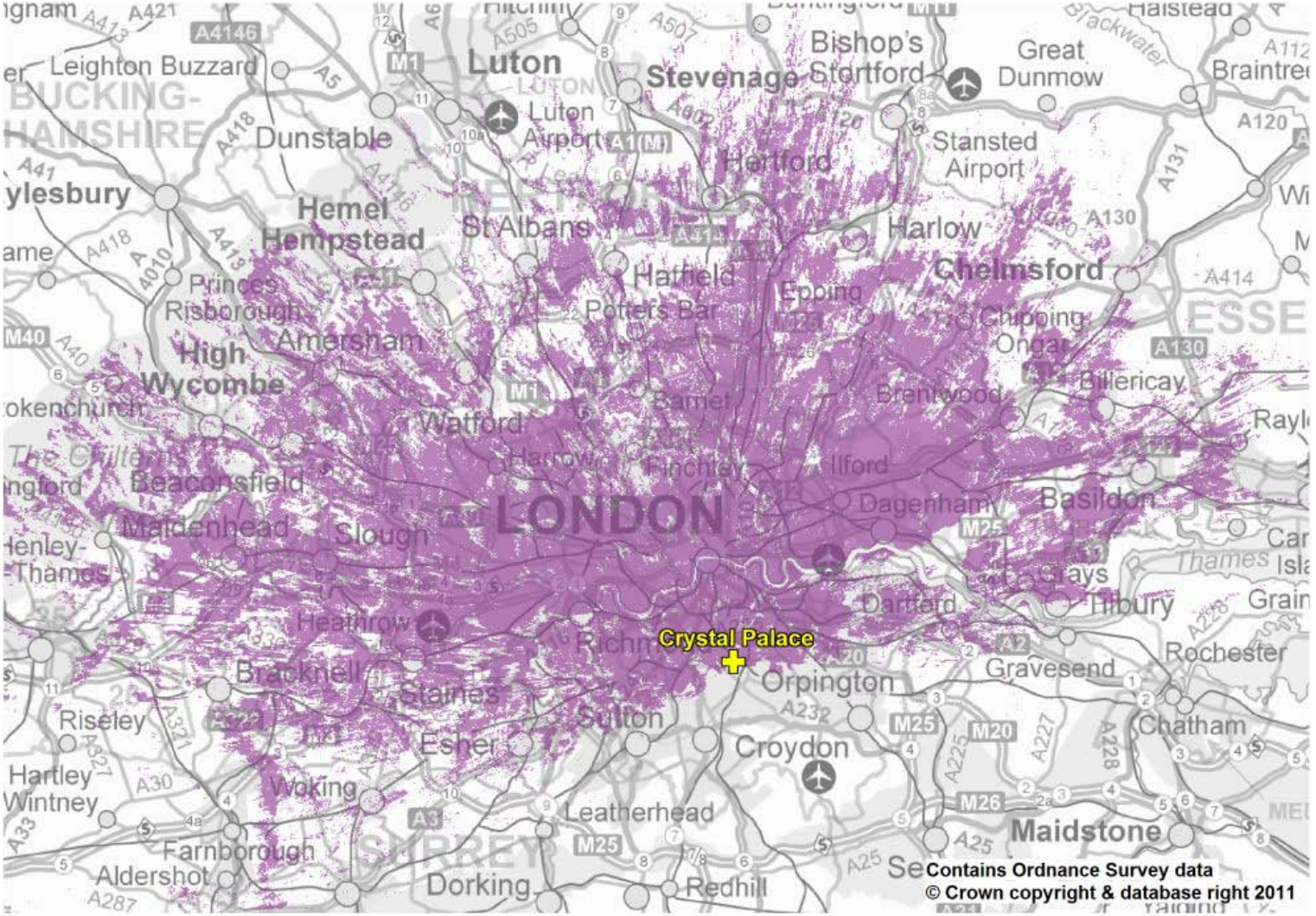
1.37 Limavady



1.38 Liverpool



1.39 London


LONDON
Crystal Palace
Luton
Stevenage
Bishop's Stortford
Great Dunmow
Braintree
Stansted Airport
Hertford
Harlow
Chelmsford
St Albans
Hemel Hempstead
Dunstable
Leighton Buzzard
Hatfield
Epping
Watford
Barnet
Brentwood
Billericay
Basildon
Romford
Ilford
Finchley
Harrow
Amersham
High Wycombe
Beaconsfield
Maidenhead
Slough
Heathrow
Richmond
Bracknell
Staines
Sutton
Esher
Croydon
Orpington
Gravesend
Rochester
Chatham
Maidstone
Dartford
Grays
Tilbury
Woking
Leatherhead
Dorking
Redhill
Farnborough
Aldershot
Hartley Wintney
Riseley
Henley-on-Thames
Princes Risborough
Chipping Ongar
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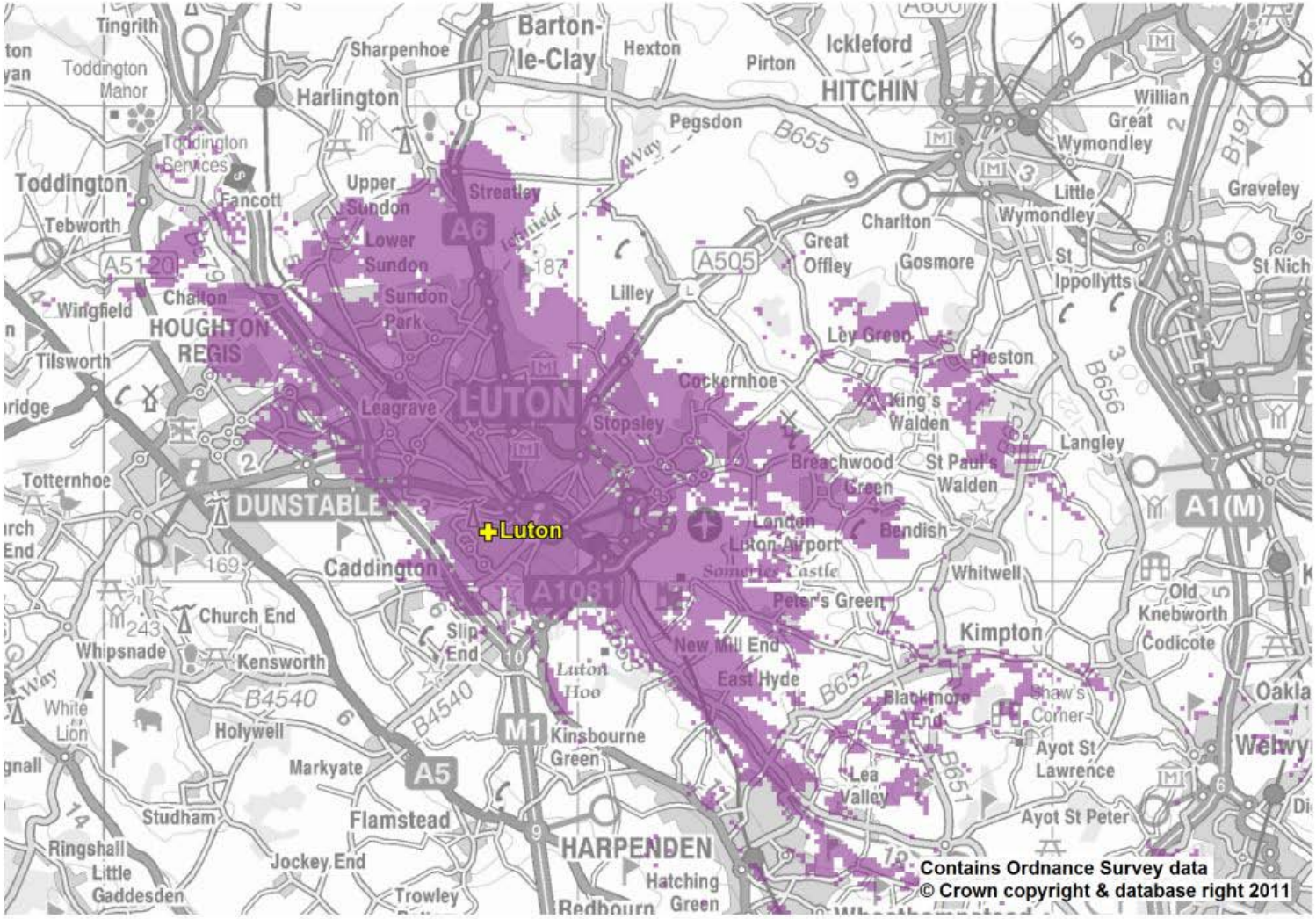
1.40 Luton


Luton
DUNSTABLE
HOUGHTON REGIS
HITCHIN
HARPENDEN
Barton-le-Clay
Harlington
Toddington
Caddington
Kimpton
Flamstead
Markyate
Kinsbourne Green
Pegsdon
Hexton
Pirton
Ickleford
Charlton
Great Offley
Gosmore
Lilley
Streatley
Upper Sundon
Lower Sundon
Sundon Park
Leagrave
Stopsley
Cockernhoe
Lye Green
Preston
King's Walden
Breachwood Green
St Paul's Walden
Langley
Bendish
Whitwell
Peter's Green
New Mill End
East Hyde
Luton Hoo
Slip End
Church End
Whipsnade
Kensworth
Holywell
Totternhoe
Tilsworth
Wingfield
Tebworth
Chalton
Fancott
Toddington Services
Toddington Manor
Tingrith
Sharpenhoe
Studham
Ringshall
Little Gaddesden
Jockey End
Trowley
Hatching Green
Redbourn
Lea Valley
Ayot St Lawrence
Ayot St Peter
Shaw's Corner
Blackmore End
Codicote
Old Knebworth
Graveley
Little Wymondley
Great Wymondley
Willian
St Ippollytts
St Nich
Welwy
Oakla
A1(M)
M1
A6
A505
A5
A1081
B655
B656
B652
B651
B4540
B197
Contains Ordnance Survey data
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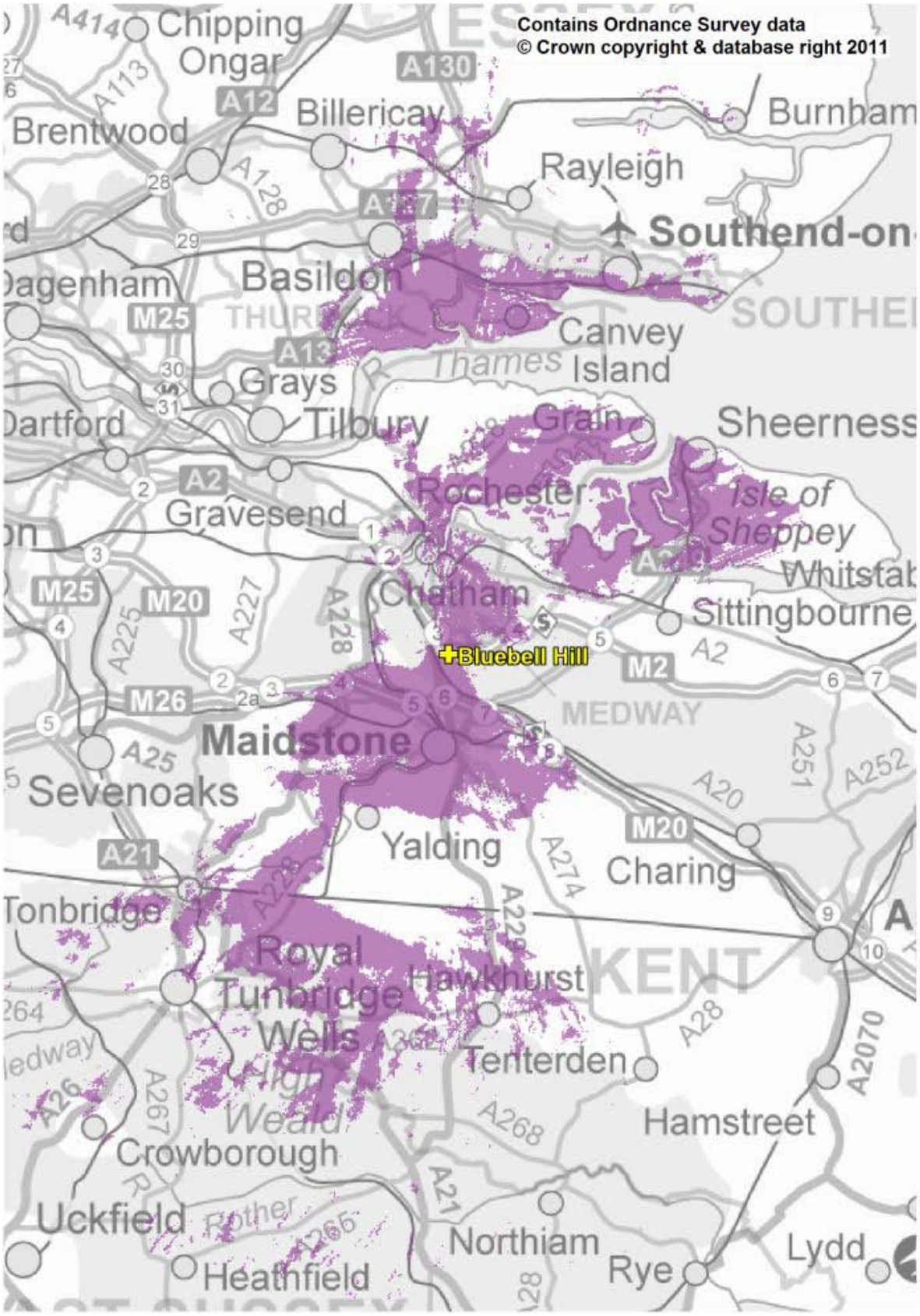
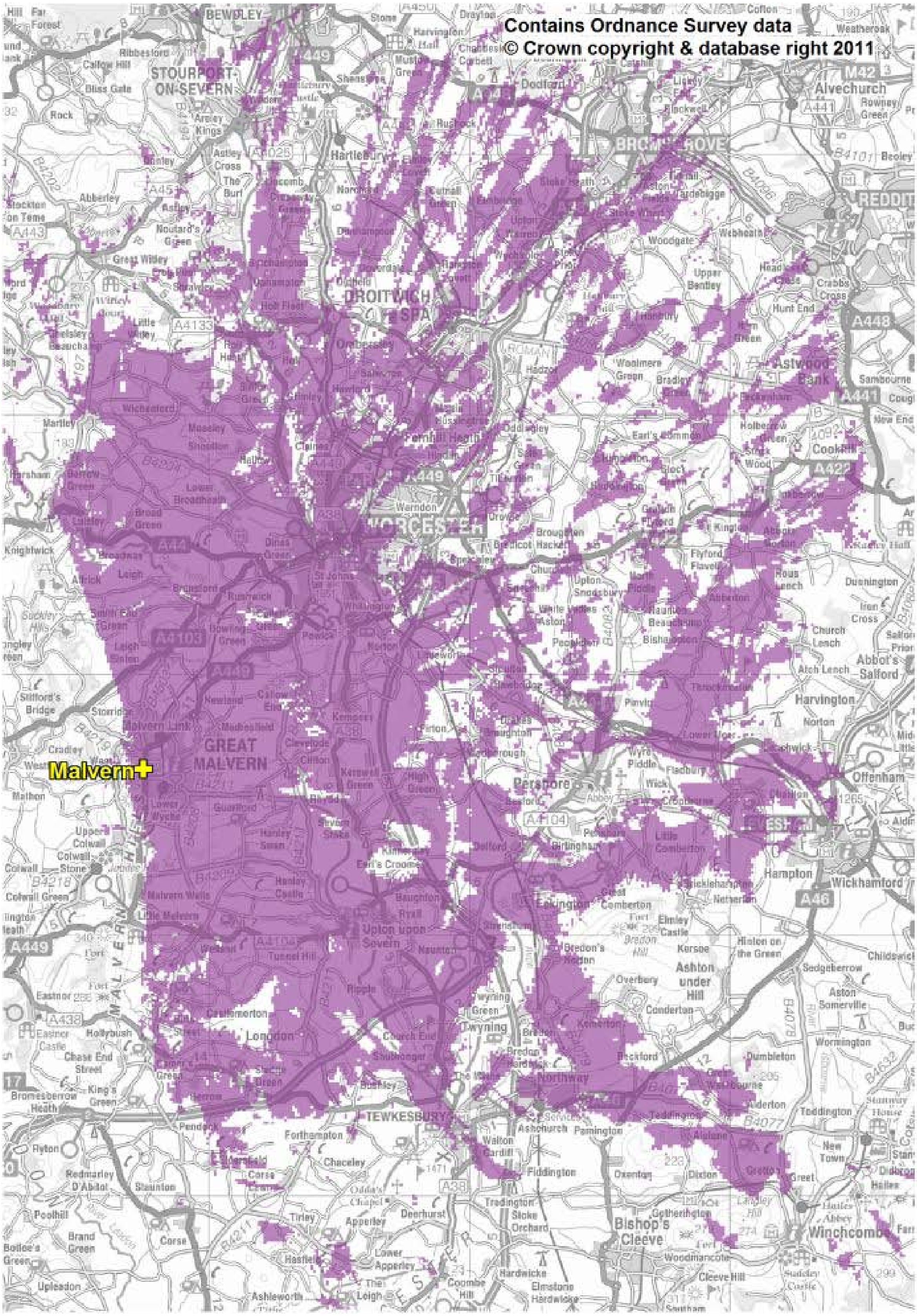
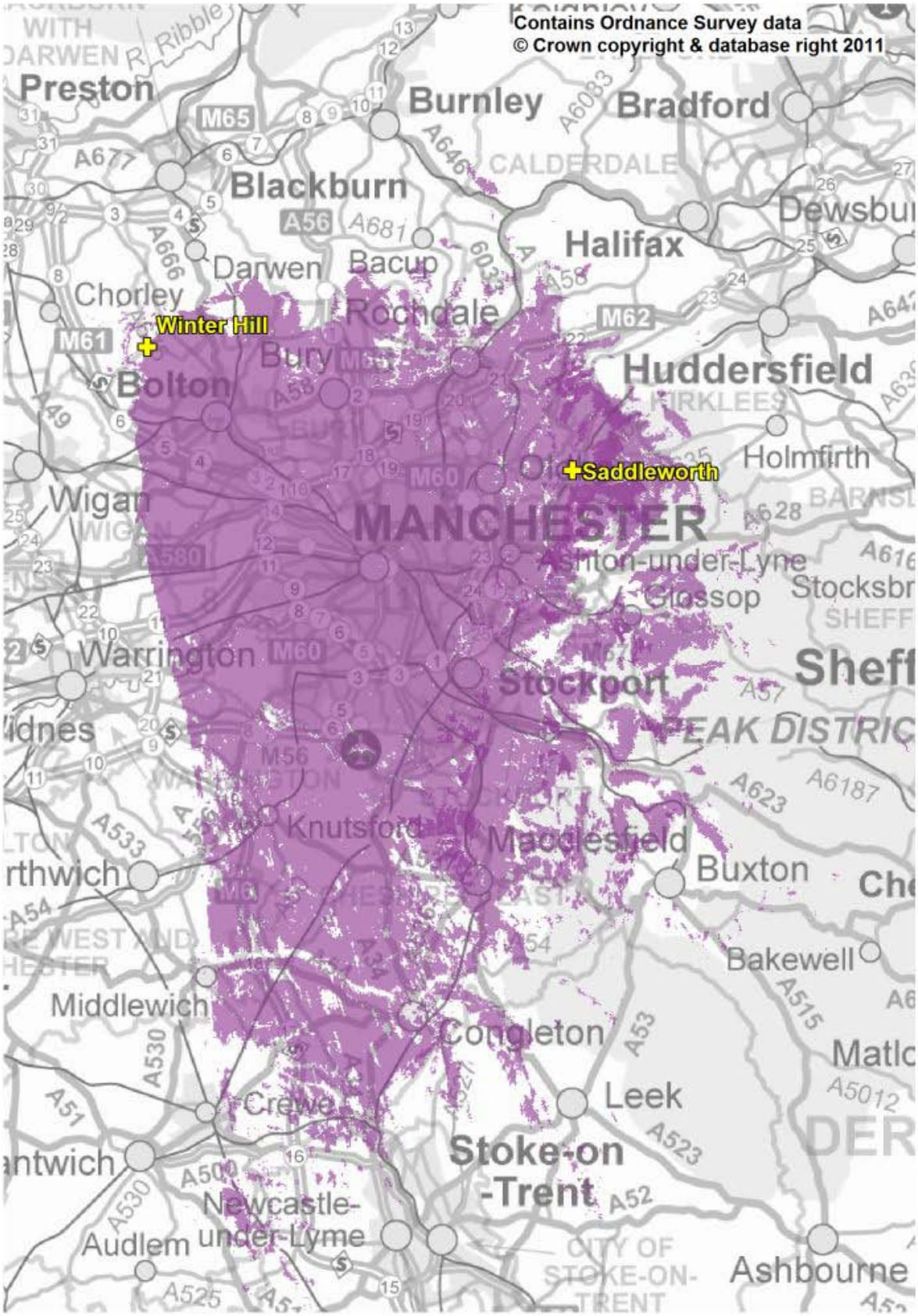
1.41 Maidstone



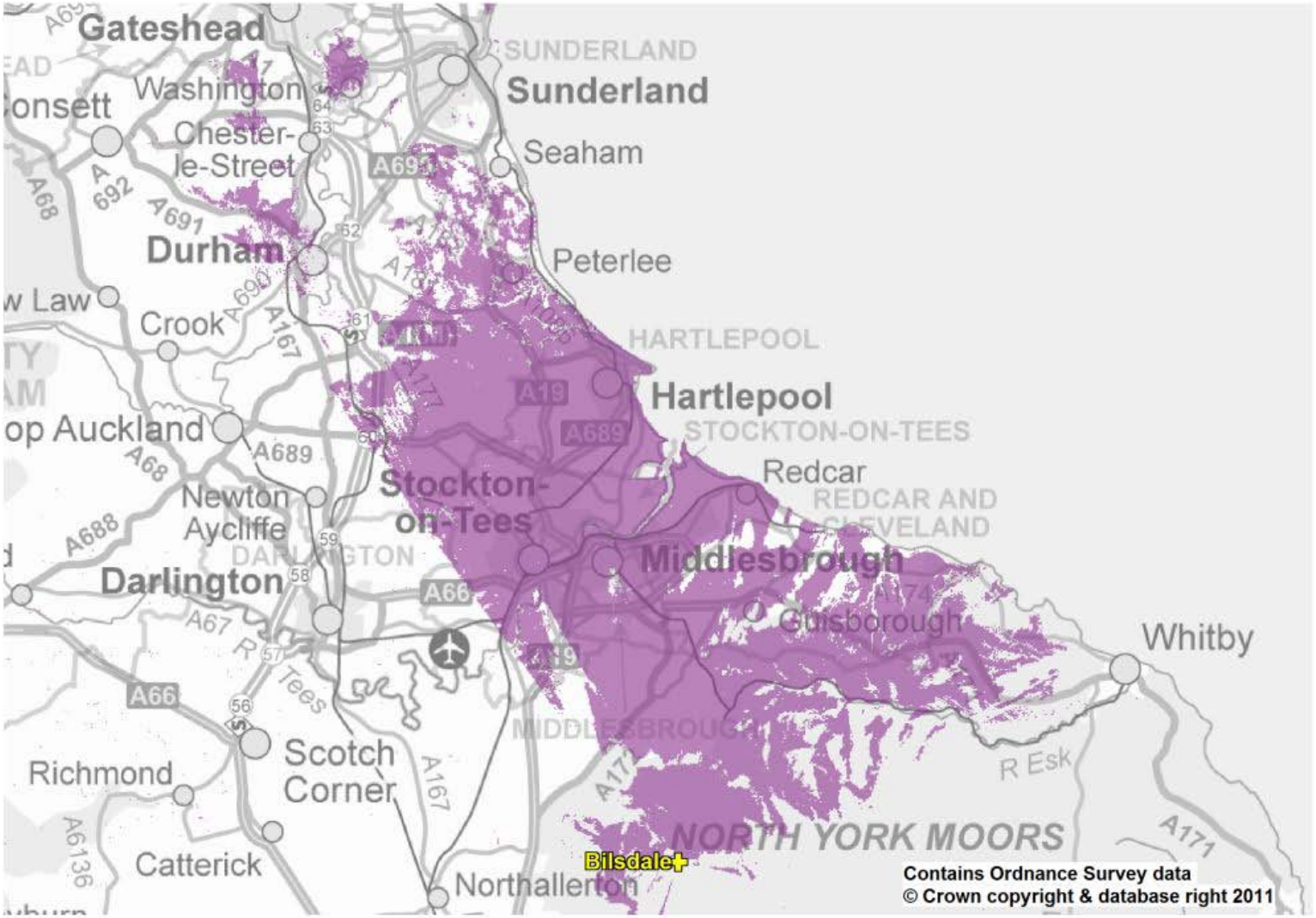
1.42 Malvern


Contains Ordnance Survey data
© Crown copyright & database right 2011
Malvern
GREAT MALVERN
WORCESTER
DROITWICH SPA
STOURPORT-ON-SEVERN
BEWDLEY
TEWKESBURY
Pershore
Bishop's Cleeve
Winchcombe
Alvechurch
Upton upon Severn

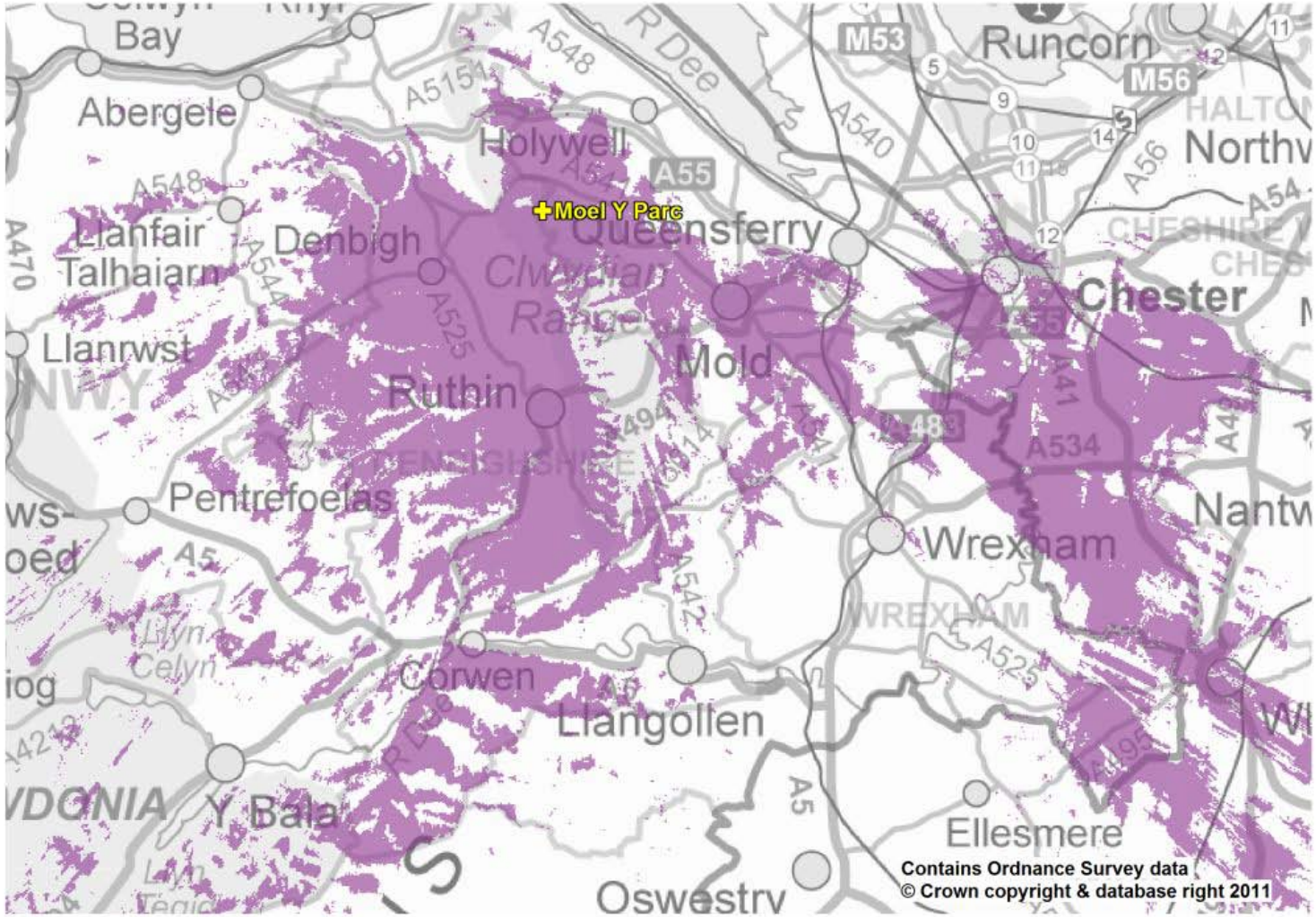
1.43 Manchester



1.44 Middlesbrough



1.45 Mold


Bay
Abergele
Holywell
A548
A5151
R Dee
M53
Runcorn
M56
A540
A55
Moel Y Parc
Queensferry
Llanfair
Talhaiarn
Denbigh
A470
A544
A525
Clwydian
Range
Chester
Llanrwst
Ruthin
Mold
A494
A541
A483
A534
A55
Pentrefoelas
Nantw
Wrexham
A5
A542
WREXHAM
A525
Llyn
Celyn
Corwen
Llangollen
A5
Y Bala
Ellesmere
Oswestry
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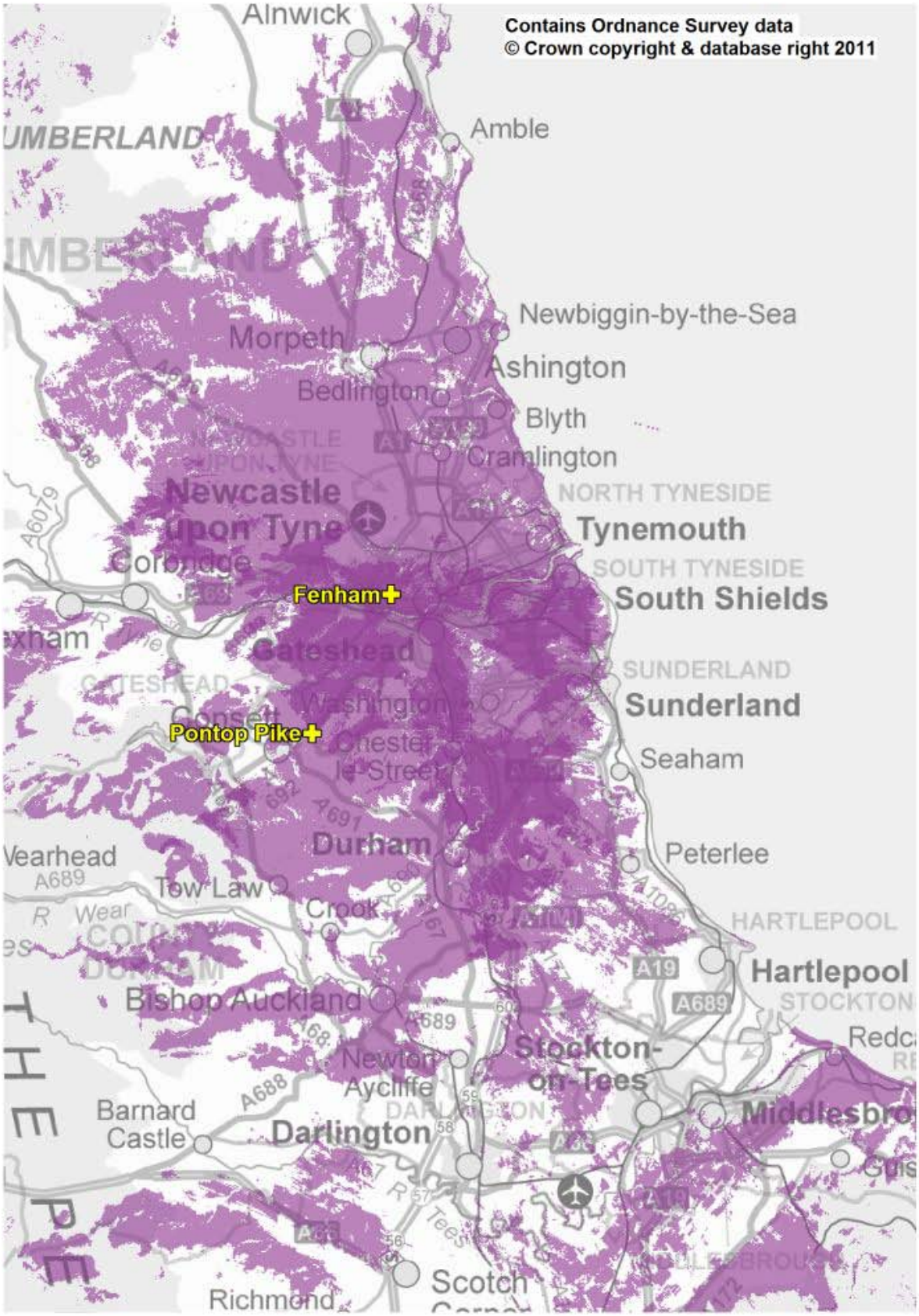
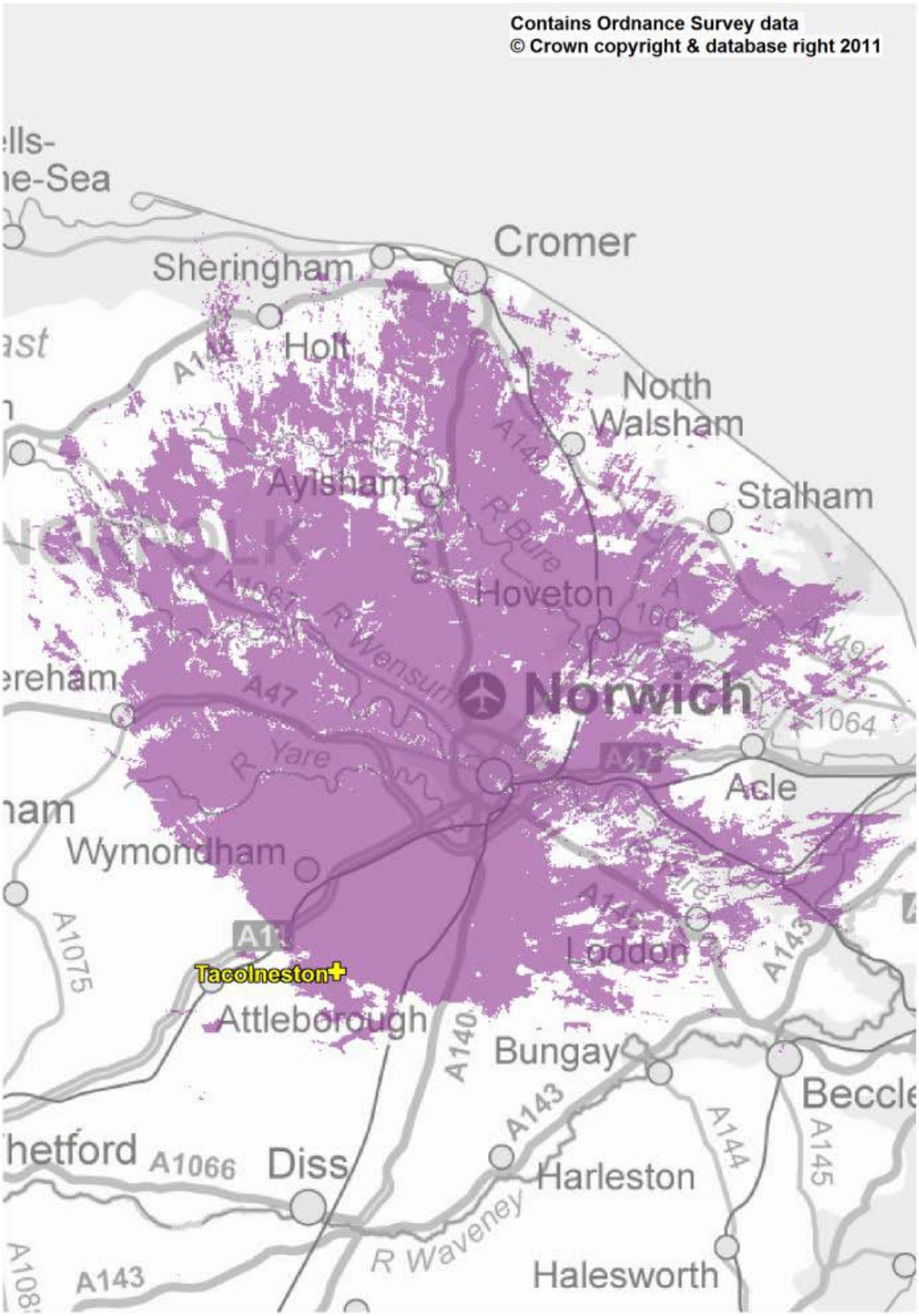
1.46 Newcastle



1.47 Norwich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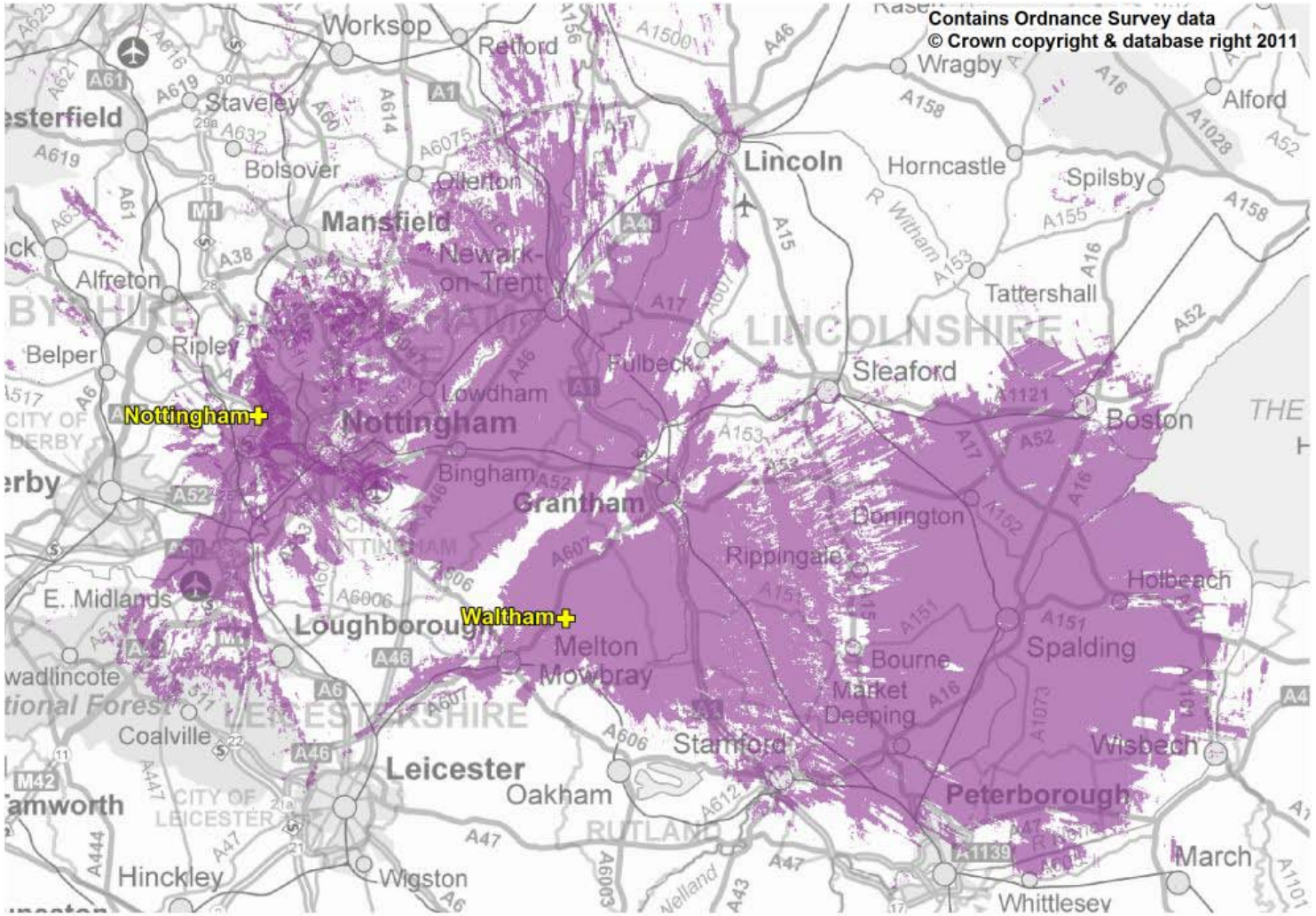
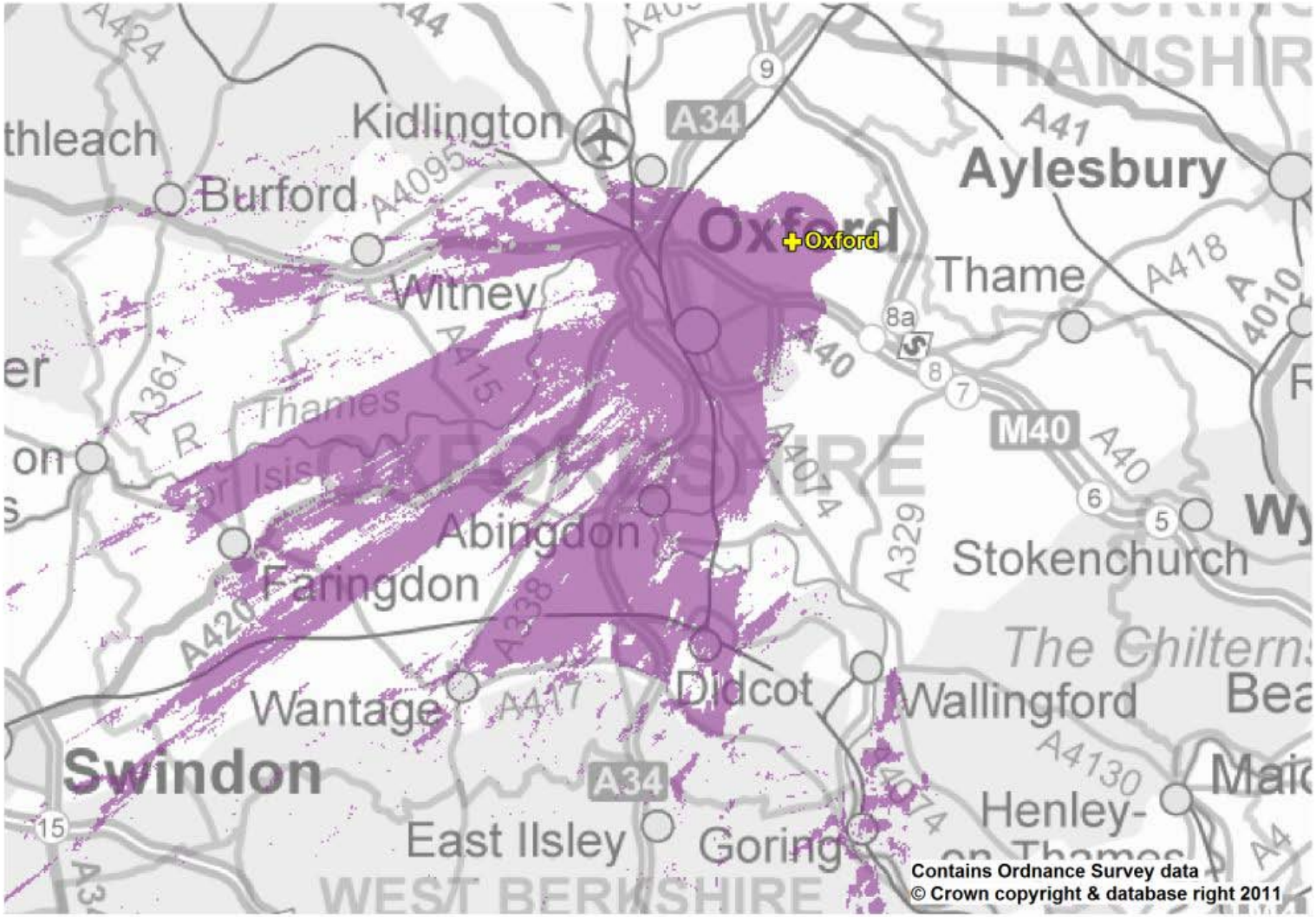
Cromer
Sheringham
Holt
North Walsham
Aylsham
Stalham
Hoveton
Norwich
Acle
Wymondham
Loddon
Tacolneston
Attleborough
Bungay
Diss
Harleston
Halesworth
A47
A1
A140
A143
A1075
A1066
A144
A145
R Bure
R Wensum
R Yare
R Waveney

1.48 Nottingham



1.49 Oxford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A34
Aylesbury
Burford
A4095
Oxford
Witney
Thame
A418
A4010
A361
A415
Thames
A40
M40
A4074
A329
Abingdon
Faringdon
Stokenchurch
A420
A338
The Chilterns
Didcot
Wallingford
Wantage
A417
Swindon
A4130
Henley-
East Ilsley
Goring
WEST BERKSHIRE
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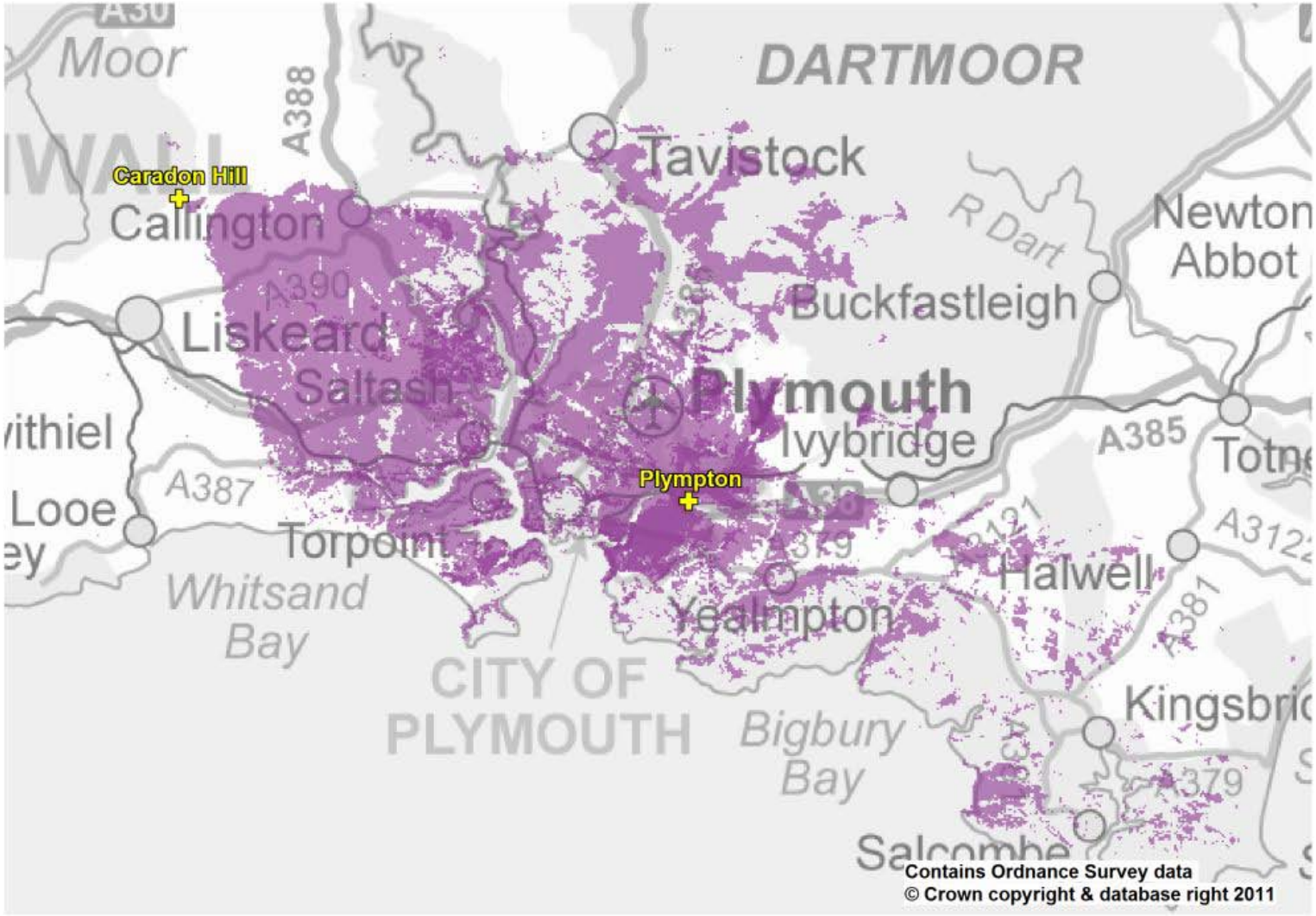
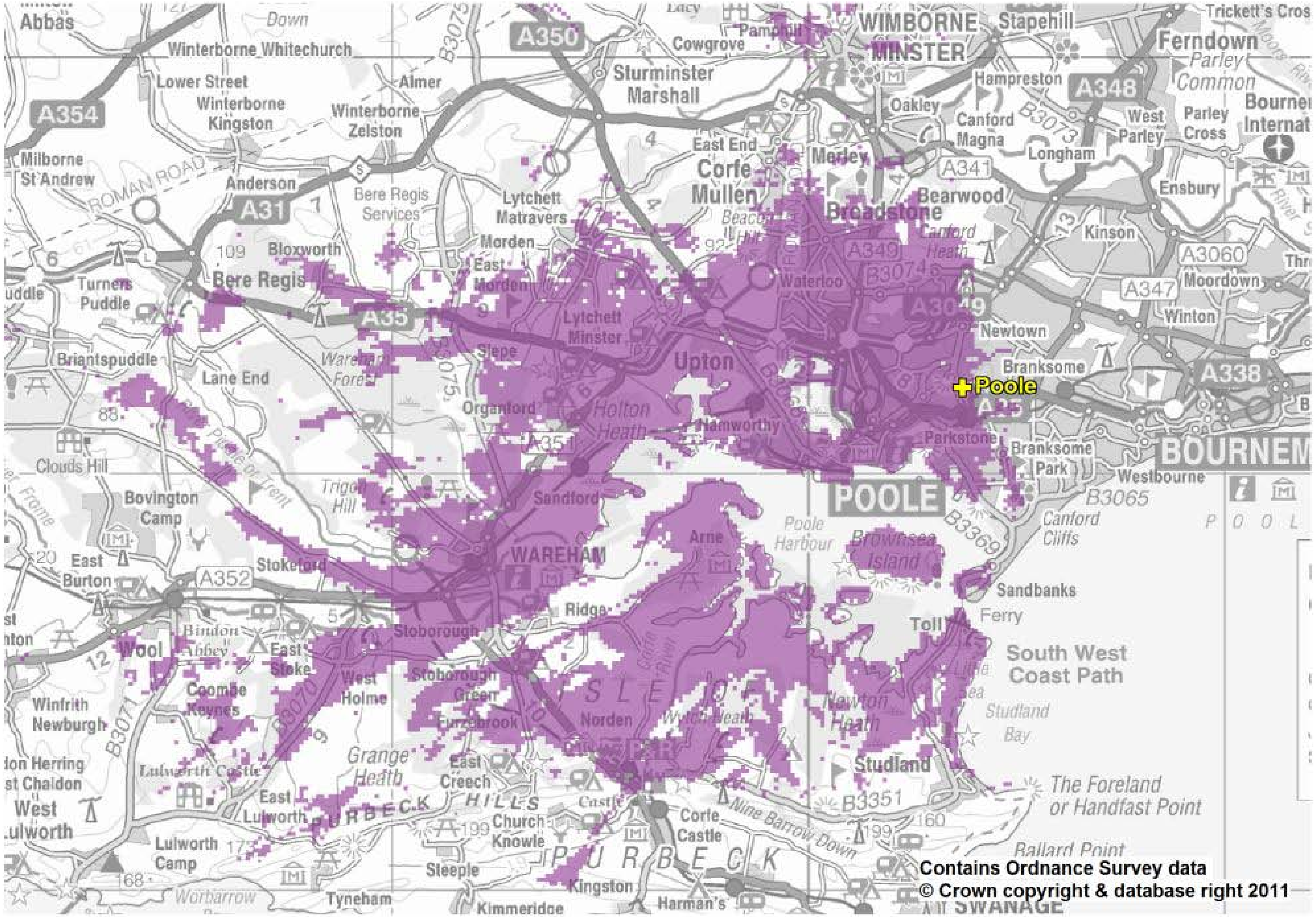
1.50 Plymouth



1.51 Poole


Poole
WIMBORNE MINSTER
Ferndown
Broadstone
Upton
POOLE
BOURNEMOUTH
WAREHAM
Corfe Mullen
Bere Regis
Sandbanks
Studland
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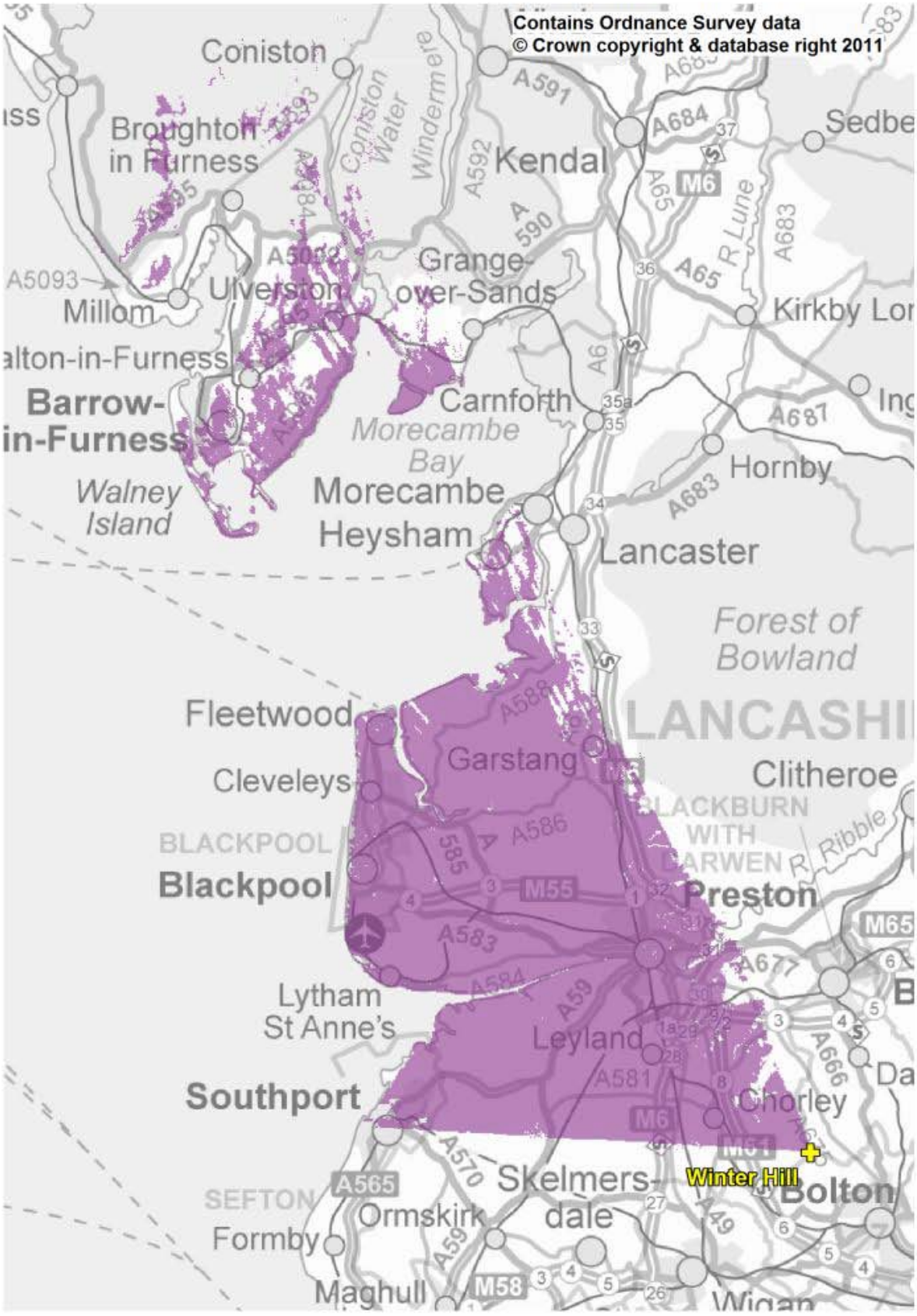
1.52 Preston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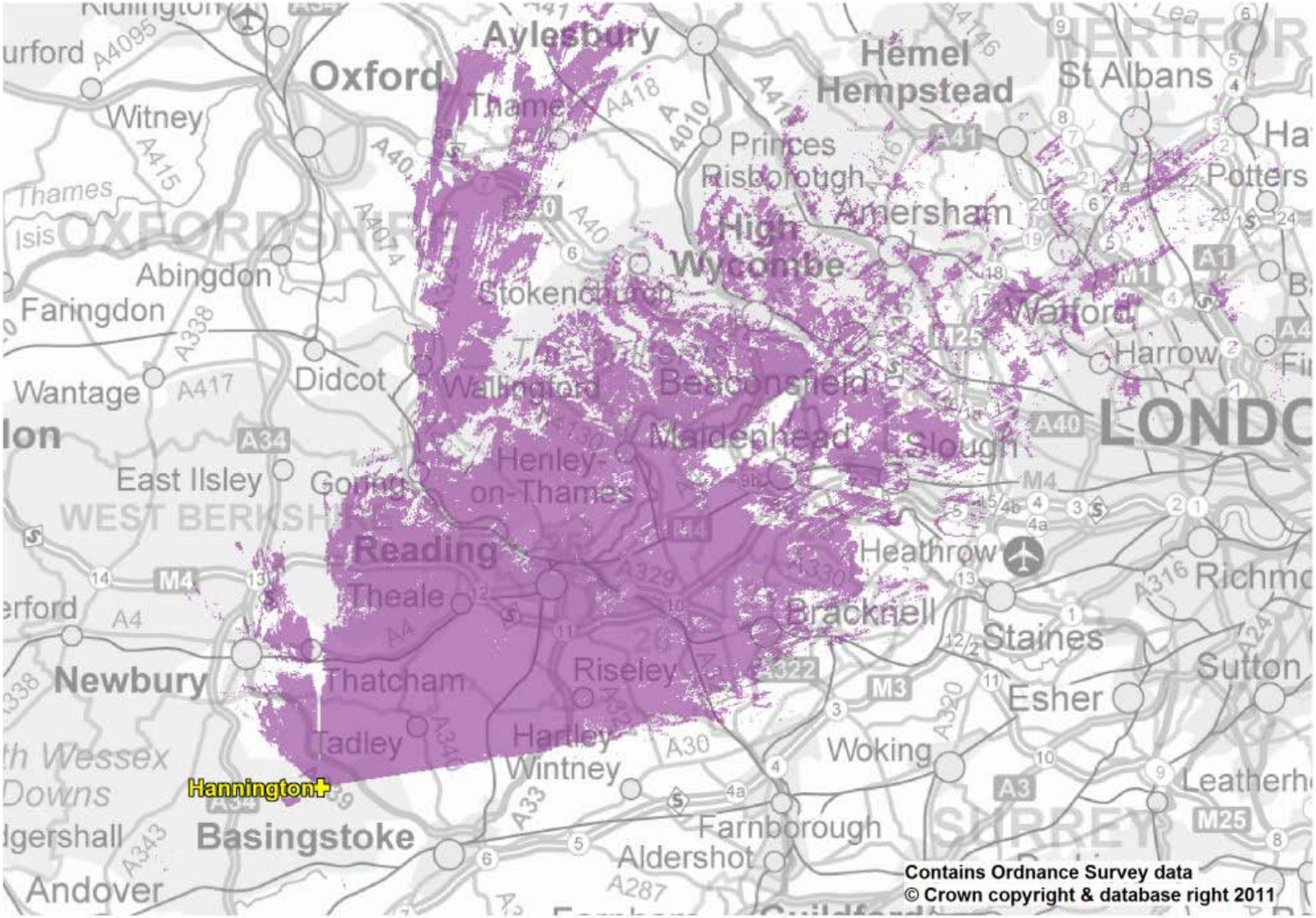
Coniston
Broughton in Furness
Millom
Ulverston
Grange-over-Sands
Kendal
Sedbe
Kirkby Lor
Barrow-in-Furness
Carnforth
Morecambe Bay
Walney Island
Morecambe
Heysham
Hornby
Lancaster
Forest of Bowland
Fleetwood
Garstang
Cleveleys
Clitheroe
BLACKPOOL
Blackpool
Preston
Lytham St Anne's
Leyland
Southport
Chorley
Winter Hill
Bolton
SEFTON
Ormskirk
Skelmersdale
Formby
Maghull
Wigan
A5093
A590
A591
A592
A684
M6
A65
A683
A687
A586
A583
A584
A581
A570
A565
M55
M65
M58
Windermere
Coniston Water
R Lune
R Ribble

1.53 Reading


Aylesbury
Oxford
Hemel Hempstead
St Albans
Witney
Princes Risborough
Amersham
High Wycombe
Abingdon
Faringdon
Didcot
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Watford
Harrow
Henley on-Thames
Maidenhead
Slough
East Ilsley
Reading
Heathrow
Theale
Bracknell
Staines
Newbury
Thatcham
Riseley
Esher
Sutton
Tadley
Hartley Wintney
Woking
Hannington
Basingstoke
Farnborough
Aldershot
Andover
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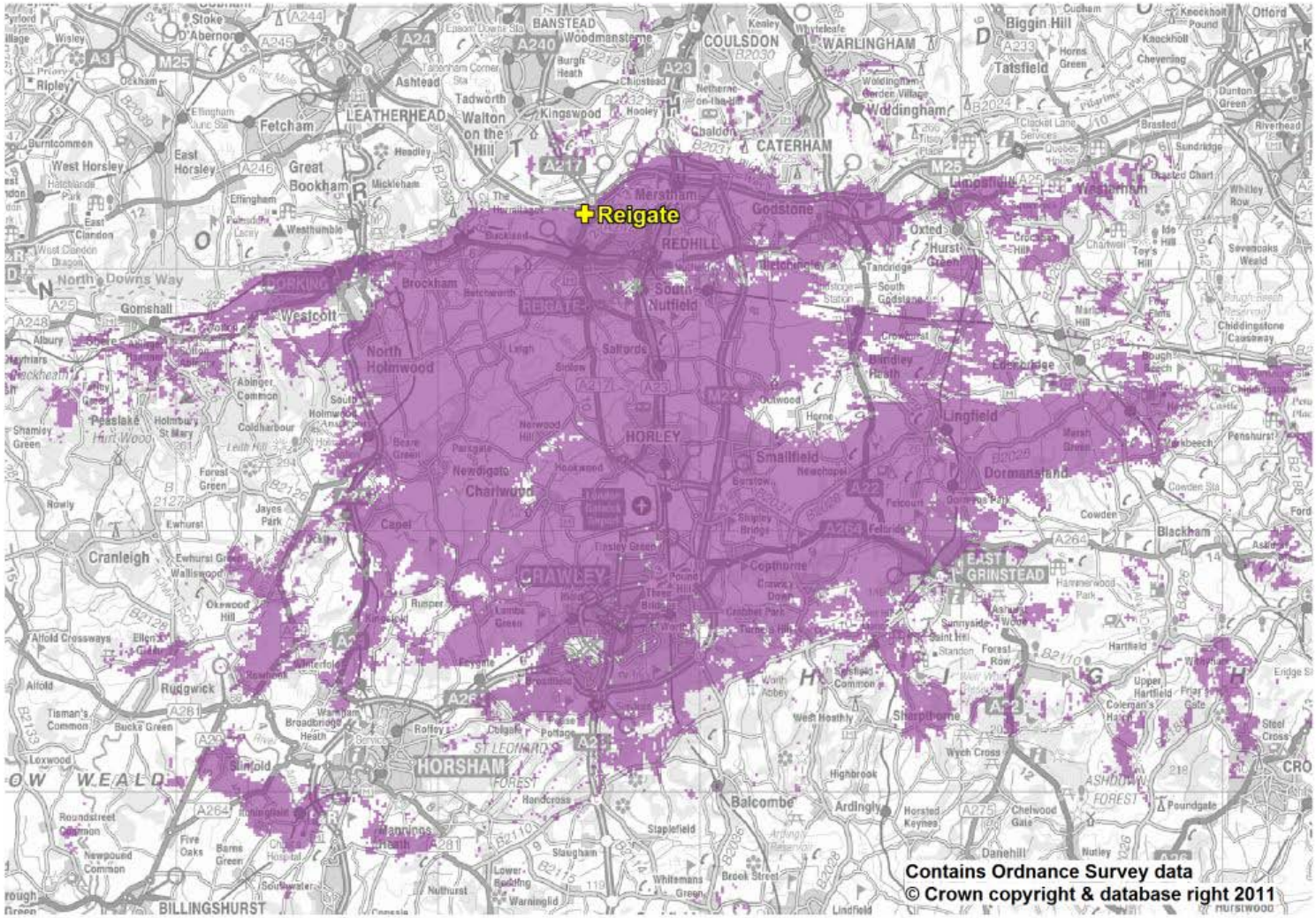
1.54 Reigate


Reigate
Contains Ordnance Survey data
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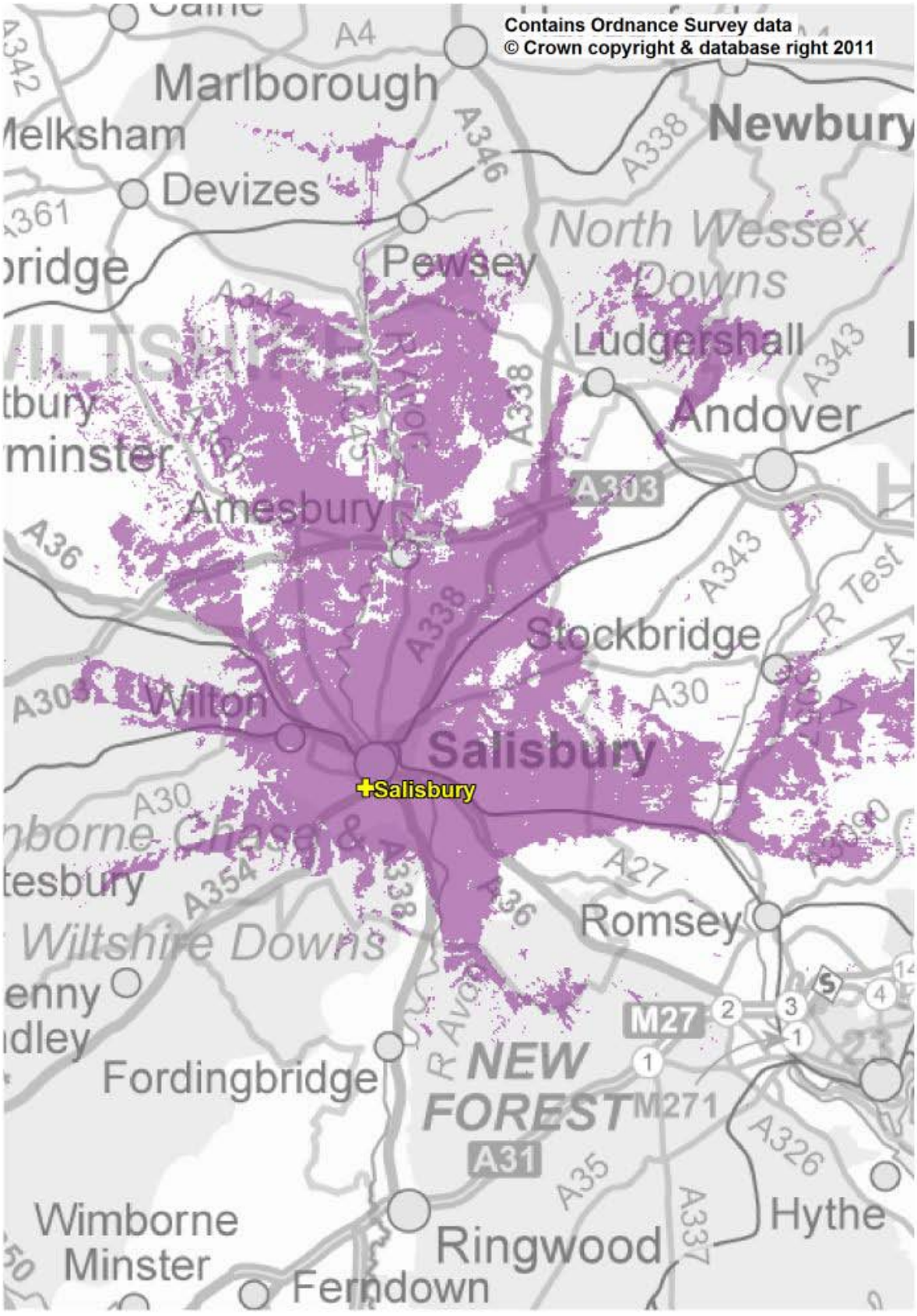
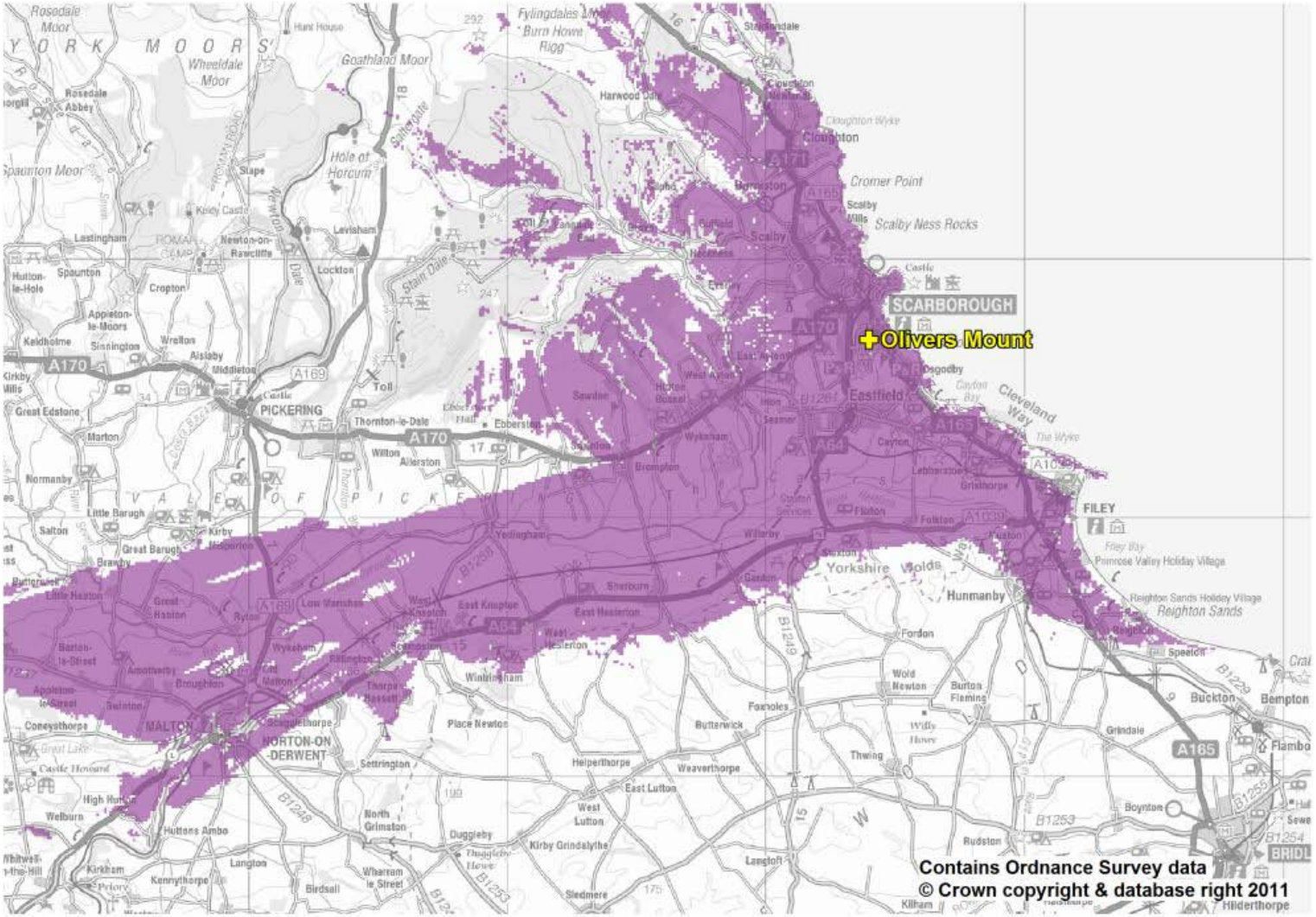
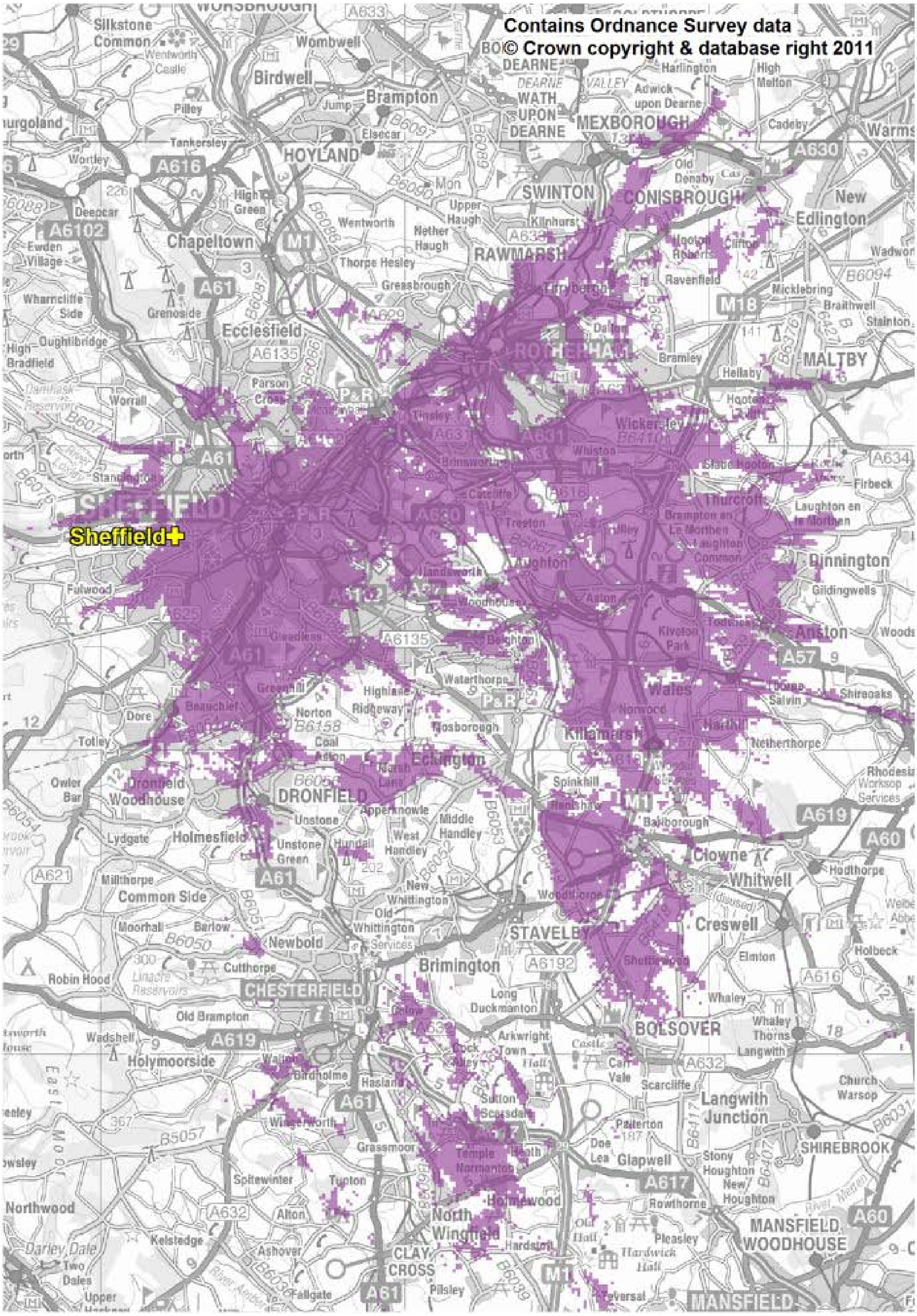
1.55 Salisbury



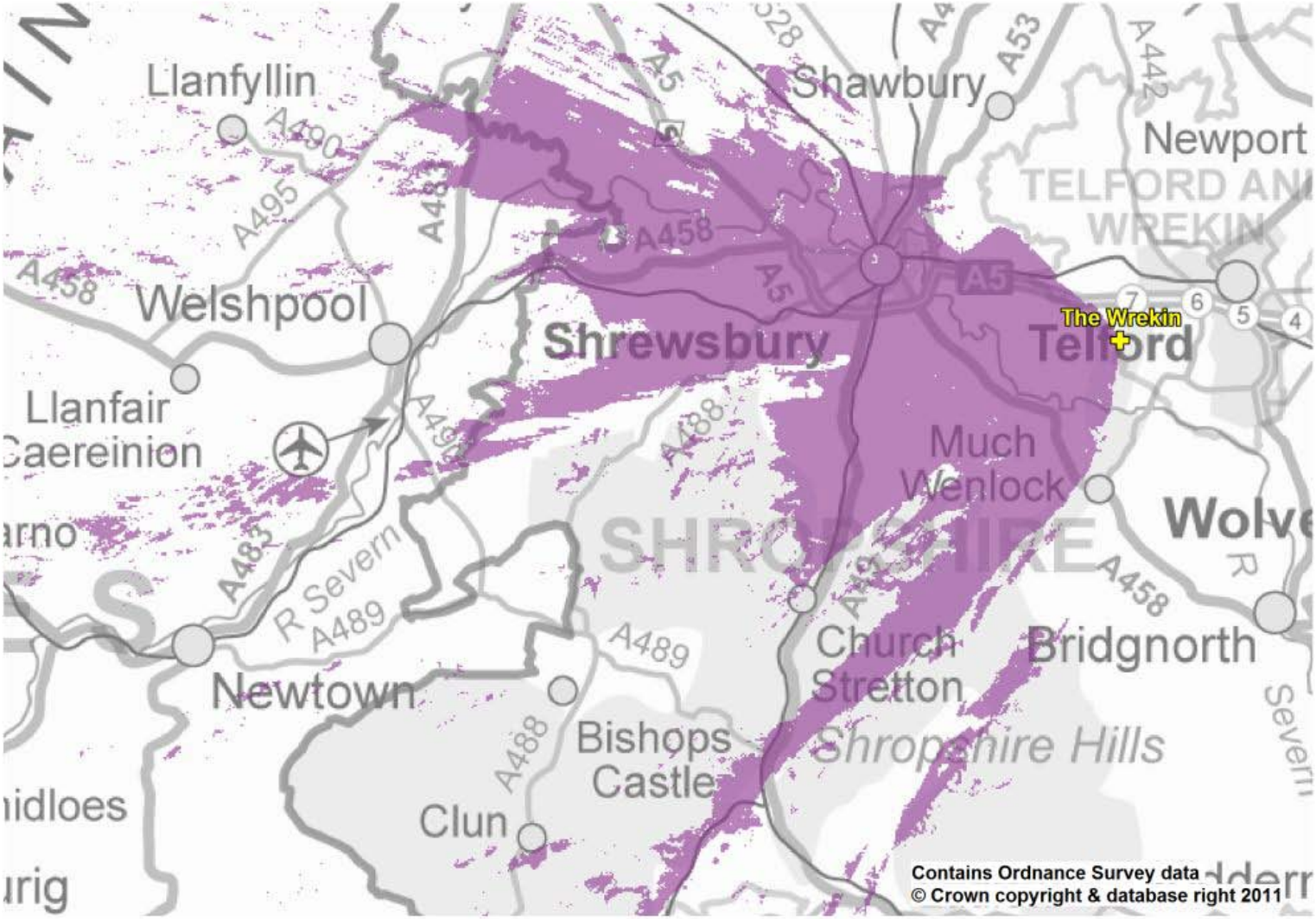
1.56 Scarborough



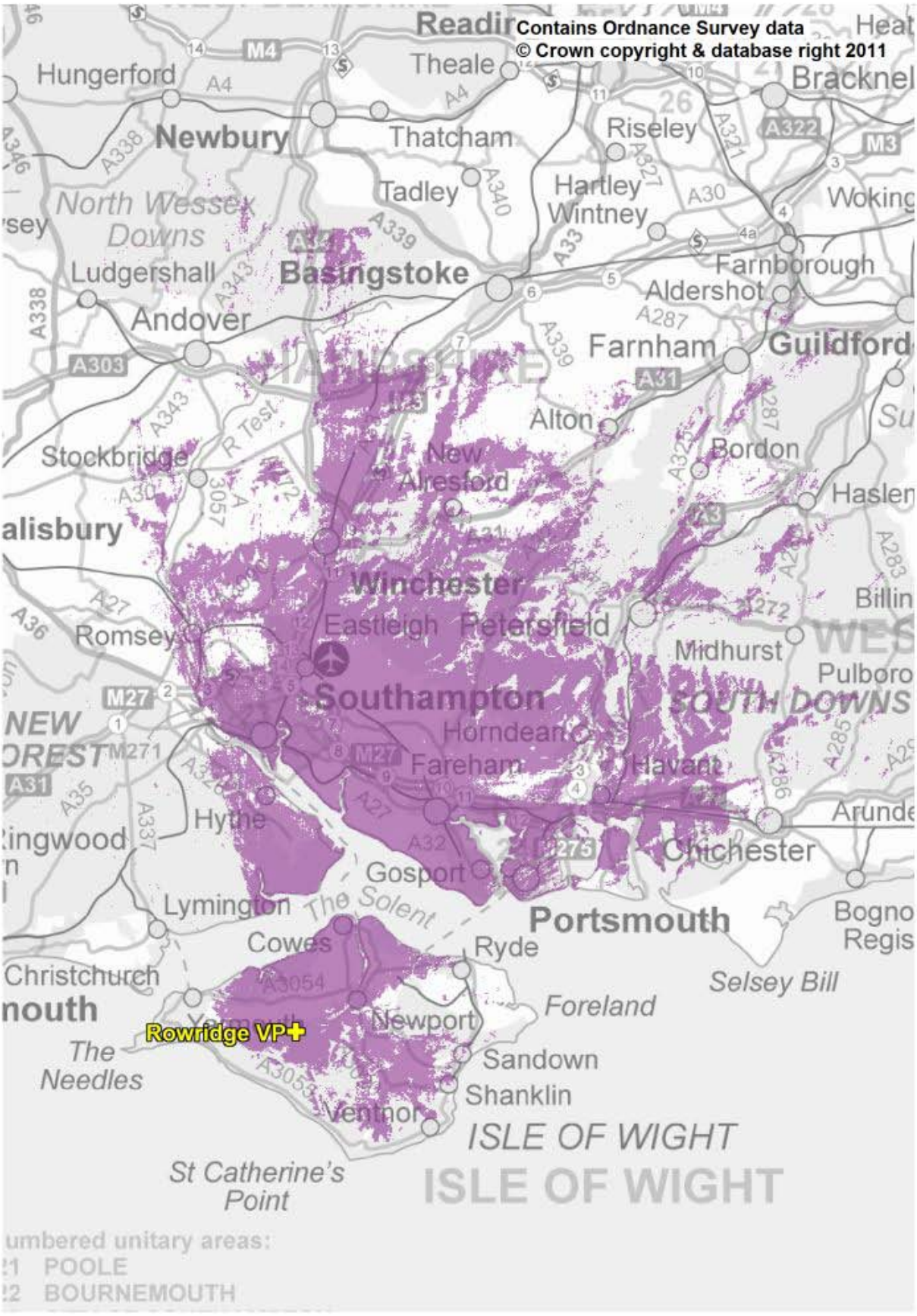
1.57 Sheffield



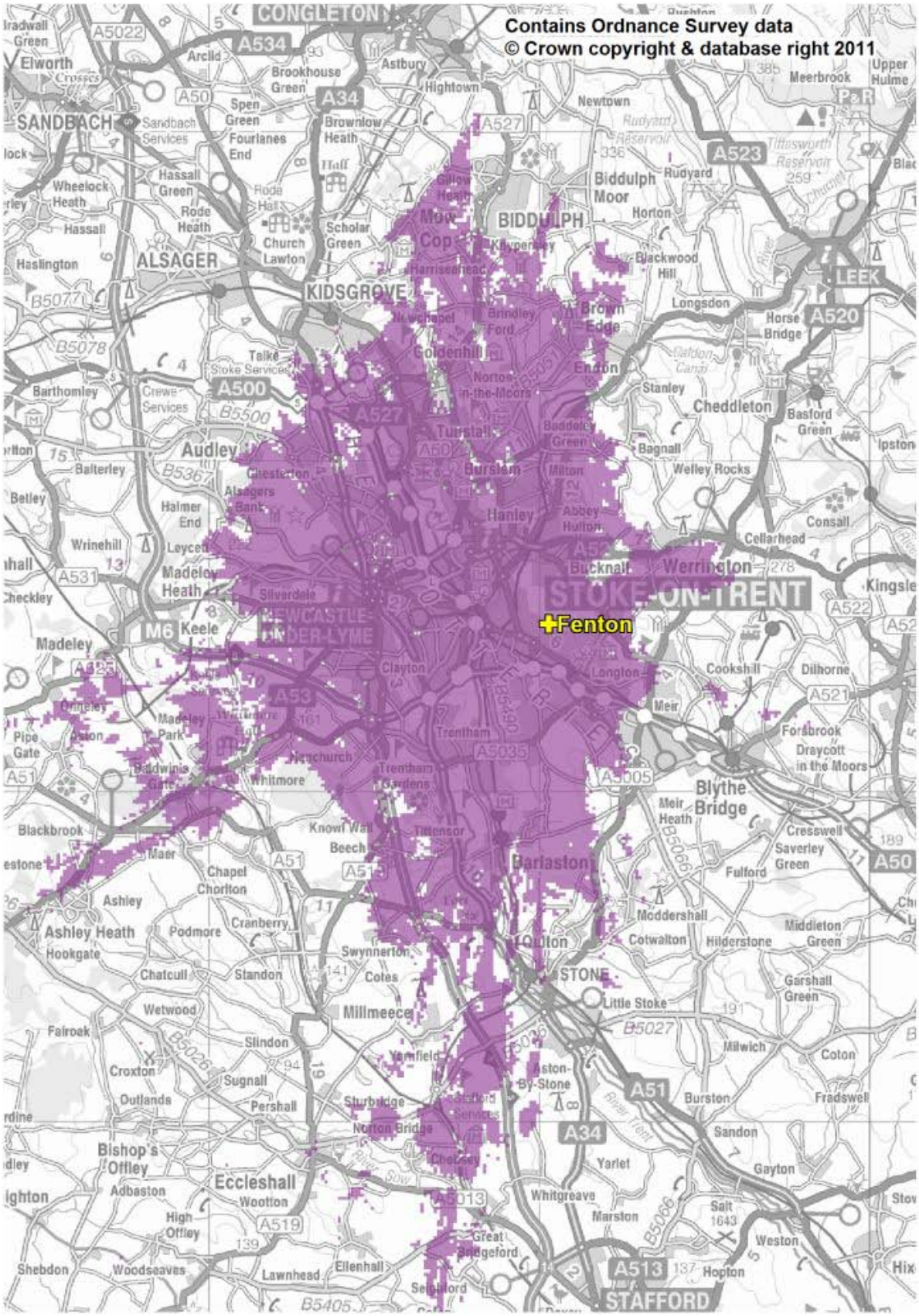
1.58 Shrewsbury



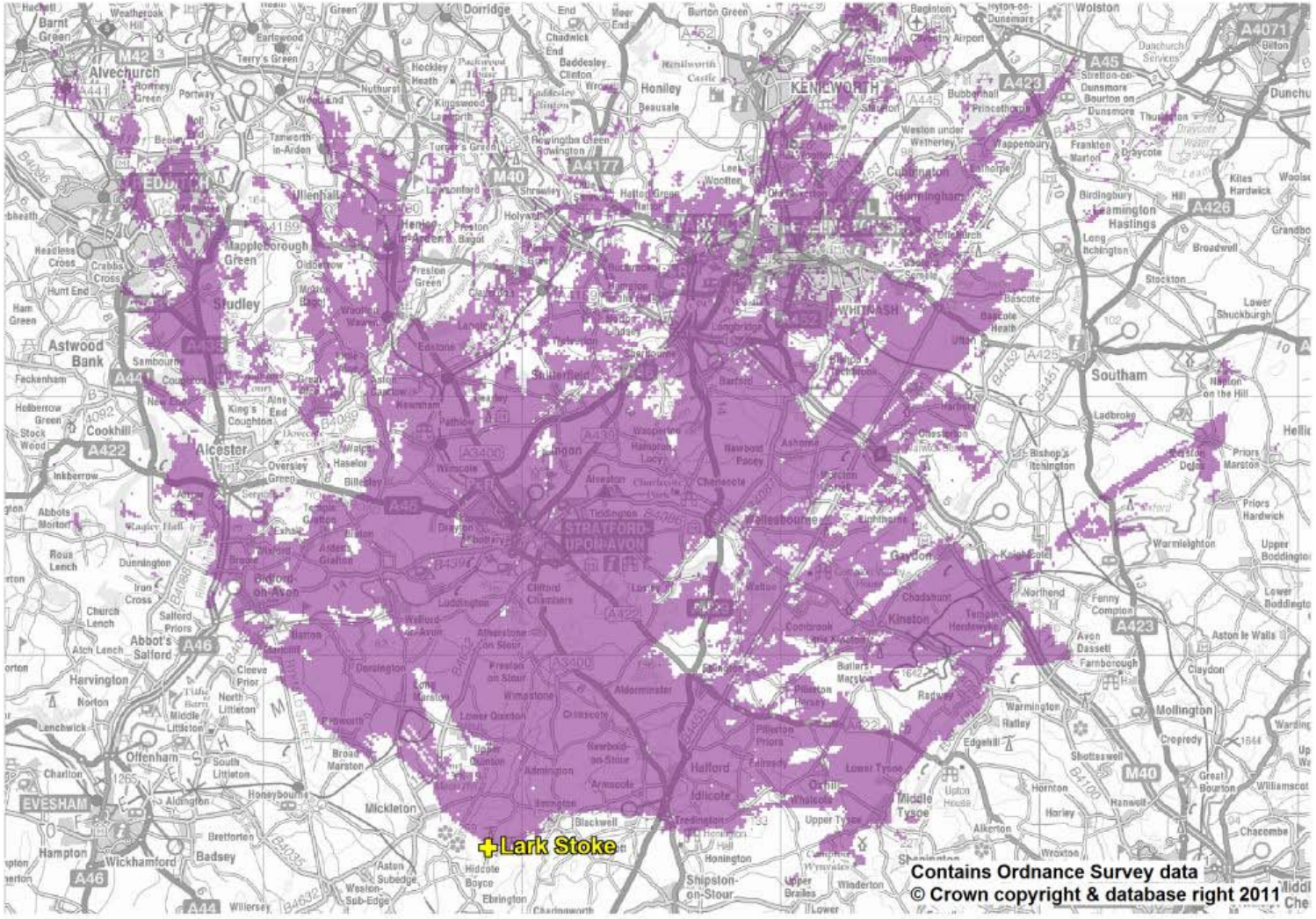
1.59 Southampton



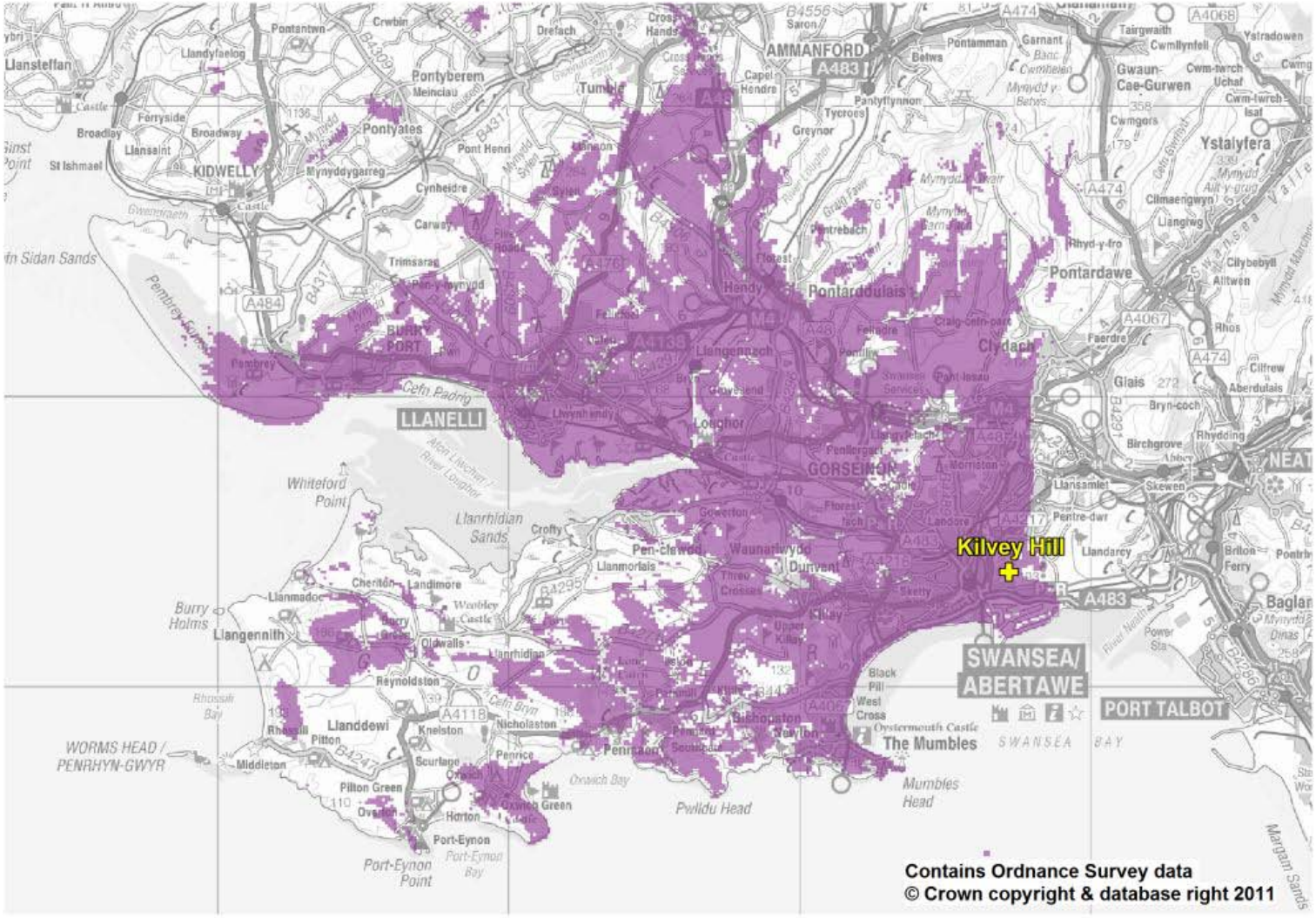
1.60 Stoke on Trent



1.61 Stratford on Avon



1.62 Swansea


Kilvey Hill
SWANSEA/
ABERTAWE
PORT TALBOT
LLANELLI
AMMANFORD
Pontardawe
Clydach
GORSEINON
Pontarddulais
KIDWELLY
Llansteffan
Pontyberem
Pontyates
Llangennith
Llanmadoc
Cheriton
Landimore
Reynoldston
Llanddewi
Pilton Green
Port-Eynon
Whiteford Point
Llanrhidian Sands
Burry Holms
WORMS HEAD / PENRHYN-GWYR
Mumbles Head
Pwlldu Head
The Mumbles
SWANSEA BAY
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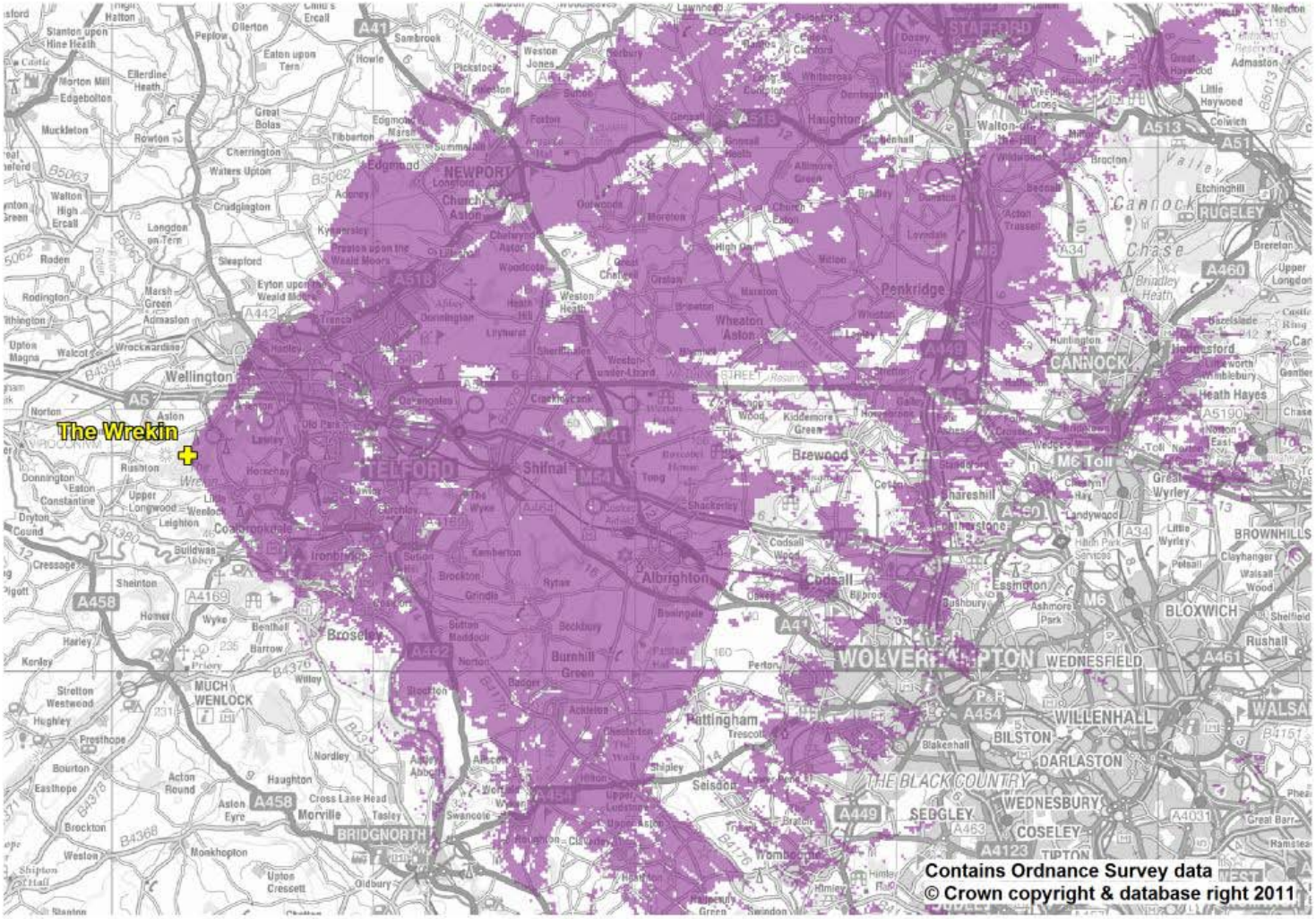
1.63 Telford


The Wrekin
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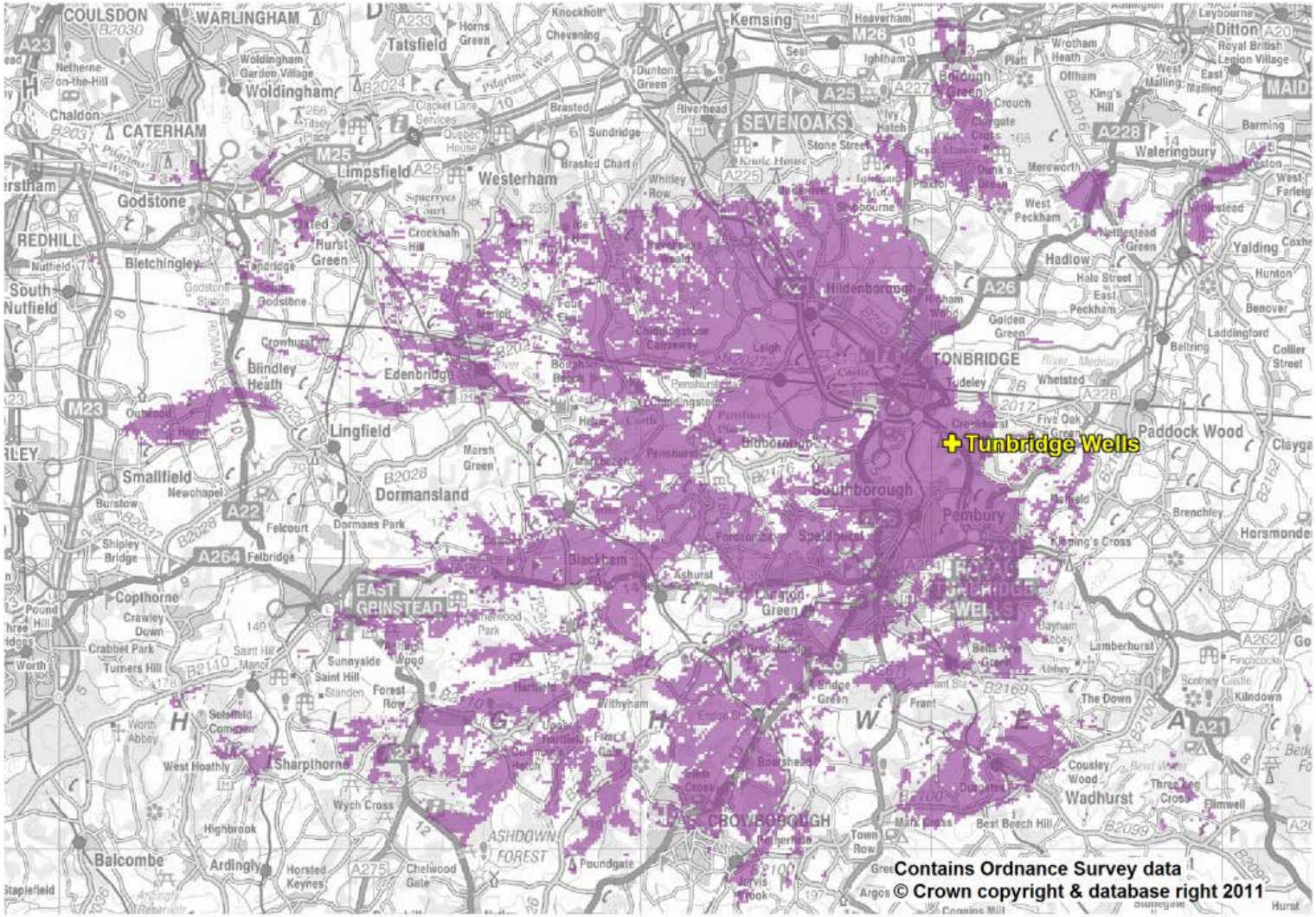
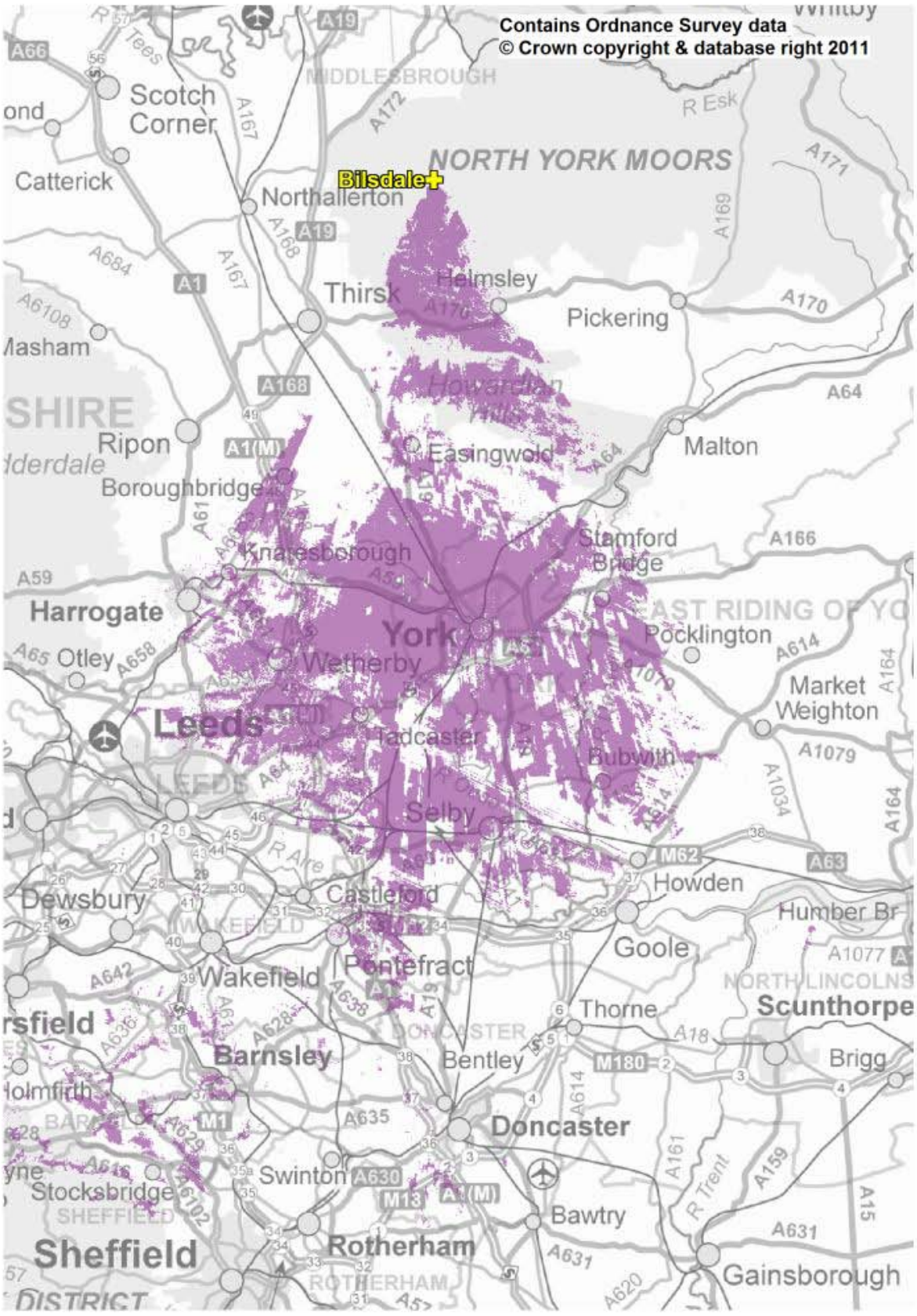
1.64 Tonbridge



1.65 York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Bilsdale
NORTH YORK MOORS
Scotch Corner
Catterick
Northallerton
Thirsk
Helmsley
Pickering
Malton
Ripon
Boroughbridge
Easingwold
Knaresborough
Stamford Bridge
Harrogate
York
Wetherby
Pocklington
Otley
Leeds
Tadcaster
Market Weighton
Selby
Howden
Dewsbury
Castleford
Goole
Humber Br
Wakefield
Pontefract
Thorne
Scunthorpe
Barnsley
Bentley
Brigg
Doncaster
Swinton
Stocksbridge
Bawtry
Sheffield
Rotherham
Gainsborough