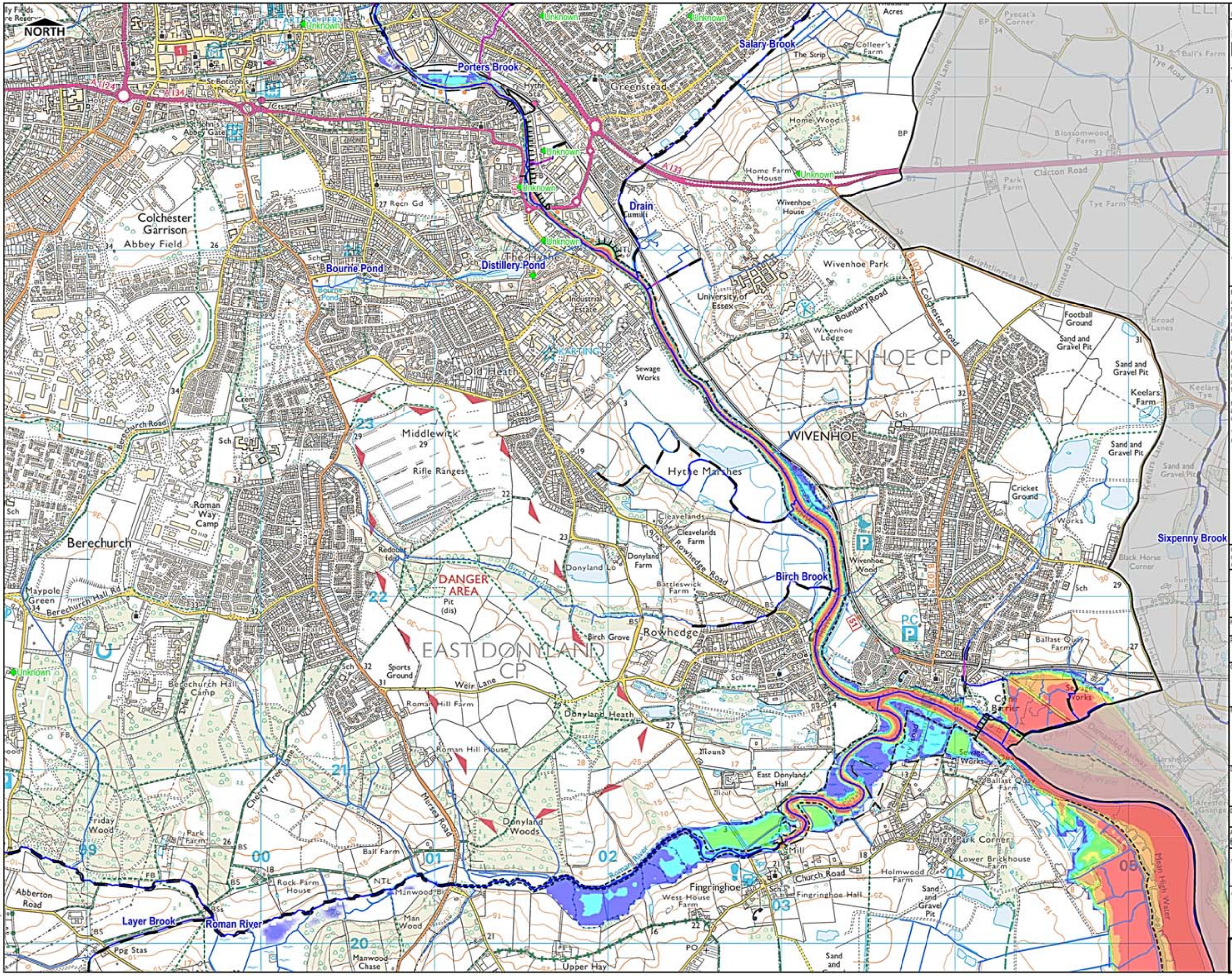
Appendix A. Figures



THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT

LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Maximum Flood Depth (m)

- 0.1 - 0.5m
- 0.5 - 1.0m
- 1.0 - 1.5m
- 1.5 - 2.0m
- 2.0 - 3.0m
- > 3.0m

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE AND BLACKWATER ESTUARY MODEL MAXIMUM FLOOD DEPTH 0.5% AEP (200YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
60473444	1:20,000

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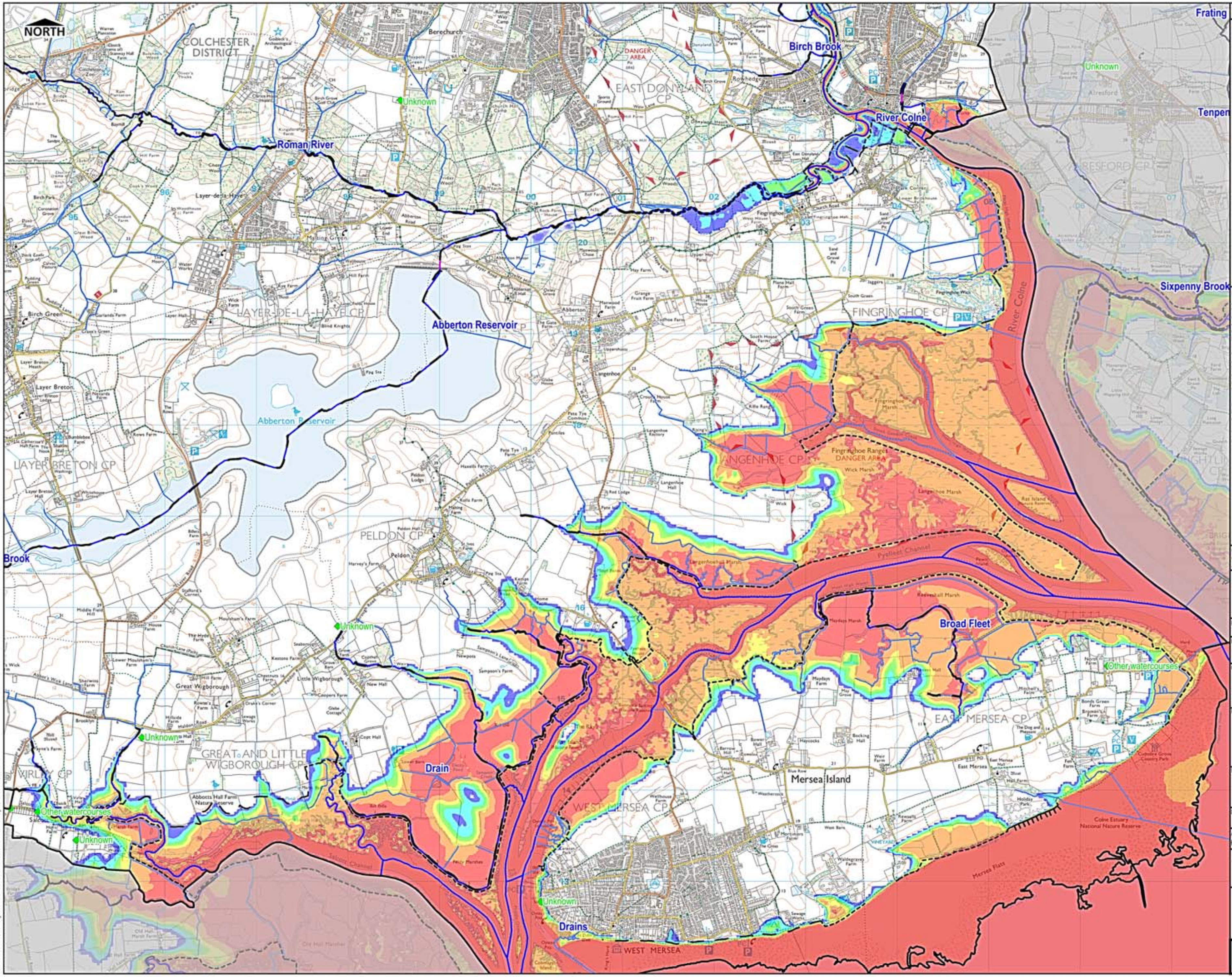
Drawing Number	Rev
FIGURE A1.1	1



LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Maximum Flood Depth (m)

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- 0.5 - 1.0m
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- 1.5 - 2.0m
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Asset Information Management System - Defences

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Drawing Title: COLNE AND BLACKWATER ESTUARY MODEL MAXIMUM FLOOD DEPTH 0.5% AEP (200YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
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Drawing Number	Rev
FIGURE A1.2	1

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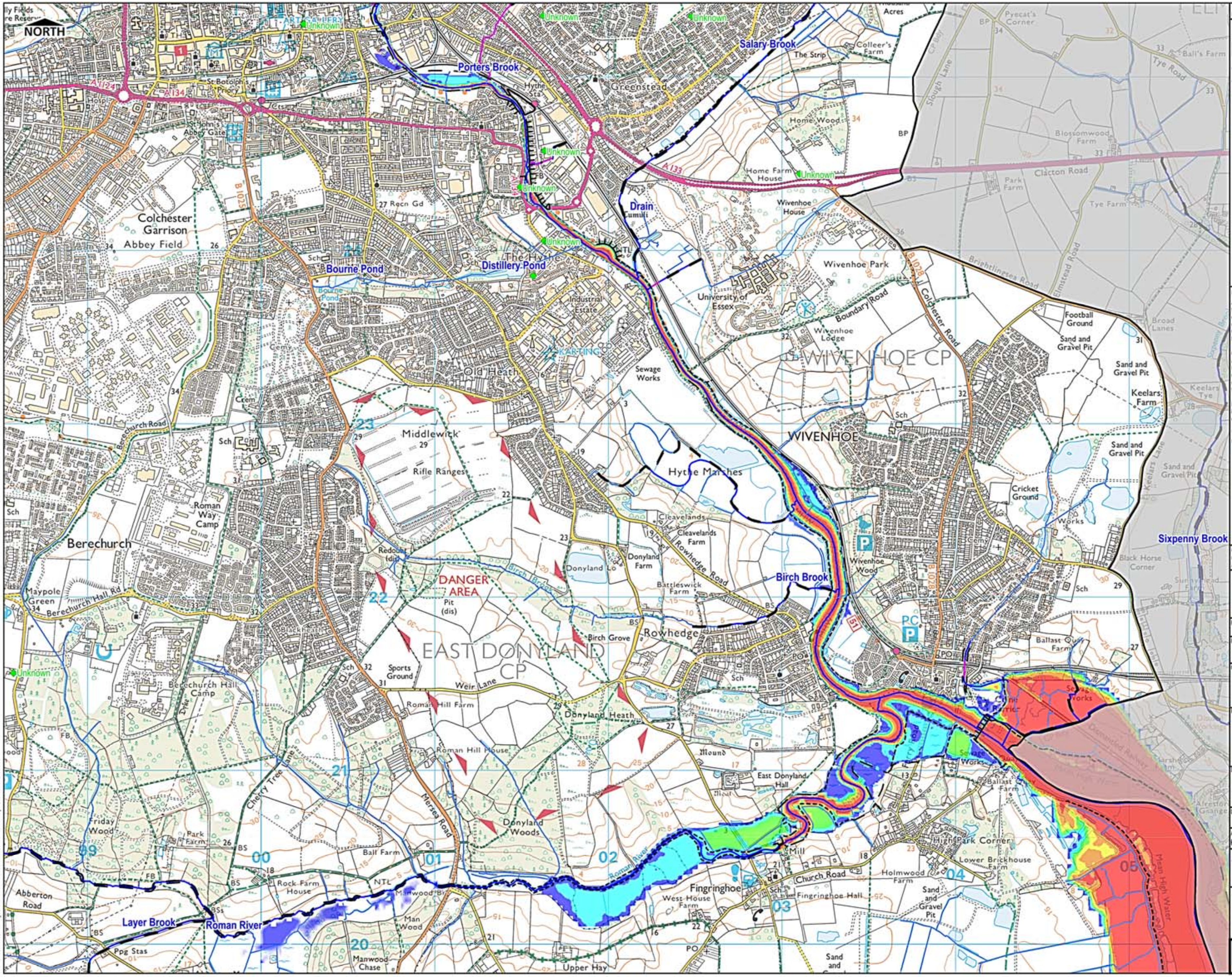

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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Maximum Flood Depth (m)

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Asset Information Management System - Defences

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Drawing Title: COLNE AND BLACKWATER ESTUARY MODEL MAXIMUM FLOOD DEPTH 0.5% AEP (200YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
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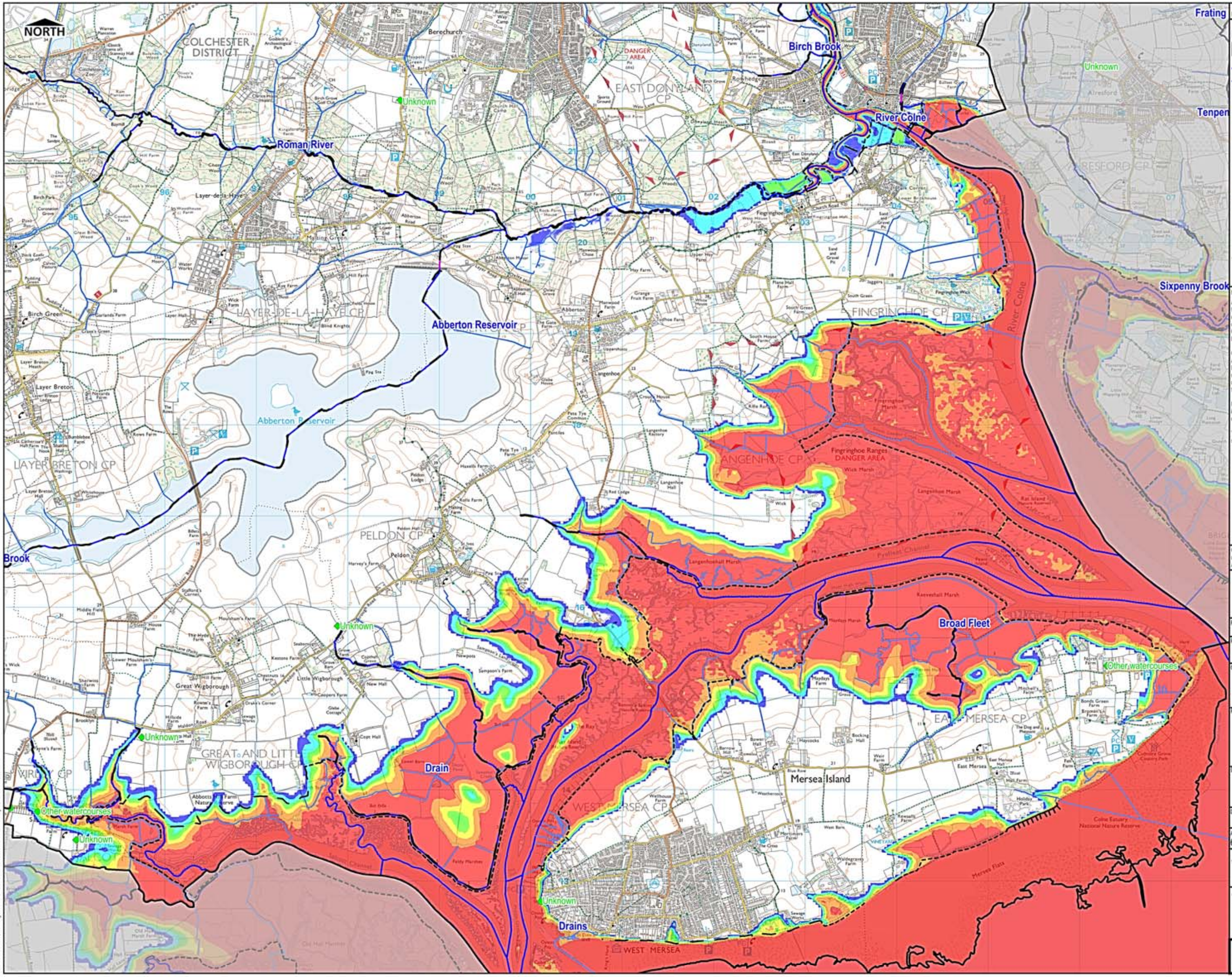
FIGURE A2.1	1



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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Maximum Flood Depth (m)

- 0.1 - 0.5m
- 0.5 - 1.0m
- 1.0 - 1.5m
- 1.5 - 2.0m
- 2.0 - 3.0m
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Asset Information Management System - Defences

- Embankment
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- Flood Gate
- Wall

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE AND BLACKWATER ESTUARY MODEL MAXIMUM FLOOD DEPTH 0.5% AEP (200YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

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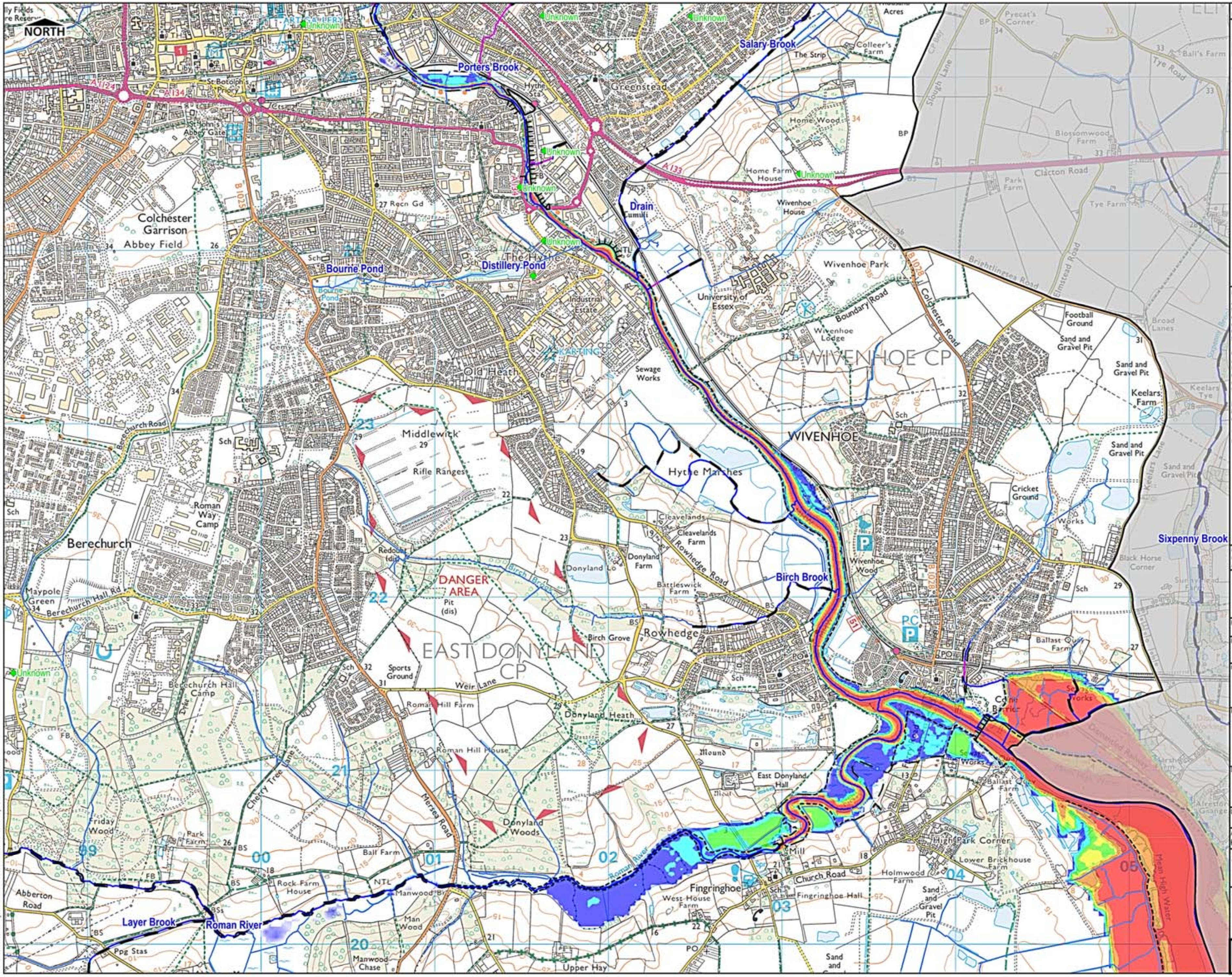

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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Maximum Flood Depth (m)

- 0.1 - 0.5m
- 0.5 - 1.0m
- 1.0 - 1.5m
- 1.5 - 2.0m
- 2.0 - 3.0m
- > 3.0m

Asset Information Management System - Defences

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Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE AND BLACKWATER ESTUARY MODEL MAXIMUM FLOOD DEPTH 0.1% AEP (1000YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
60473444	1:20,000

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Drawing Number: FIGURE A3.1 | Rev: 1

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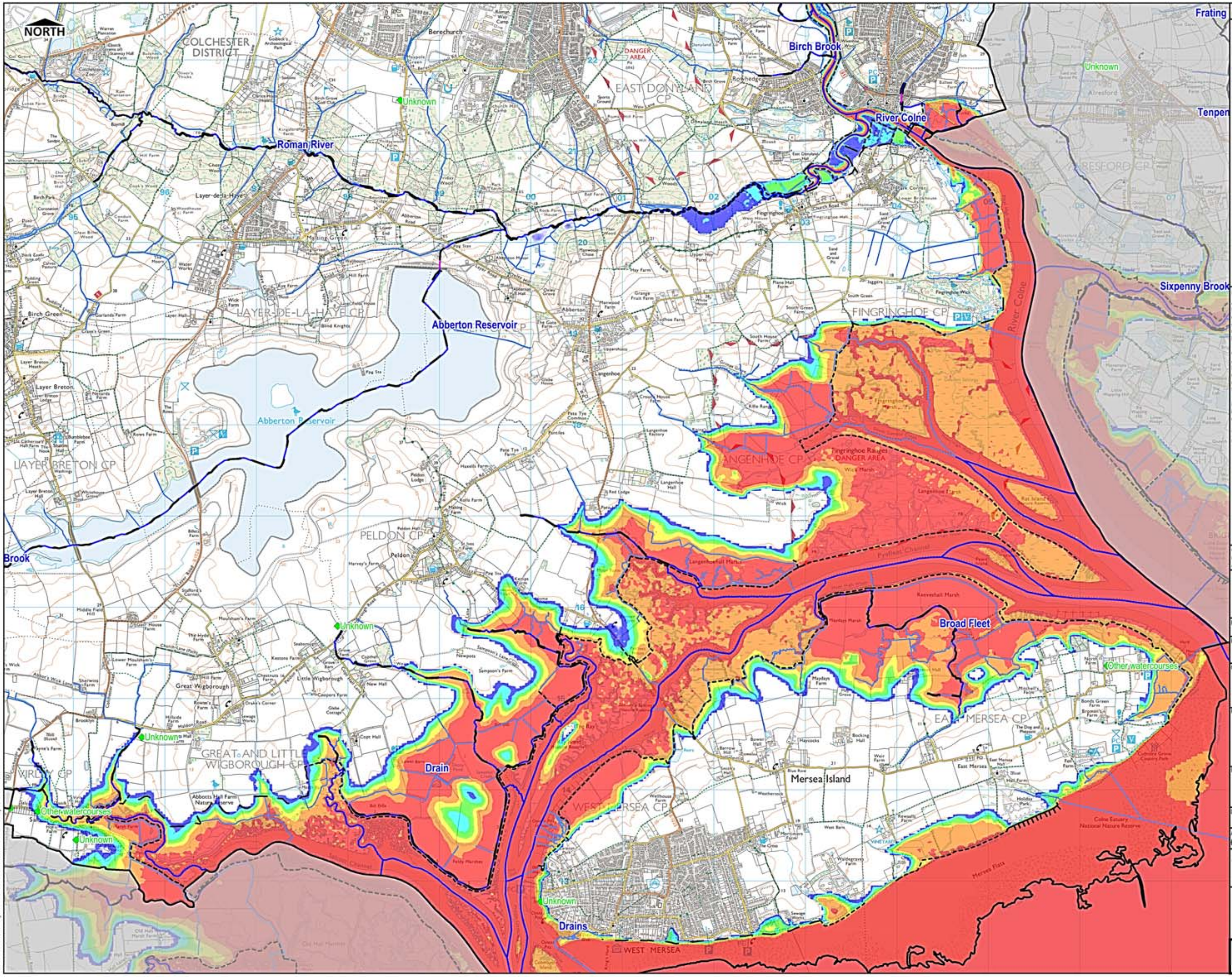

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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Maximum Flood Depth (m)

- 0.1 - 0.5m
- 0.5 - 1.0m
- 1.0 - 1.5m
- 1.5 - 2.0m
- 2.0 - 3.0m
- > 3.0m

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

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Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE AND BLACKWATER ESTUARY MODEL MAXIMUM FLOOD DEPTH 0.1% AEP (1000YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

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Drawing Number	Rev
FIGURE A3.2	1

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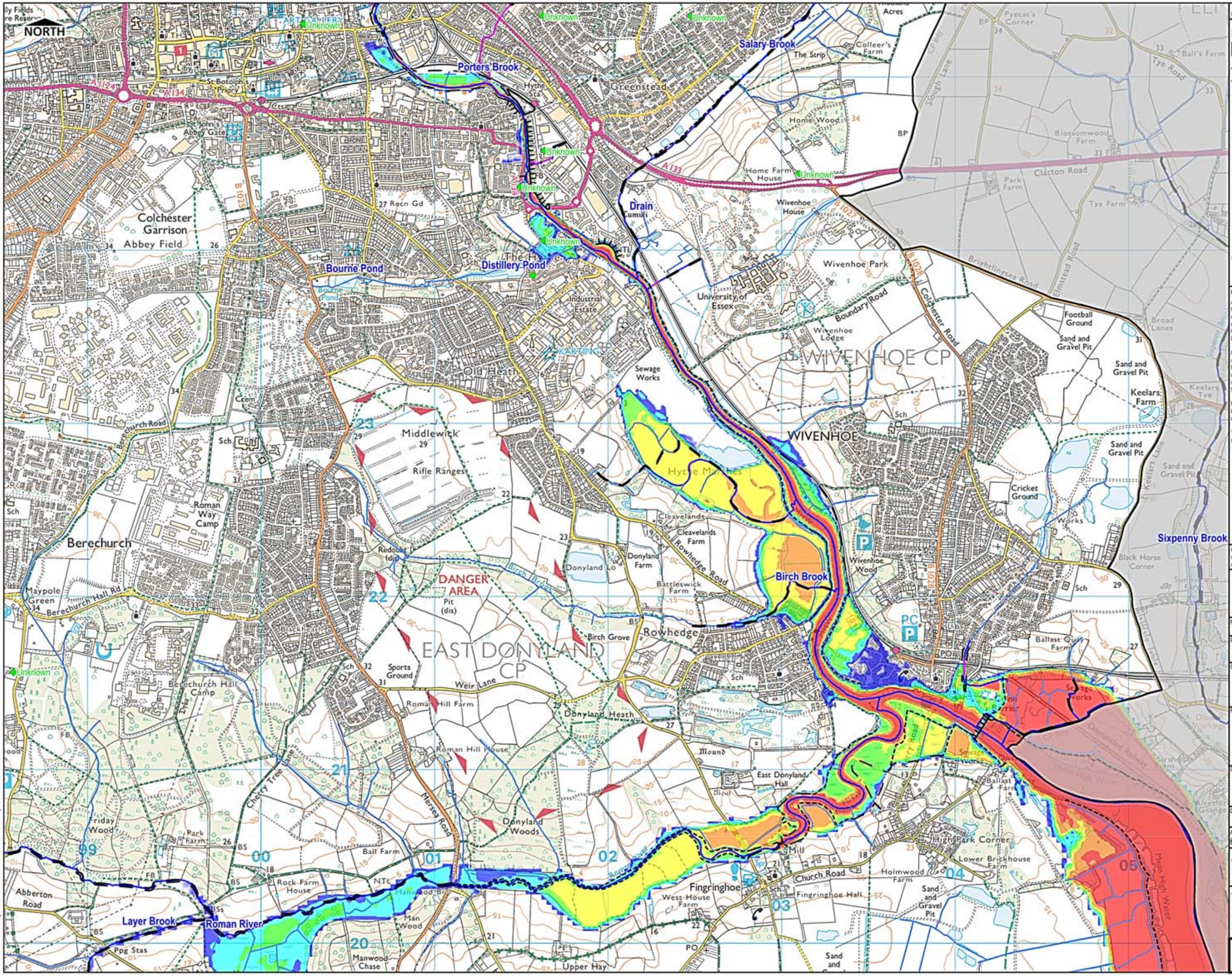

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LEGEND

Administrative Boundaries
Main River
Ordinary Watercourse
Flood Records (Essex County Council)

Maximum Flood Depth (m)

0.1 - 0.5m
0.5 - 1.0m
1.0 - 1.5m
1.5 - 2.0m
2.0 - 3.0m
> 3.0m

Asset Information Management System - Defences

Embankment
High Ground
Flood Gate
Wall

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
VERSION 1

Client
Colchester, the place to live, learn, work, and visit.

Project Title
COLCHESTER BOROUGH COUNCIL
STRATEGIC FLOOD
RISK ASSESSMENT

Drawing Title
COLNE AND BLACKWATER ESTUARY MODEL
MAXIMUM FLOOD DEPTH
0.1% AEP (1000YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
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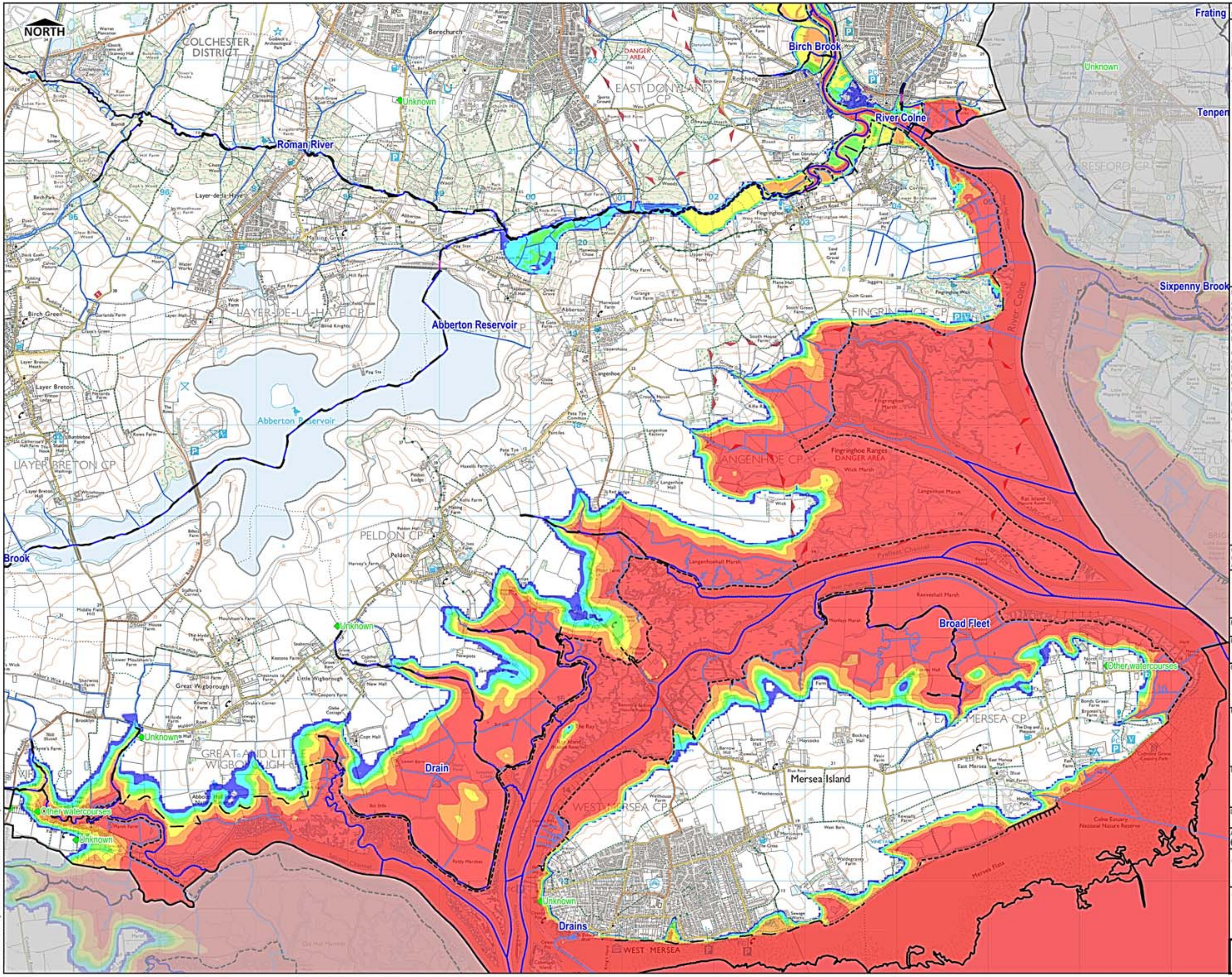
Drawing Number	Rev
FIGURE A4.1	1



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LEGEND

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Maximum Flood Depth (m)

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Asset Information Management System - Defences

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE AND BLACKWATER ESTUARY MODEL MAXIMUM FLOOD DEPTH 0.1% AEP (1000YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

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Drawing Number	Rev
FIGURE A4.2	1

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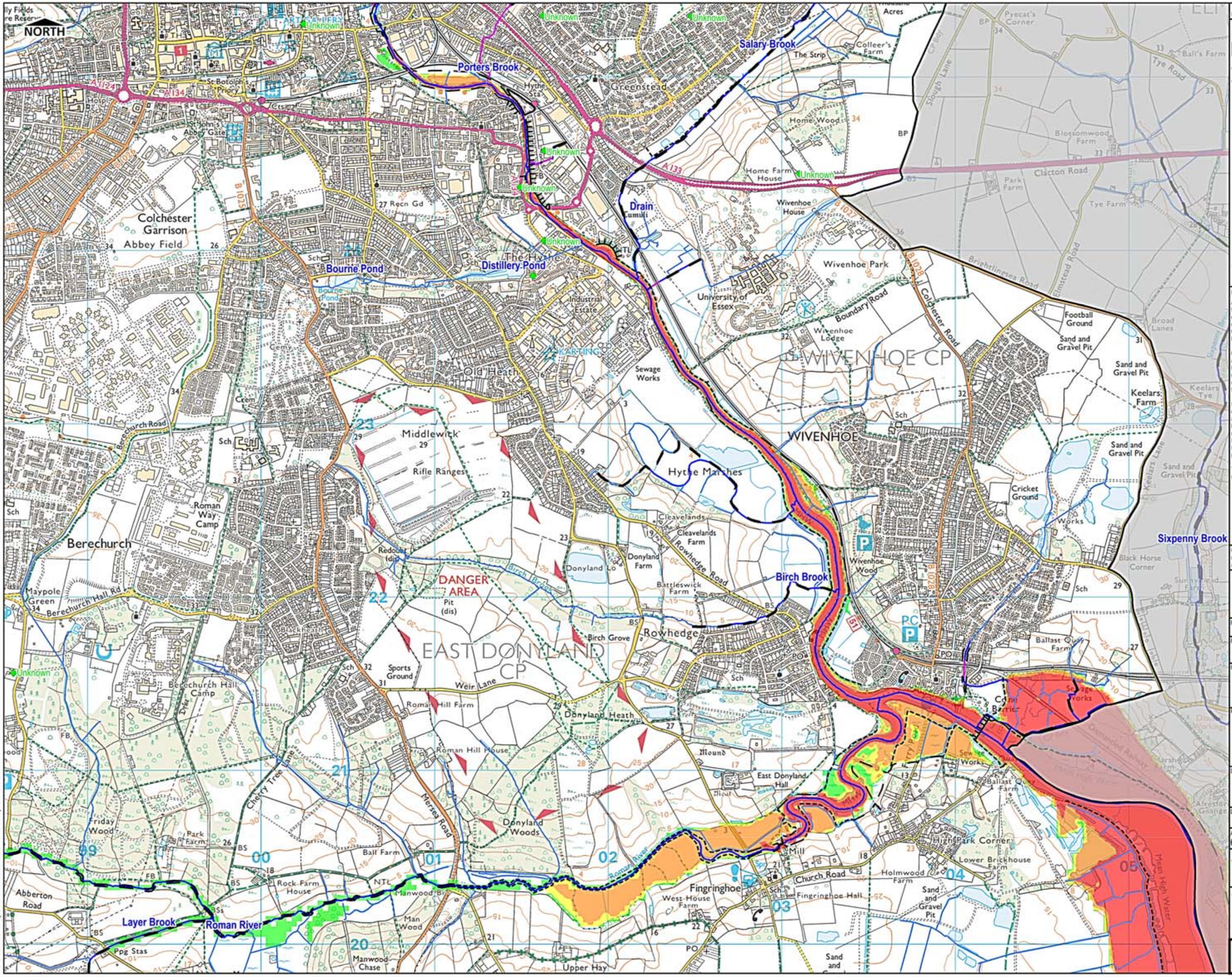

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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Hazard Rating

Flood hazard is calculated as a function of the flood depth and flow velocity at a particular point in the floodplain, along with a suitable debris factor, and is based on the methodology from Flood Risks to People FD2320 (Defra and Environment Agency, 2005).

- Low Hazard
- Moderate Hazard (Danger for Some)
- Significant Hazard (Danger for Most)
- Extreme Hazard (Danger for All)

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

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Flood hazard is a function of the flood depth and flow velocity as well as a debris factor. Each grid cell within the TUFLOW model domain has been assigned one of four hazard categories: 'Extreme Hazard', 'Significant Hazard', 'Moderate Hazard', and 'Low Hazard'. The derivation of these categories is based on Flood Risks to People FD2321 (Defra & Environment Agency, 2005), using the following equation:
Flood Hazard Rating = ((v+0.5)*D) + DF
(Where v = velocity (m/s), D = depth (m) and DF = debris factor)

This map is intended to provide a strategic overview of flood risk and should not be used to assess flood risk for individual properties.

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
VERSION 1

Client
Colchester, the place to live, learn, work, and visit.

Project Title
COLCHESTER BOROUGH COUNCIL
STRATEGIC FLOOD
RISK ASSESSMENT

Drawing Title
COLNE AND BLACKWATER ESTUARY MODEL
MAXIMUM FLOOD HAZARD
0.5% AEP (200YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
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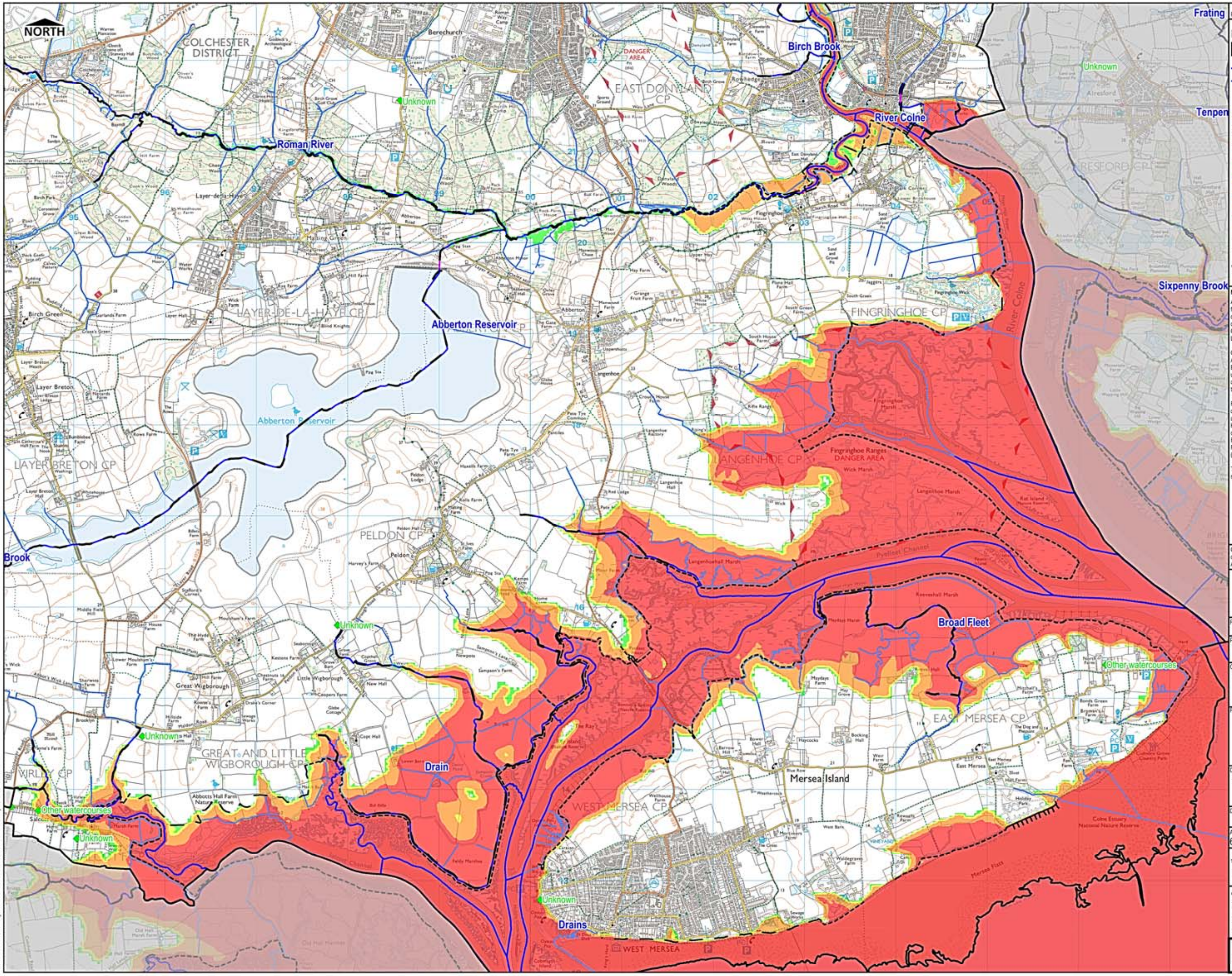
Drawing Number
FIGURE A5.1
Rev
1



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LEGEND

Administrative Boundaries
Main River
Ordinary Watercourse
Flood Records (Essex County Council)

Hazard Rating

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Low Hazard
Moderate Hazard (Danger for Some)
Significant Hazard (Danger for Most)
Extreme Hazard (Danger for All)

Asset Information Management System - Defences

Embankment
High Ground
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(Where v = velocity (m/s), D = depth (m) and DF = debris factor)

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RISK ASSESSMENT

Drawing Title
COLNE AND BLACKWATER ESTUARY MODEL
MAXIMUM FLOOD HAZARD
0.5% AEP (1000YR) 2015

Drawn	Checked	Approved	Date
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Drawing Number
FIGURE A5.2
Rev
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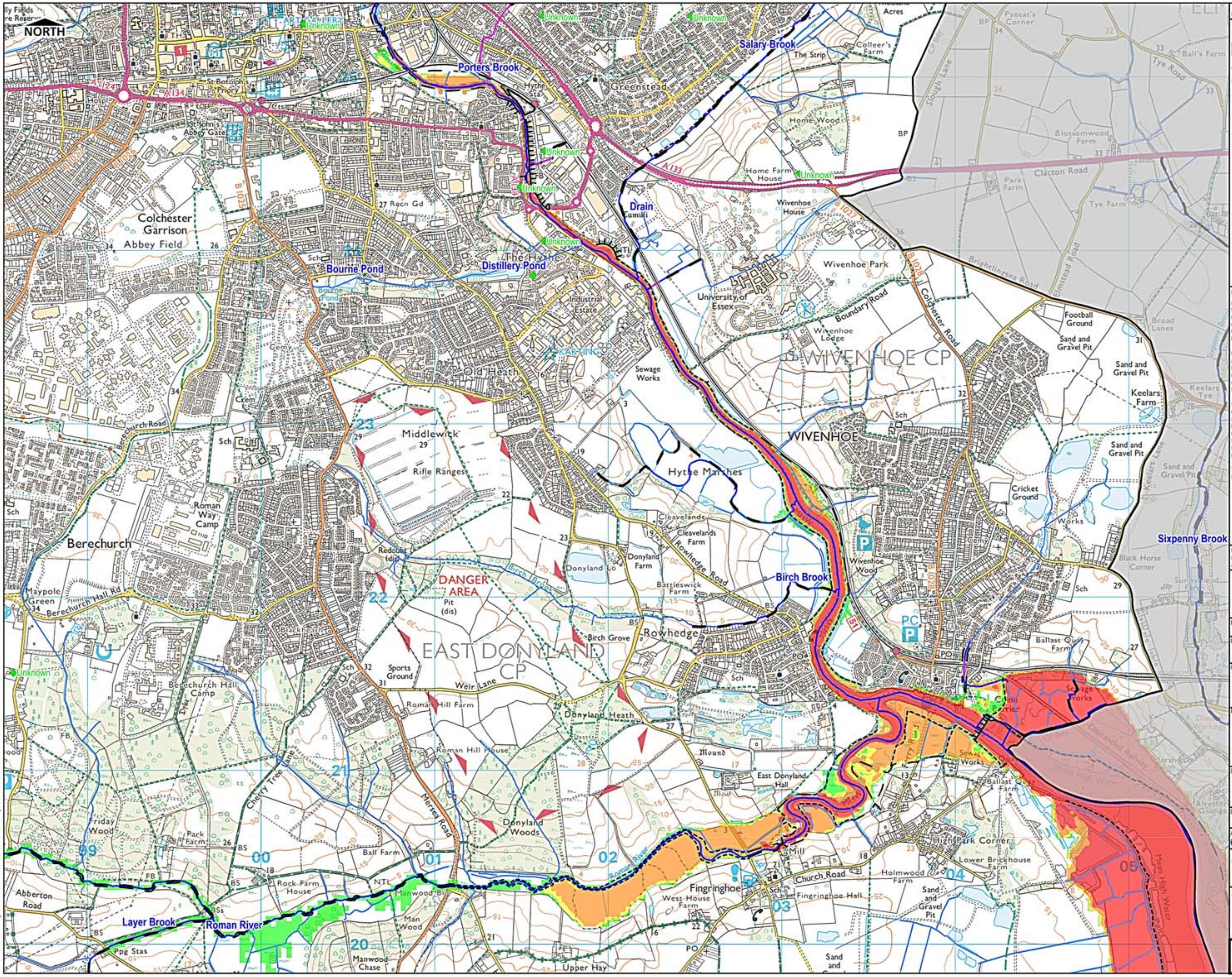

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LEGEND

Administrative Boundaries

Main River

Ordinary Watercourse

Flood Records (Essex County Council)

Hazard Rating

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Low Hazard

Moderate Hazard (Danger for Some)

Significant Hazard (Danger for Most)

Extreme Hazard (Danger for All)

Asset Information Management System - Defences

Embankment

High Ground

Flood Gate

Wall

Notes

As part of the Environment Agency national programme of coastal and fluvial modelling, a model of the Colne and Blackwater Estuary was developed in 2010 (CH2MHill). In the borough of Colchester, the model extent covers Mersea, Fingringhoe, the tidal part of the River Colne through Colchester upstream to Hythe Station, and the Roman River upstream to Layer de la Haye, (but not as far as Marks Tey).

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Flood hazard is a function of the flood depth and flow velocity as well as a debris factor. Each grid cell within the TUFLOW model domain has been assigned one of four hazard categories: 'Extreme Hazard', 'Significant Hazard', 'Moderate Hazard', and 'Low Hazard'. The derivation of these categories is based on Flood Risks to People FD2321 (Defra & Environment Agency, 2005), using the following equation:
Flood Hazard Rating = $((v+0.5)*D) + DF$
(Where v = velocity (m/s), D = depth (m) and DF = debris factor)

This map is intended to provide a strategic overview of flood risk and should not be used to assess flood risk for individual properties.

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE AND BLACKWATER ESTUARY MODEL MAXIMUM FLOOD HAZARD 0.5% AEP (200YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
60473444	1:20,000

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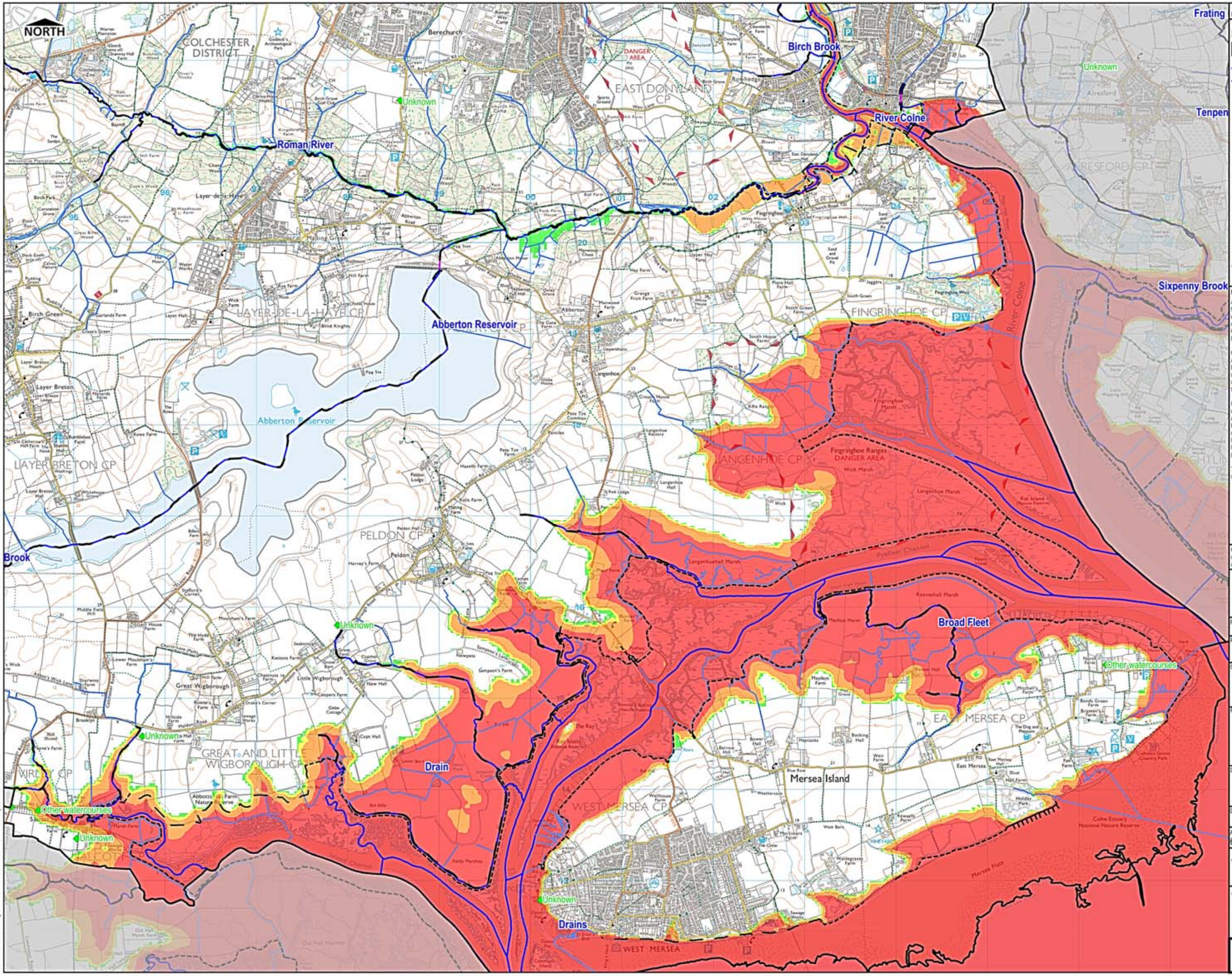
Drawing Number	Rev
FIGURE A6.1	1



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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Hazard Rating

Flood hazard is calculated as a function of the flood depth and flow velocity at a particular point in the floodplain, along with a suitable debris factor, and is based on the methodology from Flood Risks to People FD2320 (Defra and Environment Agency, 2005).

- Low Hazard
- Moderate Hazard (Danger for Some)
- Significant Hazard (Danger for Most)
- Extreme Hazard (Danger for All)

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

As part of the Environment Agency national programme of coastal and fluvial modelling, a model of the Colne and Blackwater Estuary was developed in 2010 (CH2MHill). In the borough of Colchester, the model extent covers Mersea, Fingringhoe, the tidal part of the River Colne through Colchester upstream to Hythe Station, and the Roman River upstream to Layer de la Haye, (but not as far as Marks Tey).

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE AND BLACKWATER ESTUARY MODEL MAXIMUM FLOOD HAZARD 0.5% AEP (200YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No. 60473444 | Scale at A3 1:20,000

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Drawing Number: FIGURE A6.2 | Rev: 1

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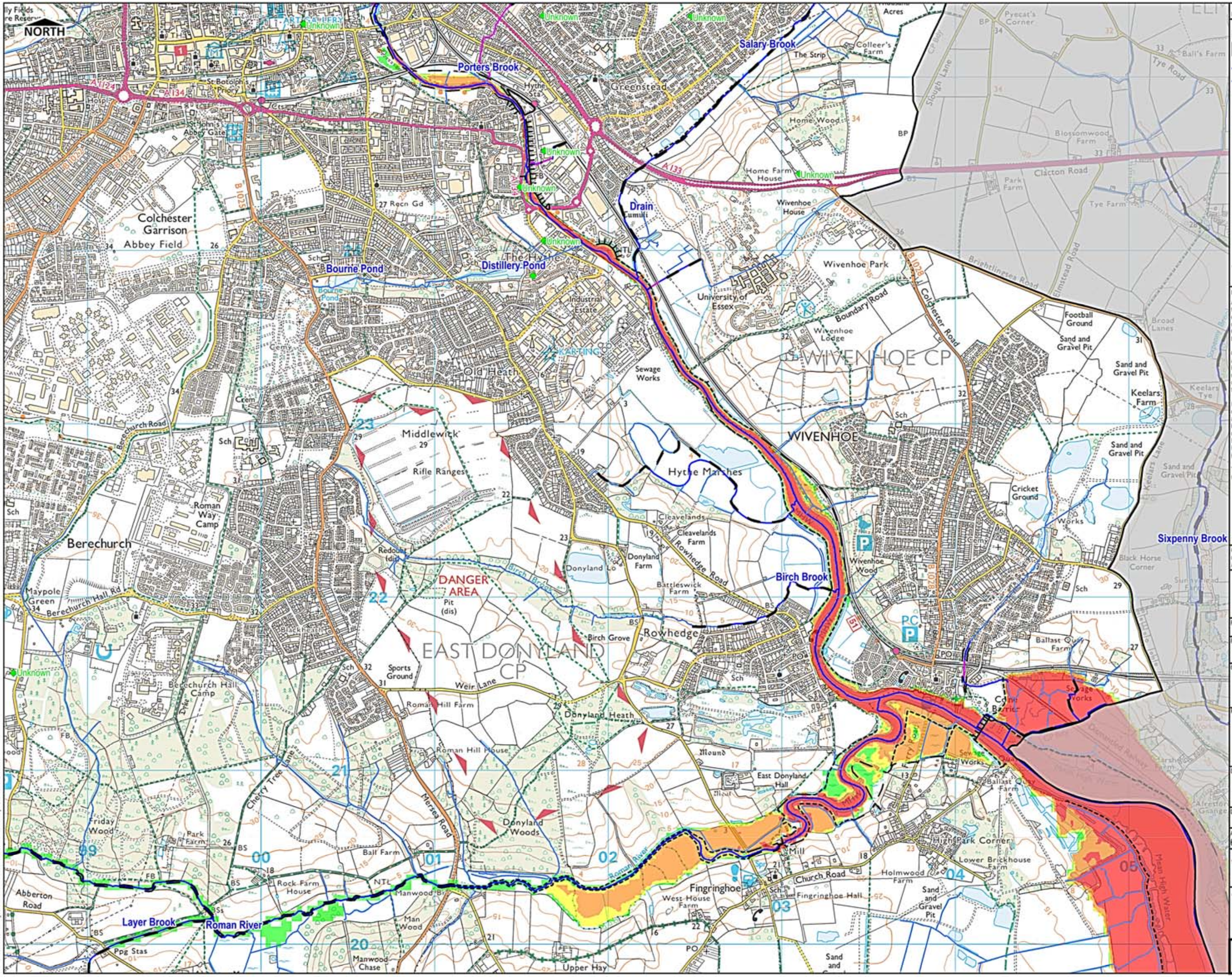

THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT

LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Hazard Rating

Flood hazard is calculated as a function of the flood depth and flow velocity at a particular point in the floodplain, along with a suitable debris factor, and is based on the methodology from Flood Risks to People FD2320 (Defra and Environment Agency, 2005).

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- Significant Hazard (Danger for Most)
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Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

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(Where v = velocity (m/s), D = depth (m) and DF = debris factor)

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE AND BLACKWATER ESTUARY MODEL MAXIMUM FLOOD HAZARD 0.1% AEP (1000YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
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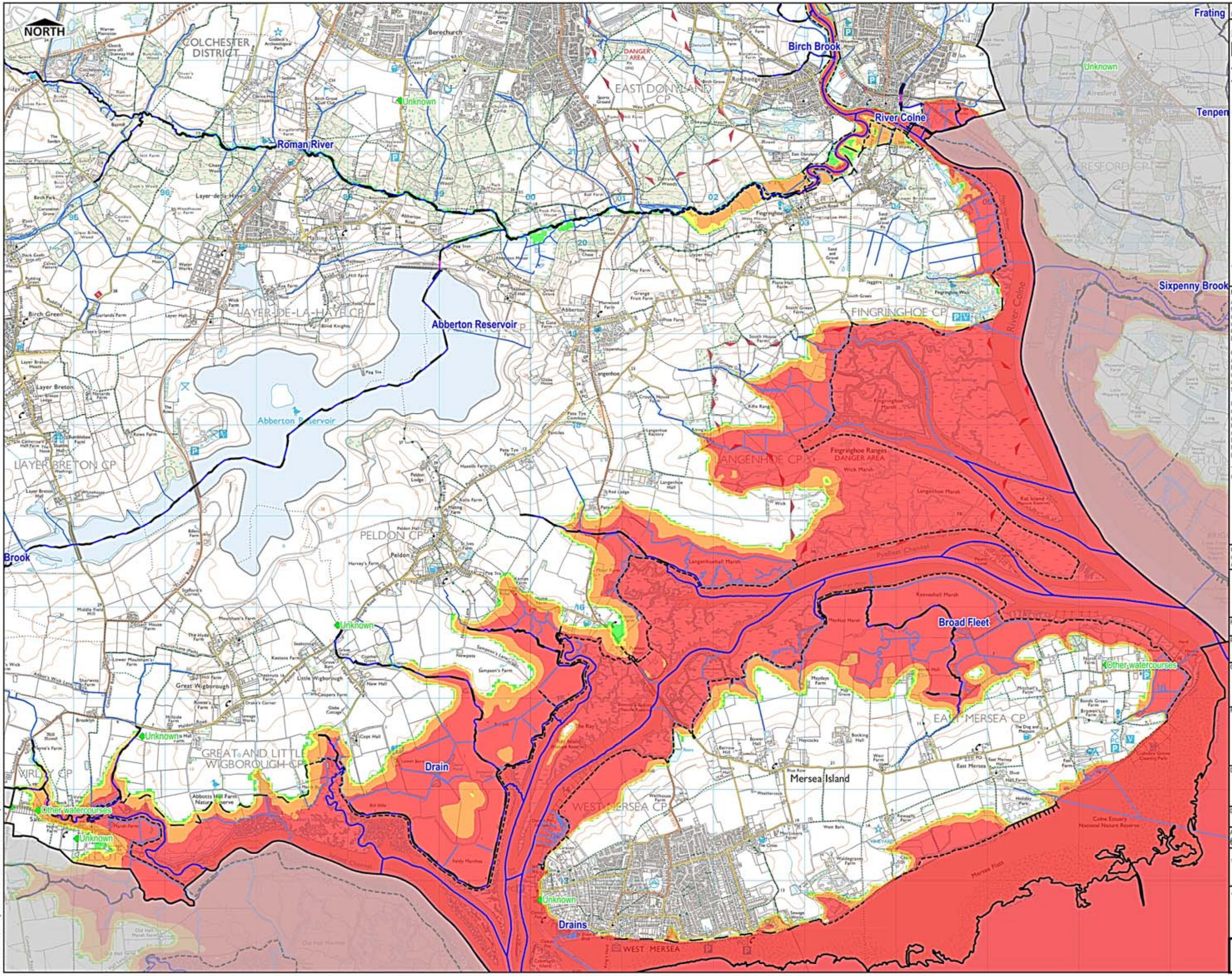
Drawing Number: FIGURE A7.1 — Rev 1



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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Hazard Rating

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- Significant Hazard (Danger for Most)
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Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
VERSION 1

Client
Colchester, the place to live, learn, work, and visit.

Project Title
COLCHESTER BOROUGH COUNCIL
STRATEGIC FLOOD
RISK ASSESSMENT

Drawing Title
COLNE AND BLACKWATER ESTUARY MODEL
MAXIMUM FLOOD HAZARD
0.1% AEP (1000YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
60473444	1:38,000

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Drawing Number	Rev
FIGURE A7.2	1

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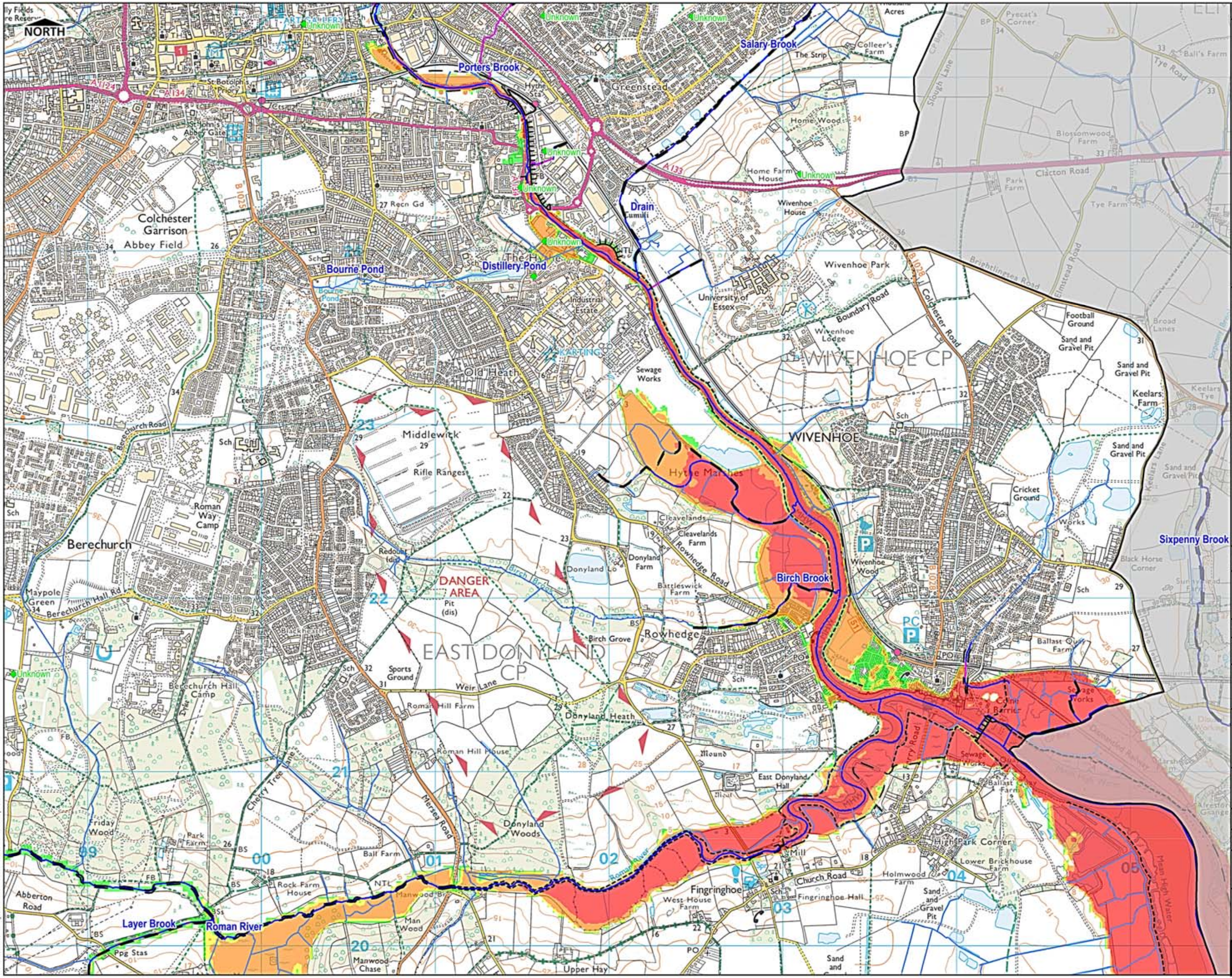

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LEGEND

Administrative Boundaries
Main River
Ordinary Watercourse
Flood Records (Essex County Council)

Hazard Rating

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Significant Hazard (Danger for Most)
Extreme Hazard (Danger for All)

Asset Information Management System - Defences

Embankment
High Ground
Flood Gate
Wall

Notes

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
VERSION 1

Client
Colchester, the place to live, learn, work, and visit.

Project Title
COLCHESTER BOROUGH COUNCIL
STRATEGIC FLOOD
RISK ASSESSMENT

Drawing Title
COLNE AND BLACKWATER ESTUARY MODEL
MAXIMUM FLOOD HAZARD
0.1% AEP (1000YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
60473444	1:20,000

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Drawing Number	Rev
FIGURE A8.1	1

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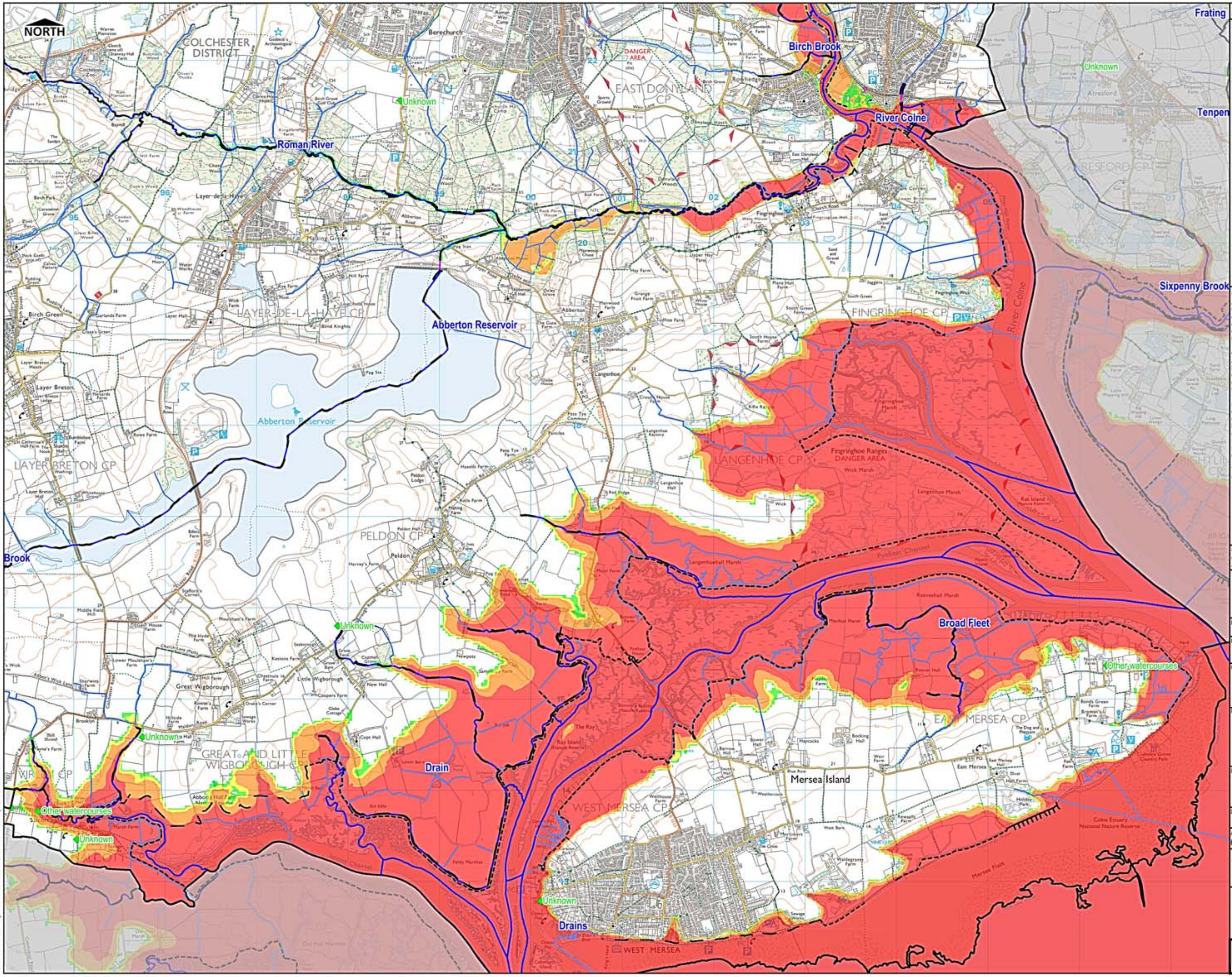

LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Hazard Rating

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- Significant Hazard (Danger for Most)
- Extreme Hazard (Danger for All)

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
VERSION 1

Client
Colchester, the place to live, learn, work, and visit.

Project Title
COLCHESTER BOROUGH COUNCIL
STRATEGIC FLOOD
RISK ASSESSMENT

Drawing Title
COLNE AND BLACKWATER ESTUARY MODEL
MAXIMUM FLOOD HAZARD
0.1% AEP (1000YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
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Drawing Number	Rev
FIGURE A8.2	1

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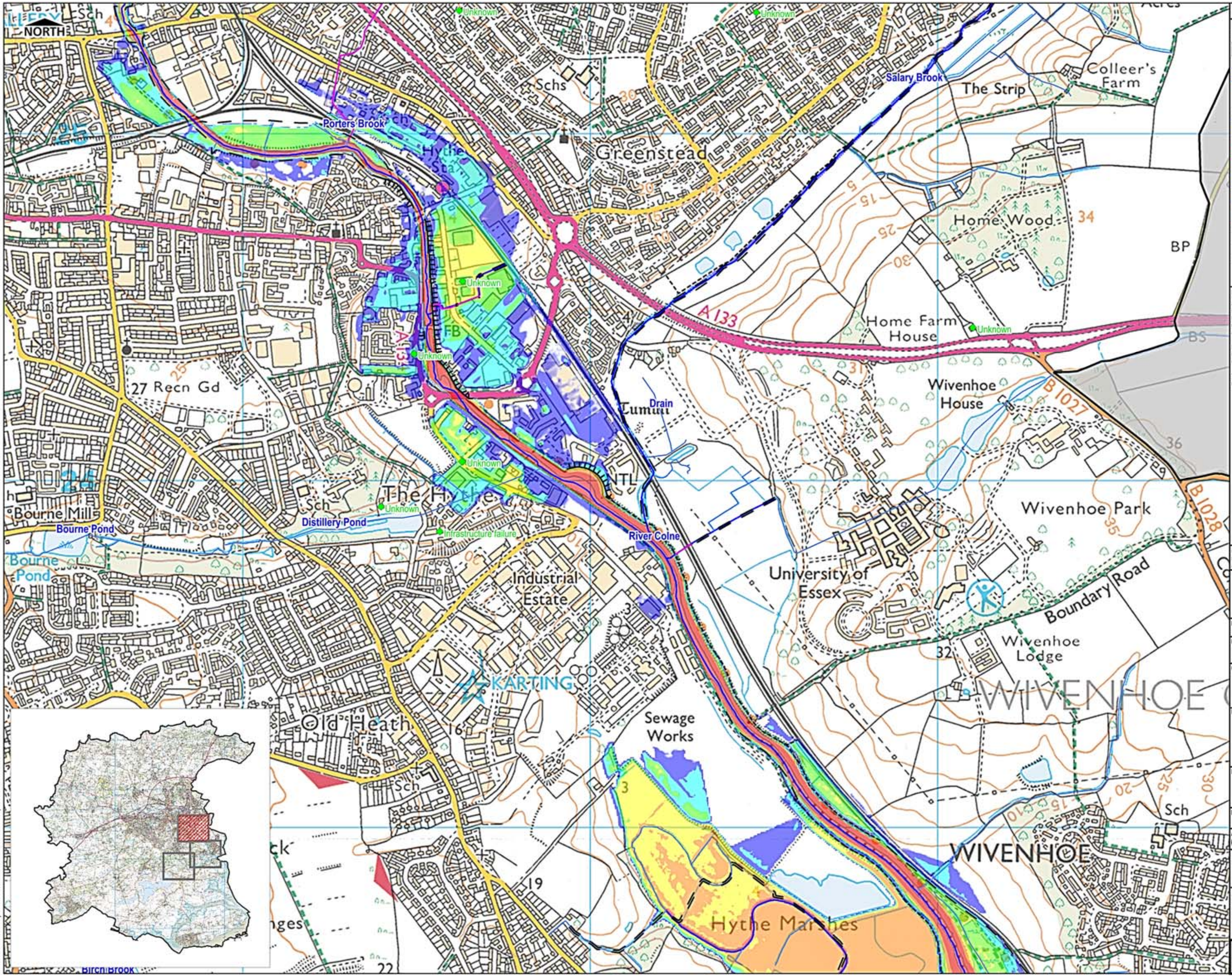

LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Maximum Flood Depth (m)

- 0.1 - 0.5m
- 0.5 - 1.0m
- 1.0 - 1.5m
- 1.5 - 2.0m
- 2.0 - 3.0m
- > 3.0m

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

As part of the update to the Level 2 Strategic Flood Risk Assessment (SFRA) for Colchester Borough Council (BC), revised modelling has been undertaken to provide an up to date assessment of the residual tidal flood risk to Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe. Details are provided in Appendix B.

Maximum flood depth mapping has been generated which shows the maximum depth of flooding experienced at each point in the floodplain throughout the entire model simulation.

This map is intended to provide a strategic overview of flood risk and should not be used to assess flood risk for individual properties.

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE BARRIER BREACH MODELLING MAXIMUM FLOOD DEPTH 0.5% AEP (200YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
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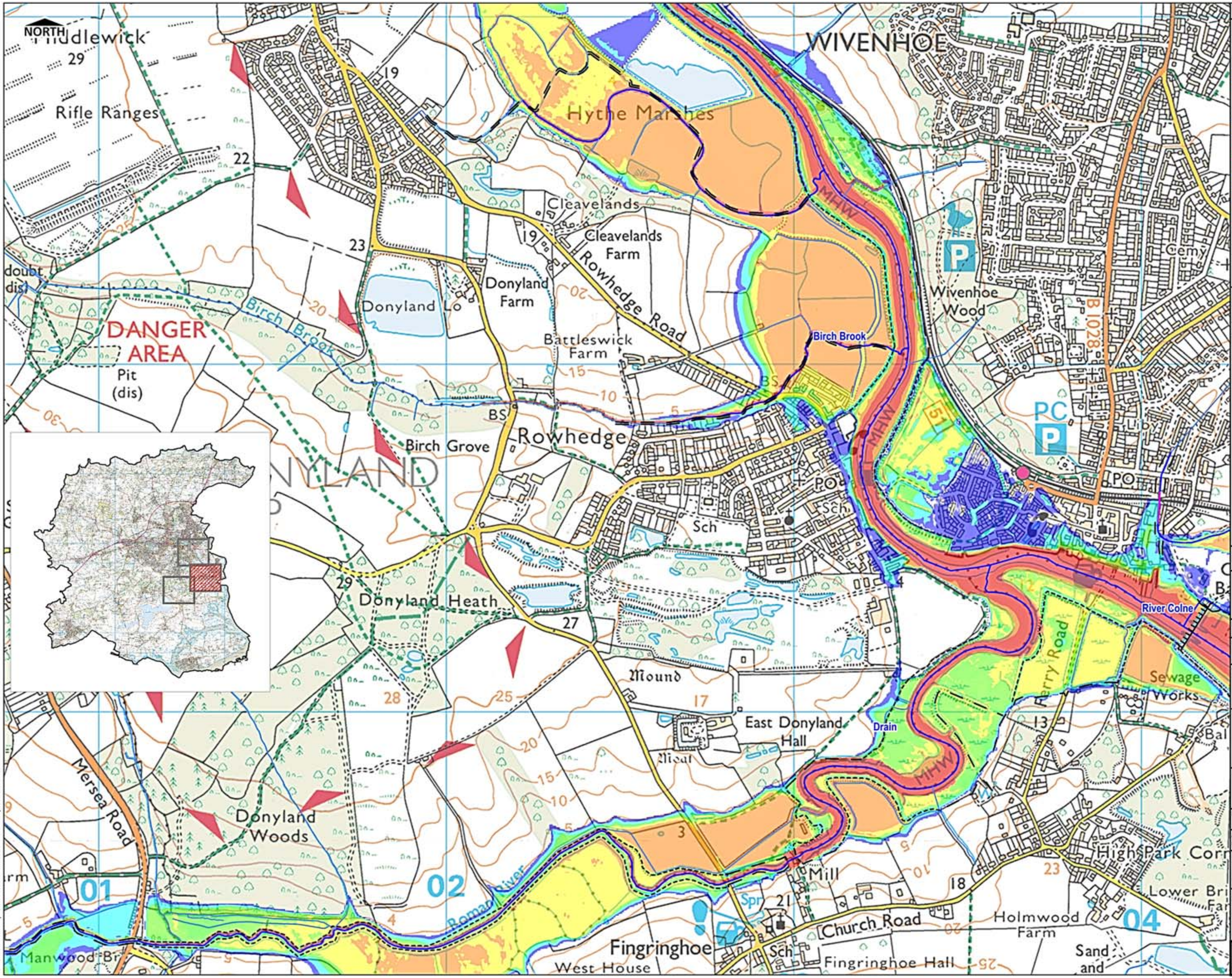
Drawing Number: FIGURE A9 | Rev: 1



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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Maximum Flood Depth (m)

- 0.1 - 0.5m
- 0.5 - 1.0m
- 1.0 - 1.5m
- 1.5 - 2.0m
- 2.0 - 3.0m
- > 3.0m

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

As part of the update to the Level 2 Strategic Flood Risk Assessment (SFRA) for Colchester Borough Council (BC), revised modelling has been undertaken to provide an up to date assessment of the residual tidal flood risk to Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe. Details are provided in Appendix B.

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE BARRIER BREACH MODELLING MAXIMUM FLOOD DEPTH 0.5% AEP (200YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
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Drawing Number	Rev
FIGURE A10	1

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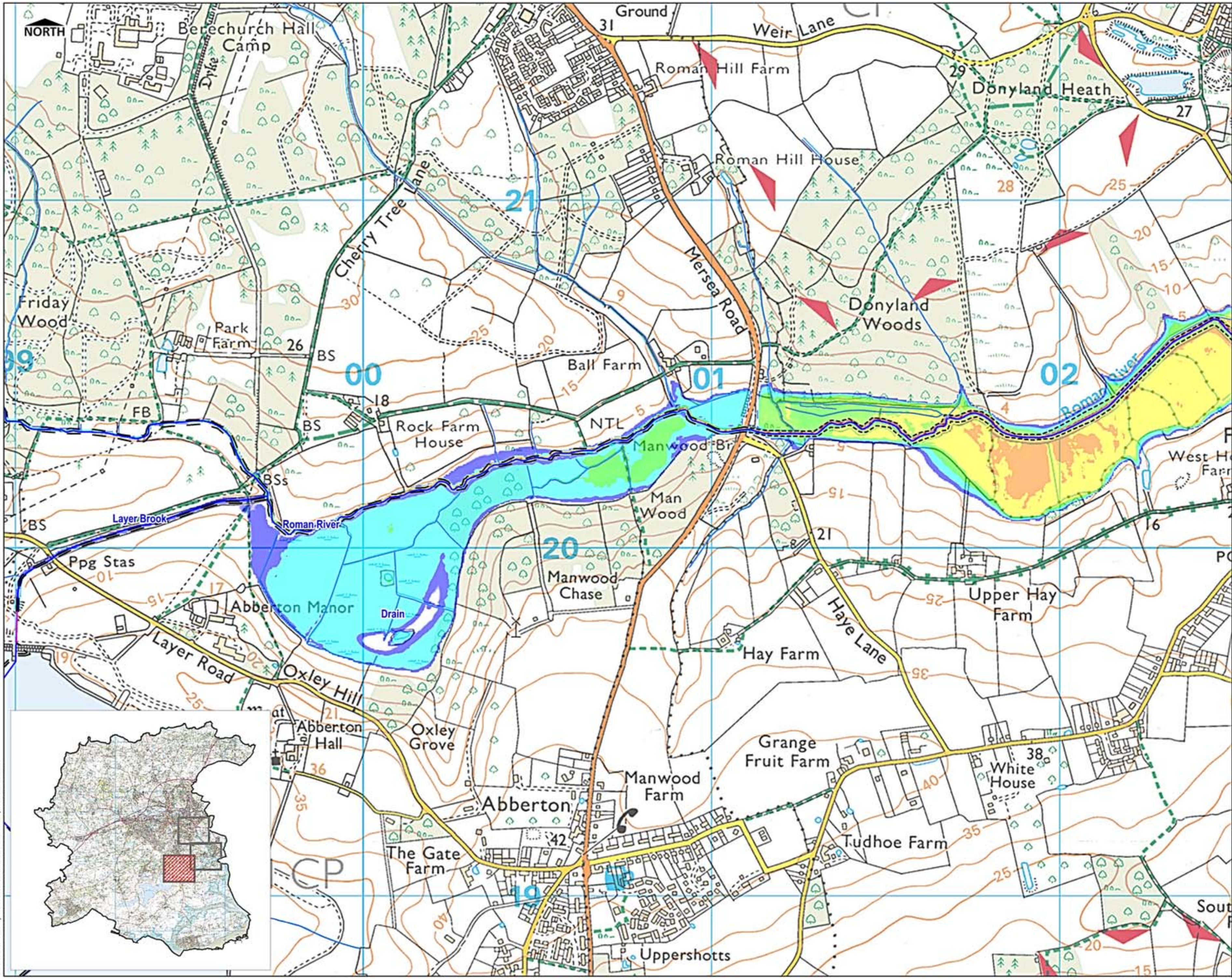

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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Maximum Flood Depth (m)

- 0.1 - 0.5m
- 0.5 - 1.0m
- 1.0 - 1.5m
- 1.5 - 2.0m
- 2.0 - 3.0m
- > 3.0m

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
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Notes

As part of the update to the Level 2 Strategic Flood Risk Assessment (SFRA) for Colchester Borough Council (BC), revised modelling has been undertaken to provide an up to date assessment of the residual tidal flood risk to Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe. Details are provided in Appendix B.

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE BARRIER BREACH MODELLING MAXIMUM FLOOD DEPTH 0.5% AEP (200YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.: 60473444

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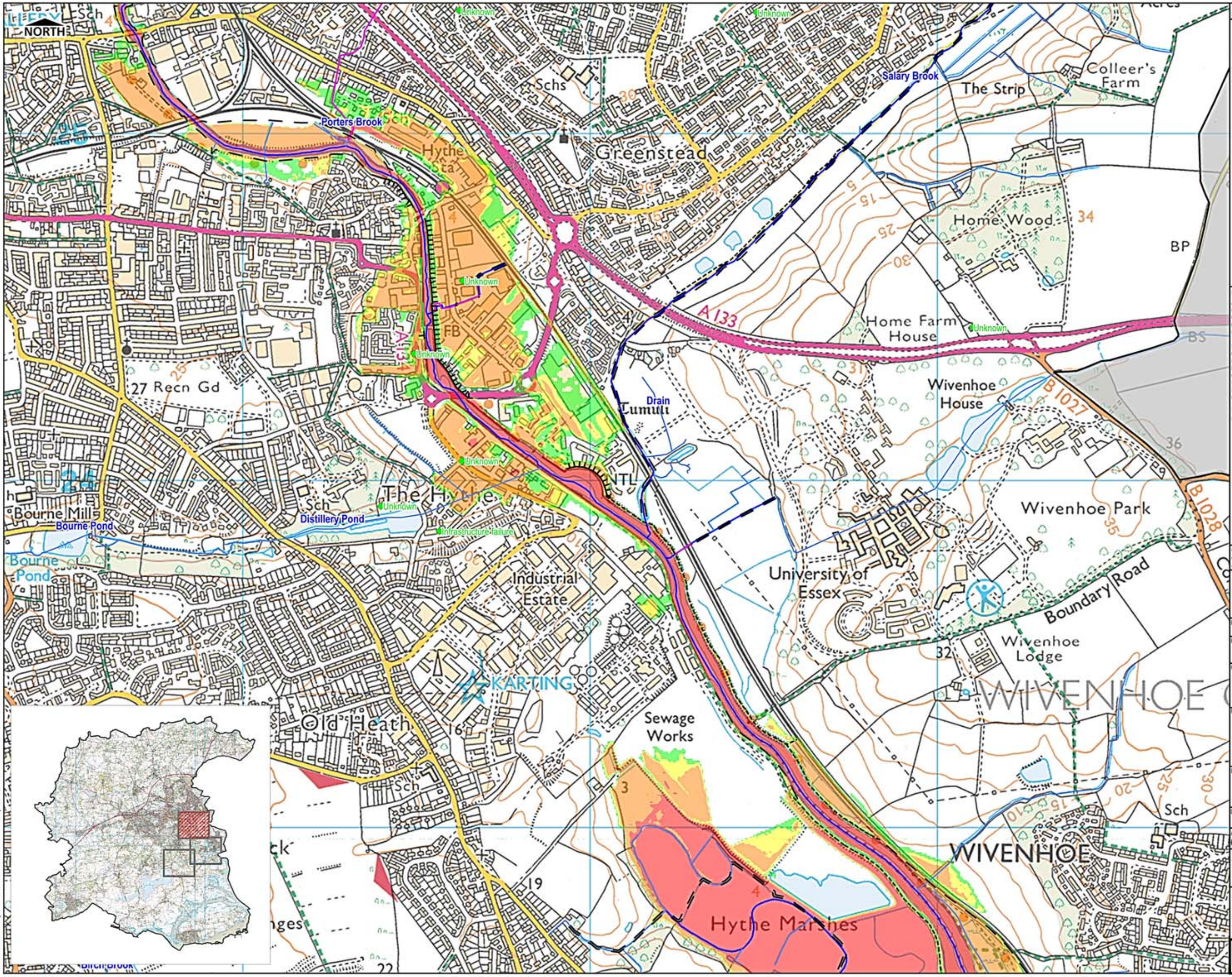
Drawing Number: FIGURE A11

Rev: 1



LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Hazard Rating

Flood hazard is calculated as a function of the flood depth and flow velocity at a particular point in the floodplain, along with a suitable debris factor, and is based on the methodology from Flood Risks to People FD2320 (Defra and Environment Agency, 2005).

- Low Hazard
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Asset Information Management System - Defences

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Notes

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
VERSION 1

Client
Colchester, the place to live, learn, work, and visit.

Project Title
COLCHESTER BOROUGH COUNCIL
STRATEGIC FLOOD
RISK ASSESSMENT

Drawing Title
COLNE BARRIER BREACH MODELLING
MAXIMUM FLOOD HAZARD
0.5% AEP (200YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
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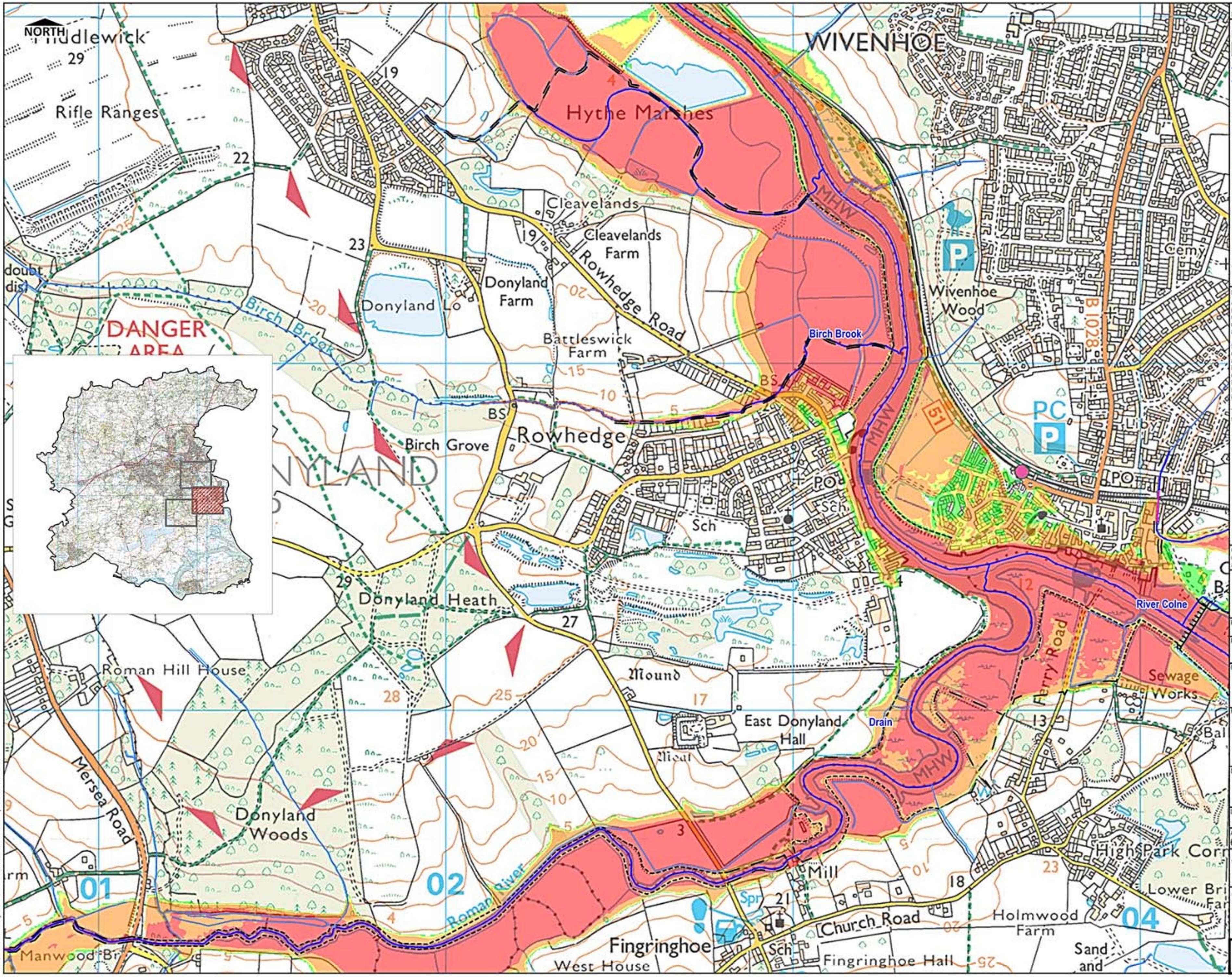
Drawing Number	Rev
FIGURE A12	1



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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Hazard Rating

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Notes

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Flood hazard is a function of the flood depth and flow velocity as well as a debris factor. Each grid cell within the TUFLOW model domain has been assigned one of four hazard categories: 'Extreme Hazard', 'Significant Hazard', 'Moderate Hazard', and 'Low Hazard'. The derivation of these categories is based on Flood Risks to People FD2321 (Defra & Environment Agency, 2005), using the following equation:
Flood Hazard Rating = $((v+0.5)*D) + DF$
(Where v = velocity (m/s), D = depth (m) and DF = debris factor)

This map is intended to provide a strategic overview of flood risk and should not be used to assess flood risk for individual properties.

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE BARRIER BREACH MODELLING MAXIMUM FLOOD HAZARD 0.5% AEP (200YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
60473444	1:10,000

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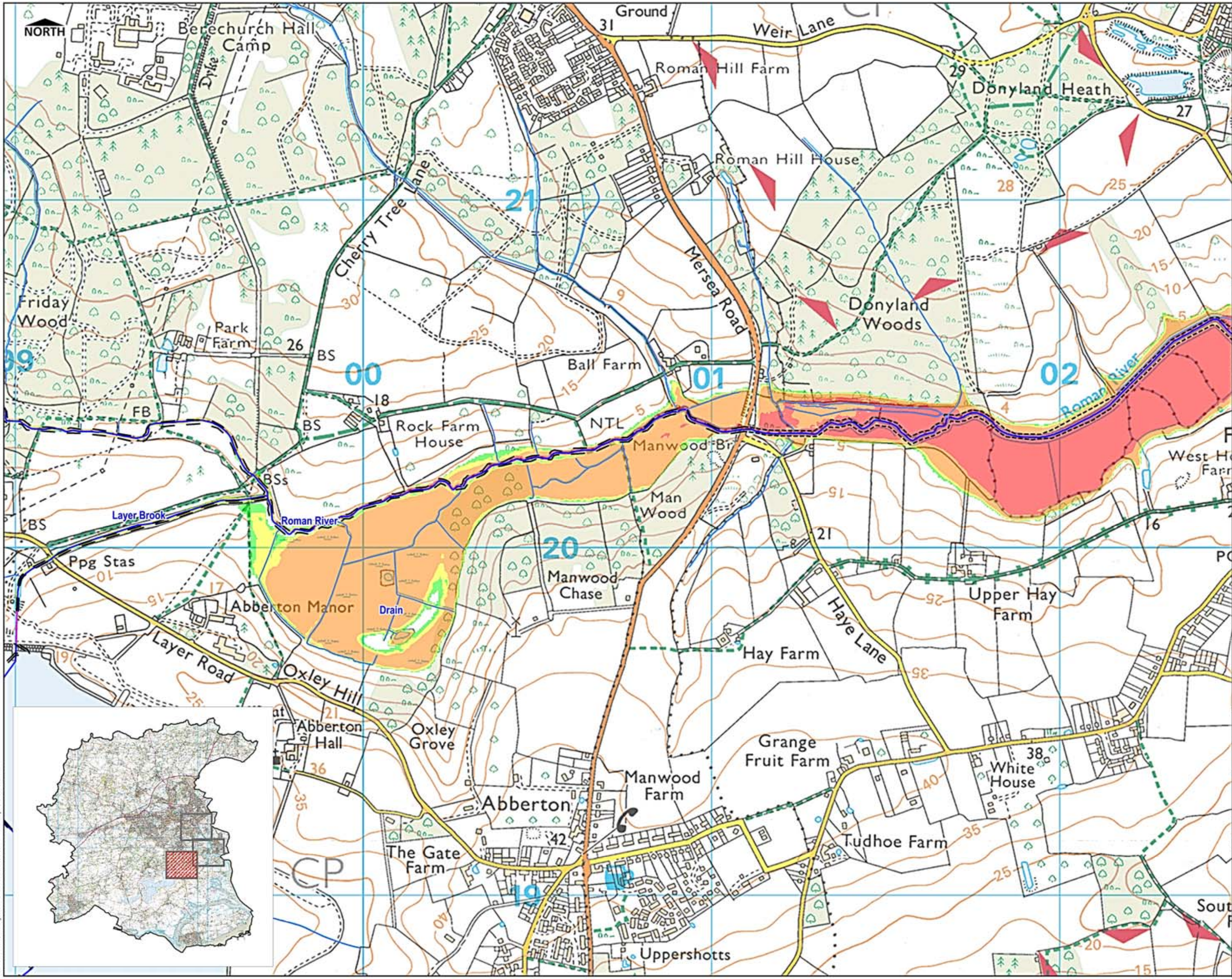
FIGURE A13	1



LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Hazard Rating

Flood hazard is calculated as a function of the flood depth and flow velocity at a particular point in the floodplain, along with a suitable debris factor, and is based on the methodology from Flood Risks to People FD2320 (Defra and Environment Agency, 2005).

- Low Hazard
- Moderate Hazard (Danger for Some)
- Significant Hazard (Danger for Most)
- Extreme Hazard (Danger for All)

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

As part of the update to the Level 2 Strategic Flood Risk Assessment (SFRA) for Colchester Borough Council (BC), revised modelling has been undertaken to provide an up to date assessment of the residual tidal flood risk to Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe. Details are provided in Appendix B.

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(Where v = velocity (m/s), D = depth (m) and DF = debris factor)

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE BARRIER BREACH MODELLING MAXIMUM FLOOD HAZARD 0.5% AEP (200YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

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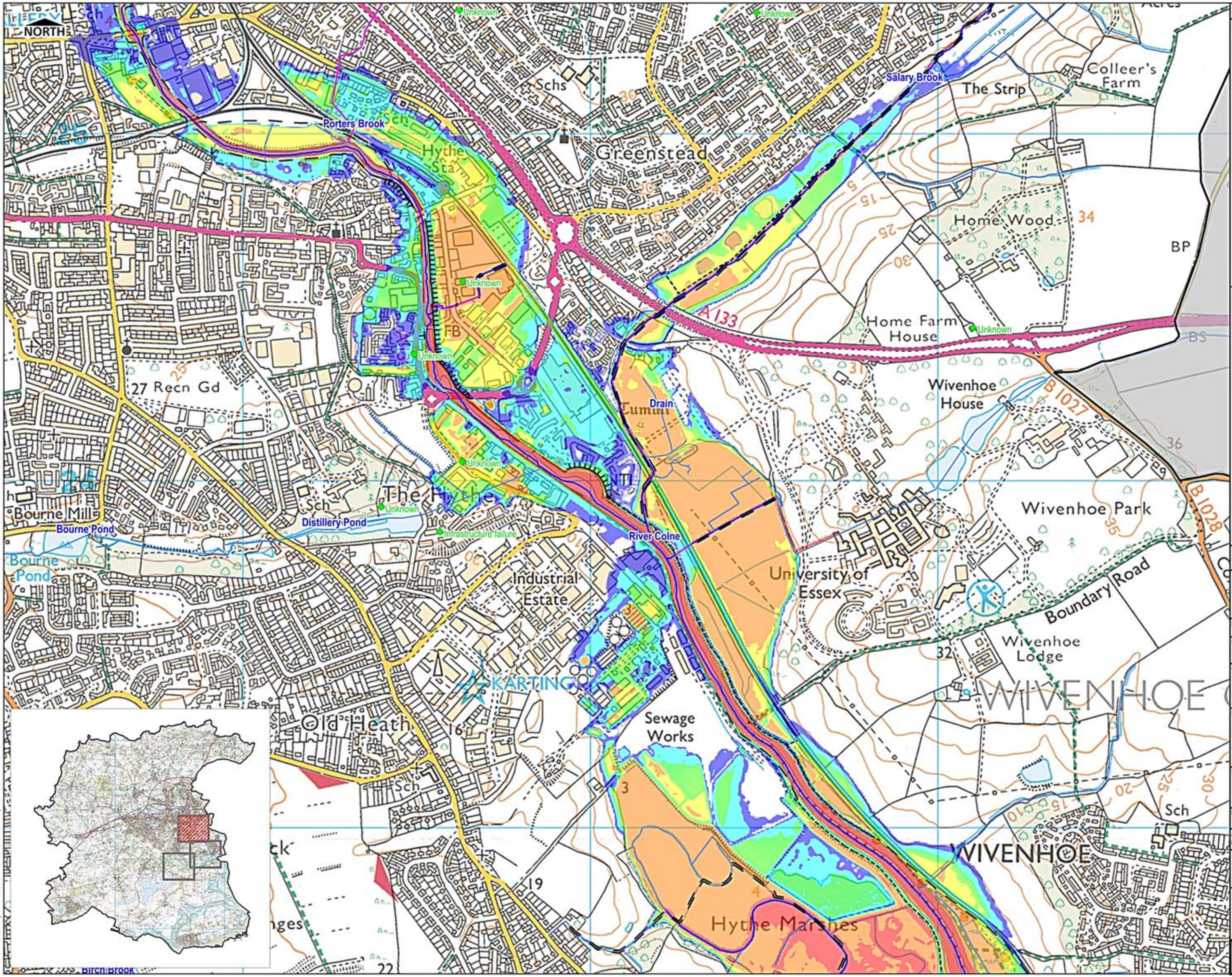
Drawing Number	Rev
FIGURE A14	1



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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Maximum Flood Depth (m)

- 0.1 - 0.5m
- 0.5 - 1.0m
- 1.0 - 1.5m
- 1.5 - 2.0m
- 2.0 - 3.0m
- > 3.0m

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

As part of the update to the Level 2 Strategic Flood Risk Assessment (SFRA) for Colchester Borough Council (BC), revised modelling has been undertaken to provide an up to date assessment of the residual tidal flood risk to Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe. Details are provided in Appendix B.

Maximum flood depth mapping has been generated which shows the maximum depth of flooding experienced at each point in the floodplain throughout the entire model simulation.

This map is intended to provide a strategic overview of flood risk and should not be used to assess flood risk for individual properties.

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE BARRIER BREACH MODELLING MAXIMUM FLOOD DEPTH 0.5% AEP (200YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
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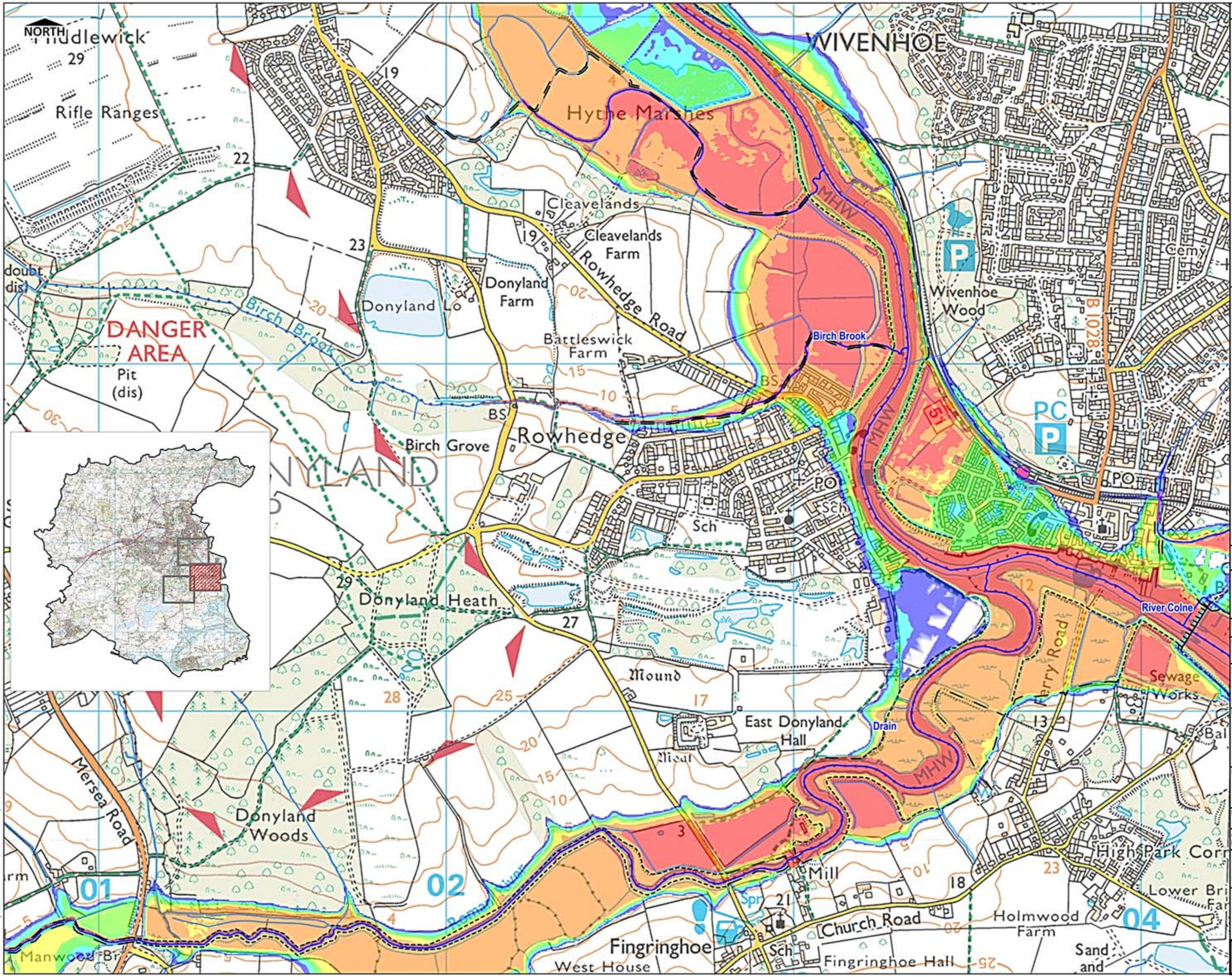
Drawing Number	Rev
FIGURE A15	1



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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Maximum Flood Depth (m)

- 0.1 - 0.5m
- 0.5 - 1.0m
- 1.0 - 1.5m
- 1.5 - 2.0m
- 2.0 - 3.0m
- > 3.0m

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

As part of the update to the Level 2 Strategic Flood Risk Assessment (SFRA) for Colchester Borough Council (BC), revised modelling has been undertaken to provide an up to date assessment of the residual tidal flood risk to Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe. Details are provided in Appendix B.

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE BARRIER BREACH MODELLING MAXIMUM FLOOD DEPTH 0.5% AEP (200YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
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Drawing Number	Rev
FIGURE A16	1

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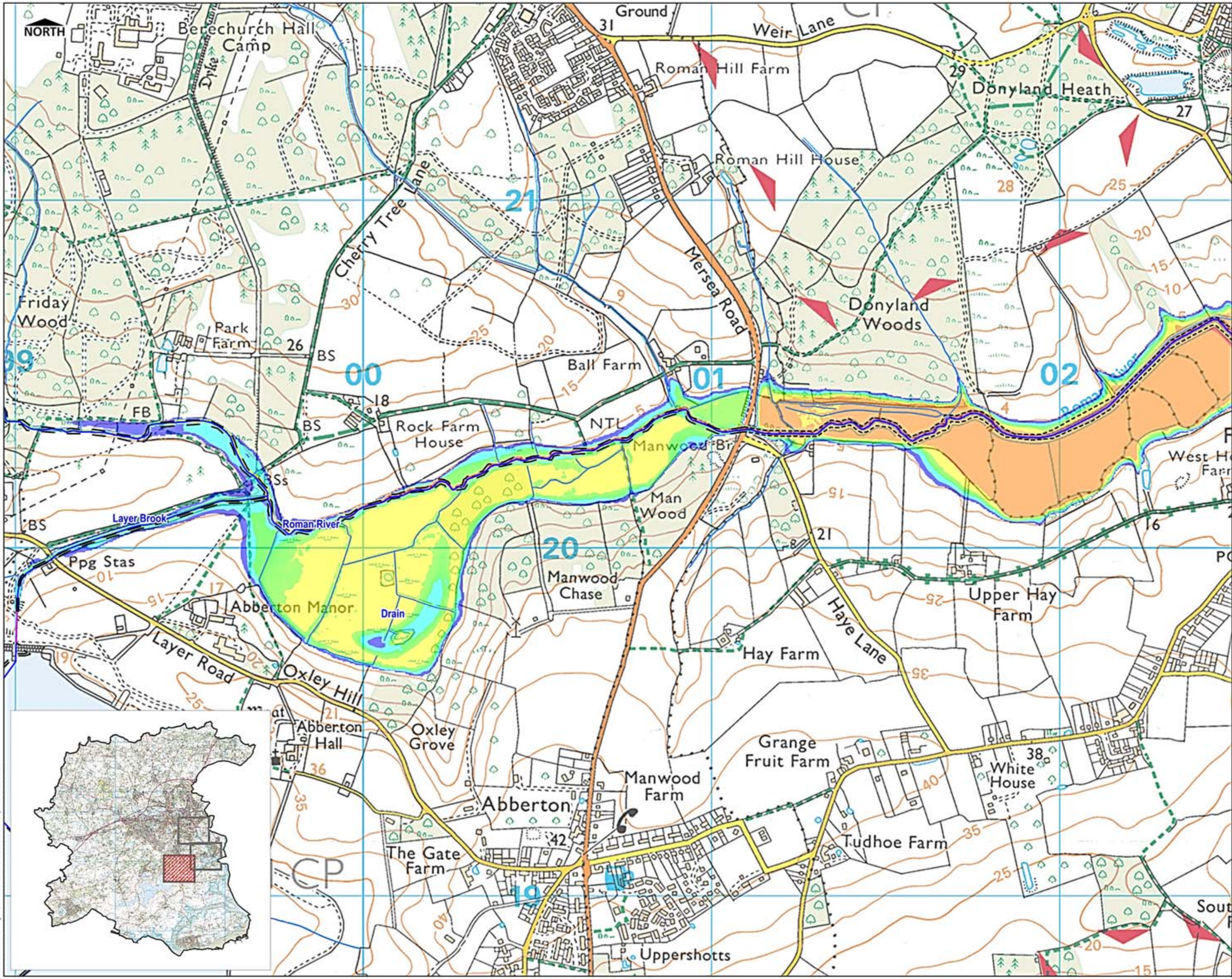

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LEGEND

Administrative Boundaries
Main River
Ordinary Watercourse
Flood Records (Essex County Council)

Maximum Flood Depth (m)

0.1 - 0.5m
0.5 - 1.0m
1.0 - 1.5m
1.5 - 2.0m
2.0 - 3.0m
> 3.0m

Asset Information Management System - Defences

Embankment
High Ground
Flood Gate
Wall

Notes

As part of the update to the Level 2 Strategic Flood Risk Assessment (SFRA) for Colchester Borough Council (BC), revised modelling has been undertaken to provide an up to date assessment of the residual tidal flood risk to Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe. Details are provided in Appendix B.

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
VERSION 1

Client
Colchester, the place to live, learn, work, and visit.

Project Title
COLCHESTER BOROUGH COUNCIL
STRATEGIC FLOOD
RISK ASSESSMENT

Drawing Title
COLNE BARRIER BREACH MODELLING
MAXIMUM FLOOD DEPTH
0.5% AEP (200YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

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Drawing Number: FIGURE A17
Rev: 1

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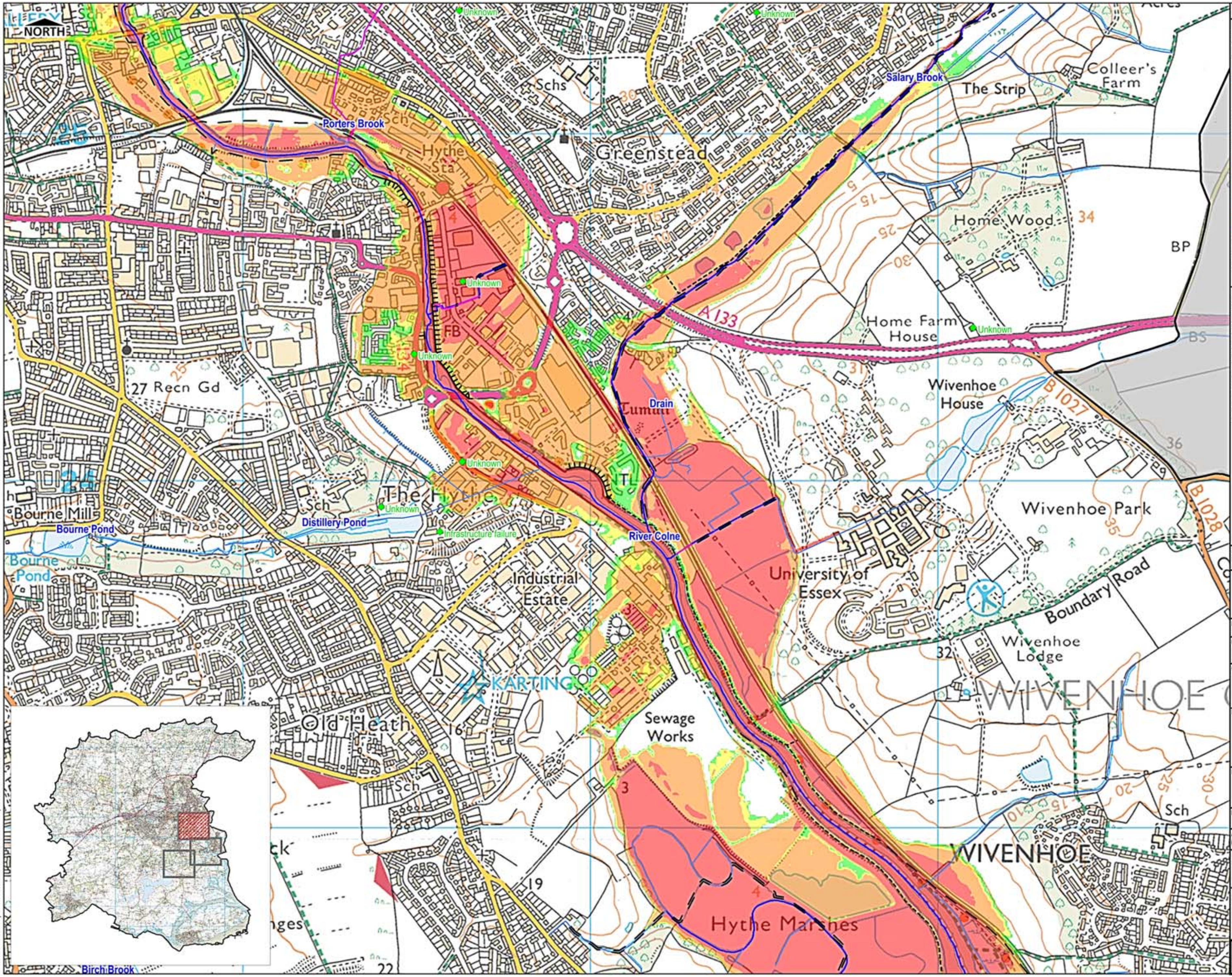

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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Hazard Rating

Flood hazard is calculated as a function of the flood depth and flow velocity at a particular point in the floodplain, along with a suitable debris factor, and is based on the methodology from Flood Risks to People FD2320 (Defra and Environment Agency, 2005).

- Low Hazard
- Moderate Hazard (Danger for Some)
- Significant Hazard (Danger for Most)
- Extreme Hazard (Danger for All)

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

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This map is intended to provide a strategic overview of flood risk and should not be used to assess flood risk for individual properties.

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
VERSION 1

Client
Colchester, the place to live, learn, work, and visit.

Project Title
COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title
COLNE BARRIER BREACH MODELLING
MAXIMUM FLOOD HAZARD
0.5% AEP (200YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
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FIGURE A18

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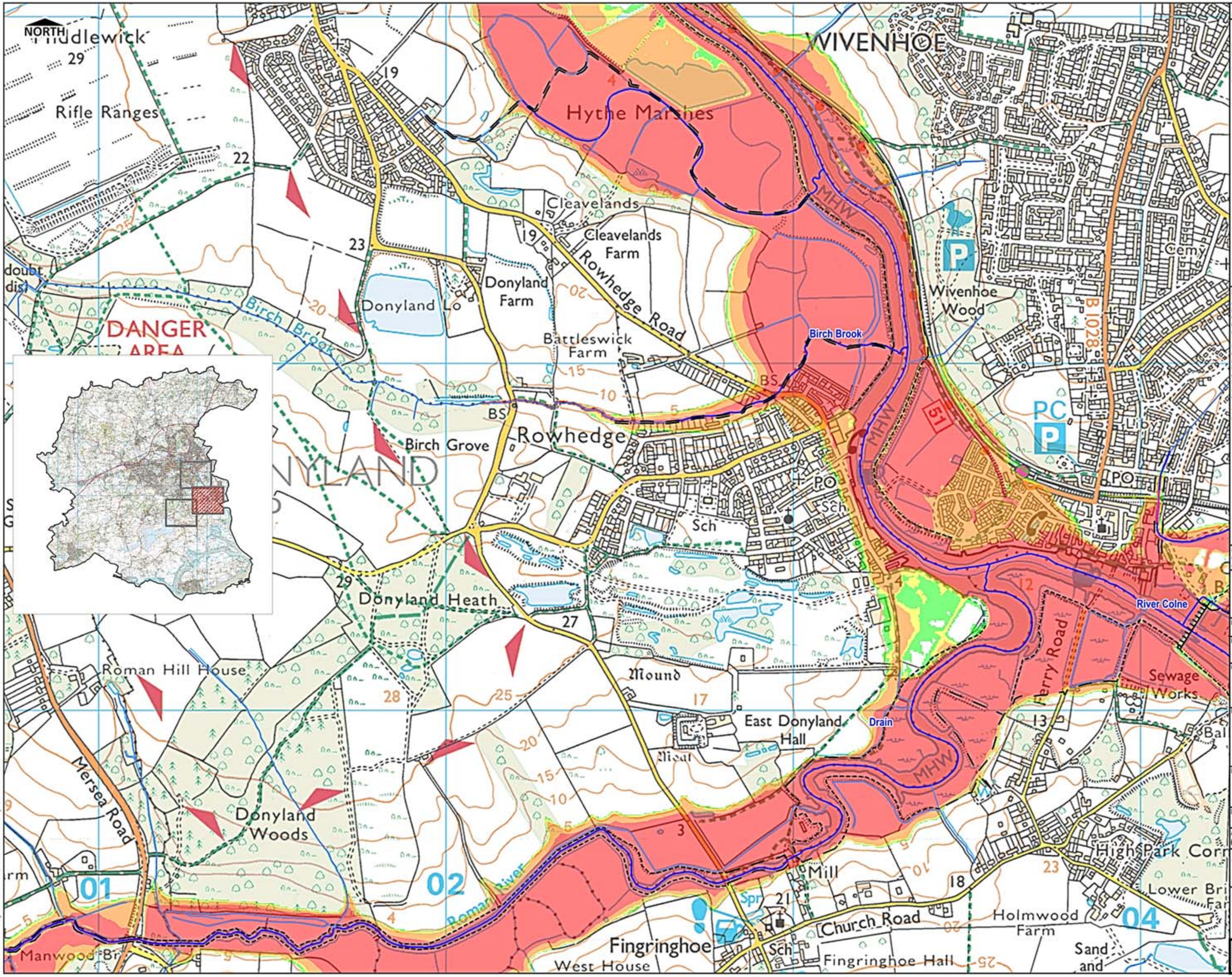
1



LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Hazard Rating

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Asset Information Management System - Defences

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
VERSION 1

Client
Colchester, the place to live, learn, work, and visit.

Project Title
COLCHESTER BOROUGH COUNCIL
STRATEGIC FLOOD
RISK ASSESSMENT

Drawing Title
COLNE BARRIER BREACH MODELLING
MAXIMUM FLOOD HAZARD
0.5% AEP (200YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
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Drawing Number
FIGURE A19

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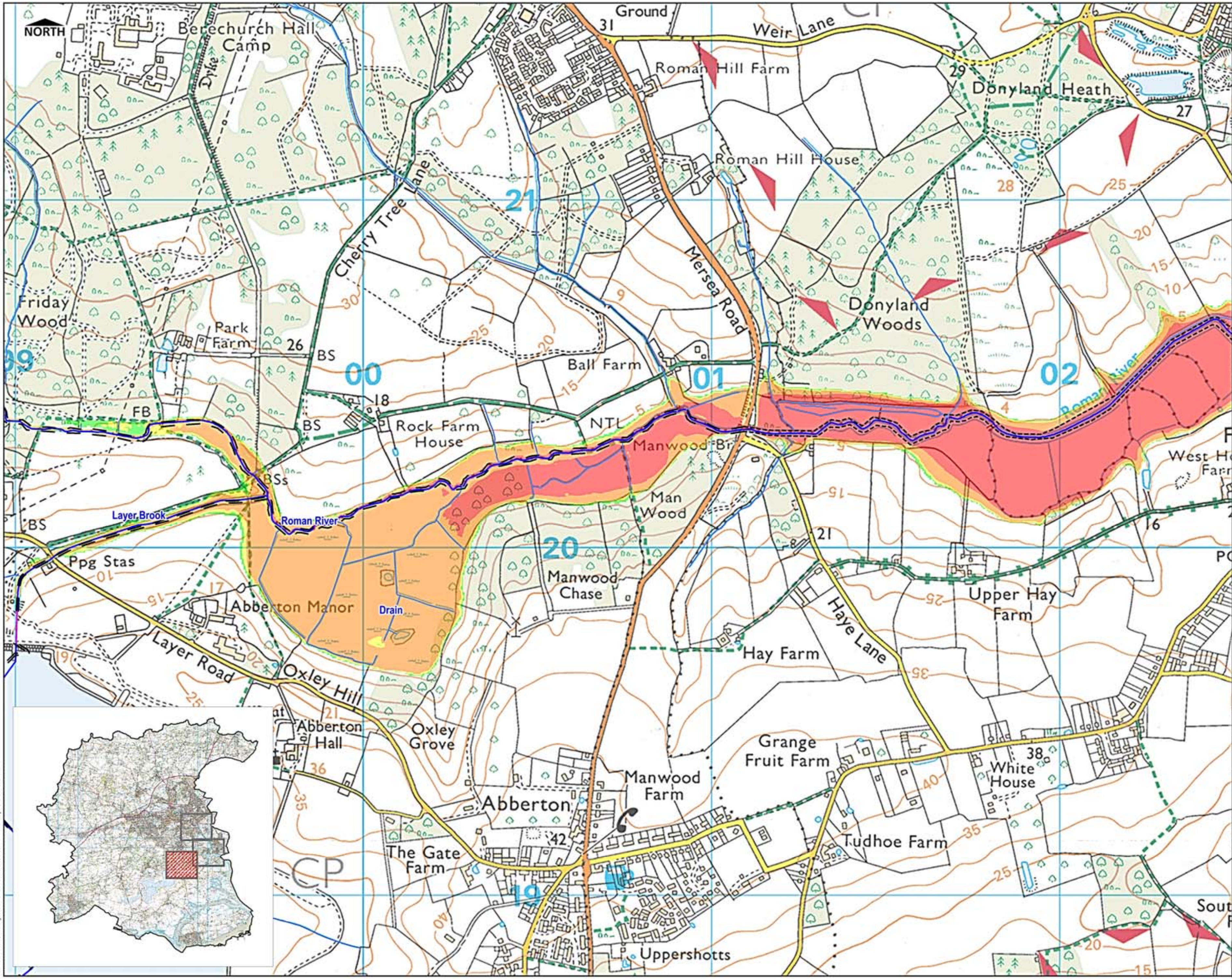

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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Hazard Rating

Flood hazard is calculated as a function of the flood depth and flow velocity at a particular point in the floodplain, along with a suitable debris factor, and is based on the methodology from Flood Risks to People FD2320 (Defra and Environment Agency, 2005).

- Low Hazard
- Moderate Hazard (Danger for Some)
- Significant Hazard (Danger for Most)
- Extreme Hazard (Danger for All)

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
VERSION 1

Client
Colchester, the place to live, learn, work, and visit.

Project Title
COLCHESTER BOROUGH COUNCIL
STRATEGIC FLOOD
RISK ASSESSMENT

Drawing Title
COLNE BARRIER BREACH MODELLING
MAXIMUM FLOOD HAZARD
0.5% AEP (200YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
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Drawing Number	Rev
FIGURE A20	1

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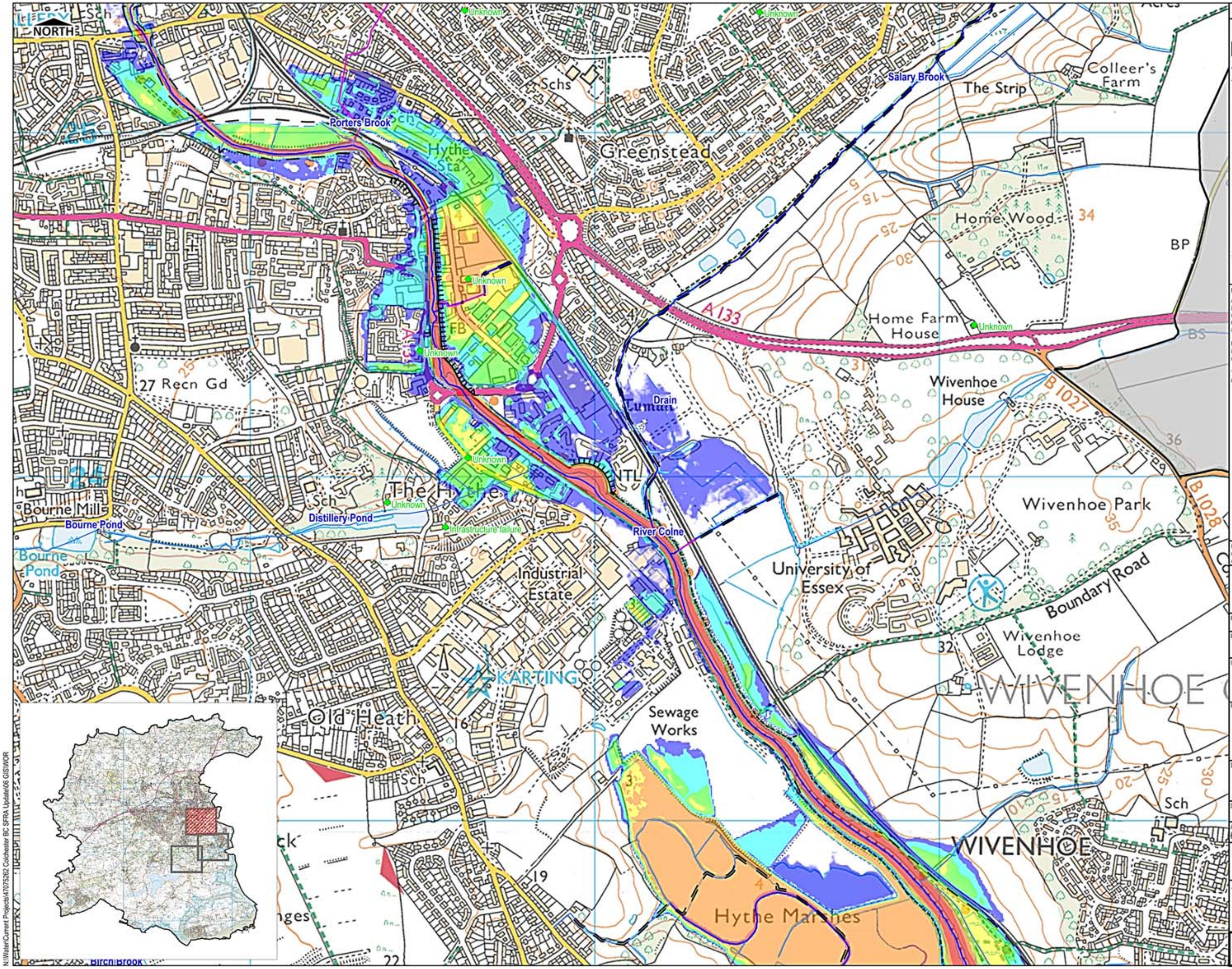

LEGEND

Administrative Boundaries
Main River
Ordinary Watercourse
Flood Records (Essex County Council)

Maximum Flood Depth (m)

0.1 - 0.5m
0.5 - 1.0m
1.0 - 1.5m
1.5 - 2.0m
2.0 - 3.0m
> 3.0m

Asset Information Management System - Defences

Embankment
High Ground
Flood Gate
Wall

Notes

As part of the update to the Level 2 Strategic Flood Risk Assessment (SFRA) for Colchester Borough Council (BC), revised modelling has been undertaken to provide an up to date assessment of the residual tidal flood risk to Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe. Details are provided in Appendix B.

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
VERSION 1

Client
Colchester, the place to live, learn, work, and visit.

Project Title
COLCHESTER BOROUGH COUNCIL
STRATEGIC FLOOD
RISK ASSESSMENT

Drawing Title
COLNE BARRIER BREACH MODELLING
MAXIMUM FLOOD DEPTH
0.1% AEP (1000YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
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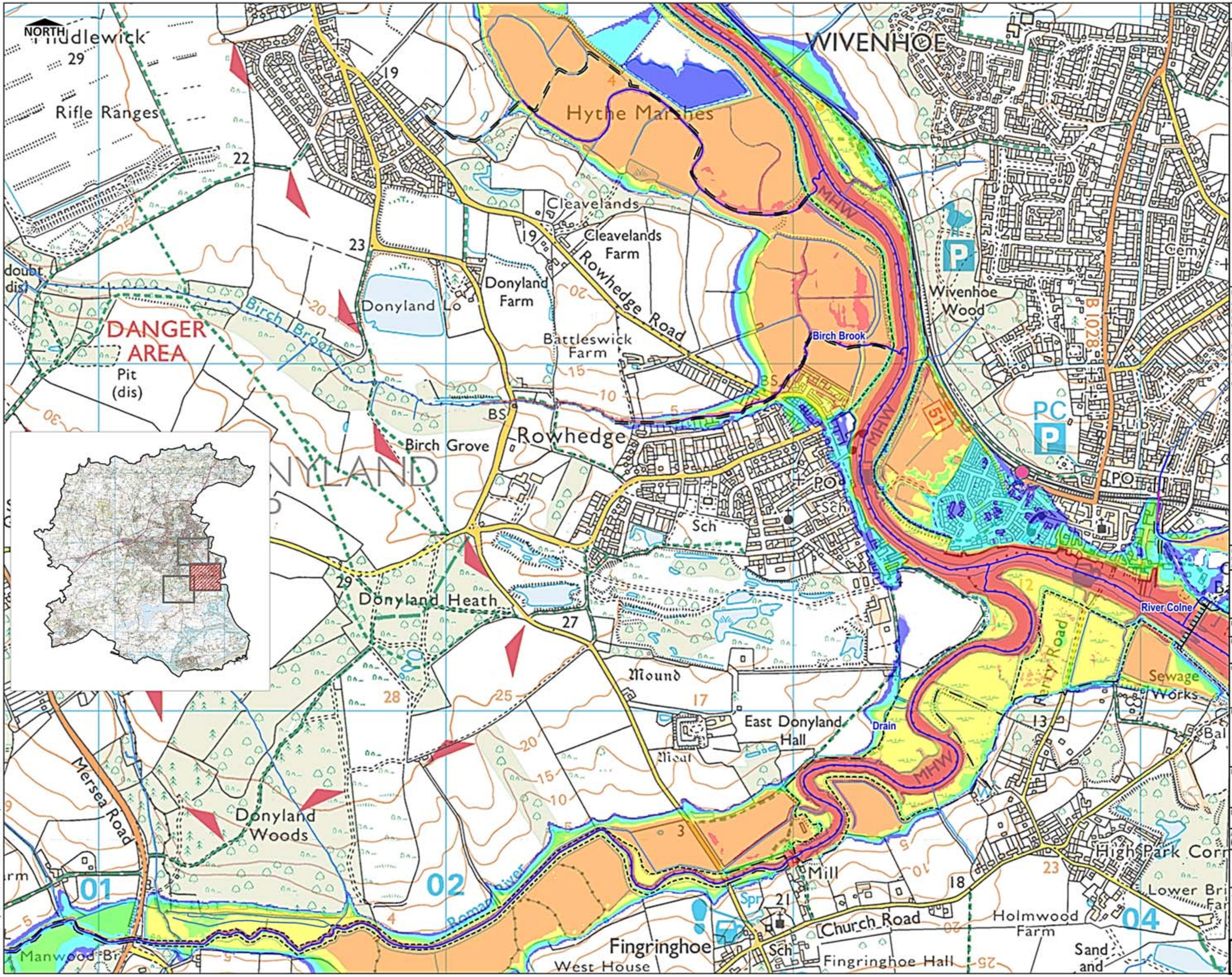
Rev: 1



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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Maximum Flood Depth (m)

- 0.1 - 0.5m
- 0.5 - 1.0m
- 1.0 - 1.5m
- 1.5 - 2.0m
- 2.0 - 3.0m
- > 3.0m

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE BARRIER BREACH MODELLING MAXIMUM FLOOD DEPTH 0.1% AEP (1000YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
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FIGURE A22	1

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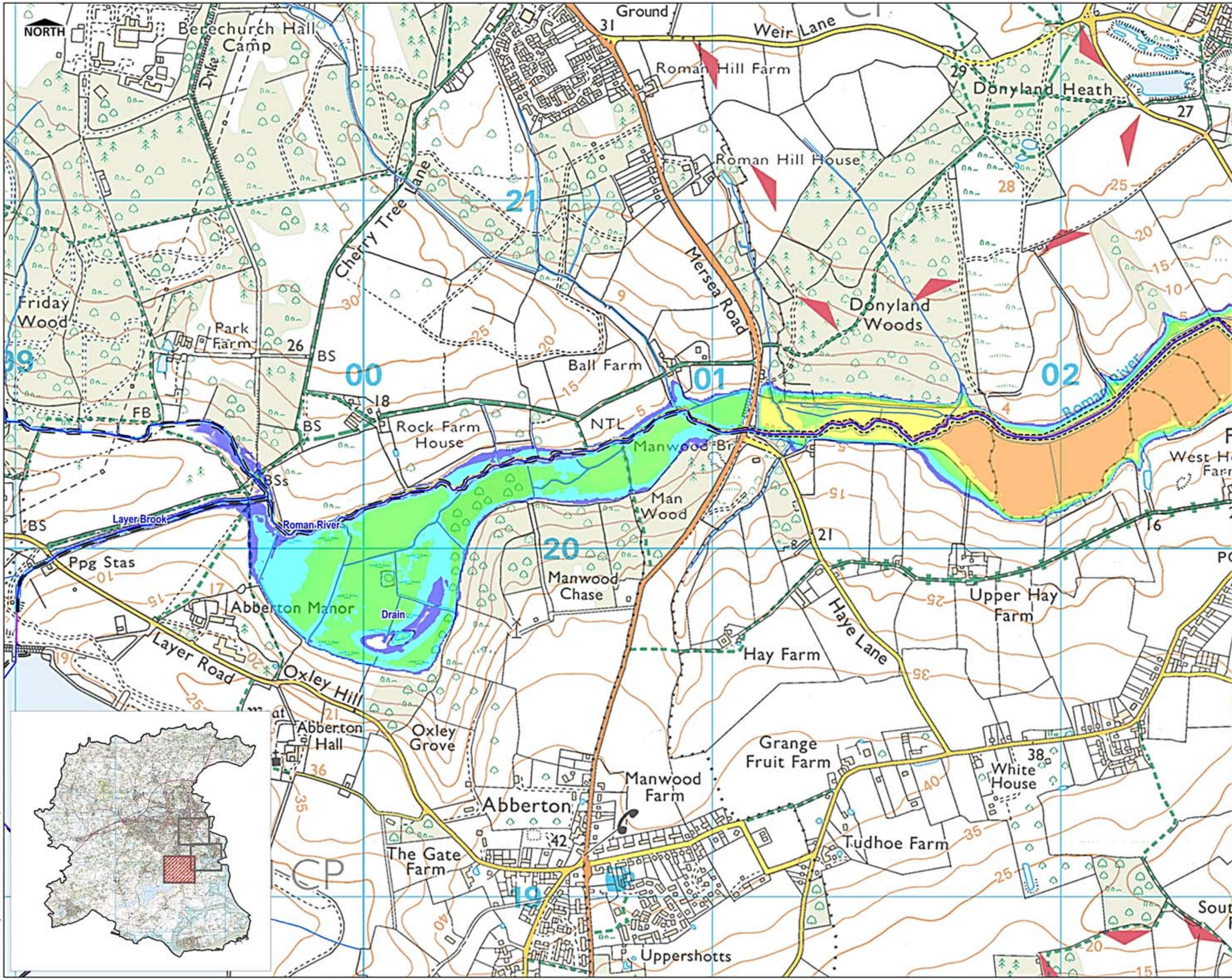

LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Maximum Flood Depth (m)

- 0.1 - 0.5m
- 0.5 - 1.0m
- 1.0 - 1.5m
- 1.5 - 2.0m
- 2.0 - 3.0m
- > 3.0m

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE BARRIER BREACH MODELLING MAXIMUM FLOOD DEPTH 0.1% AEP (1000YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
60473444	1:10,000

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FIGURE A23	1

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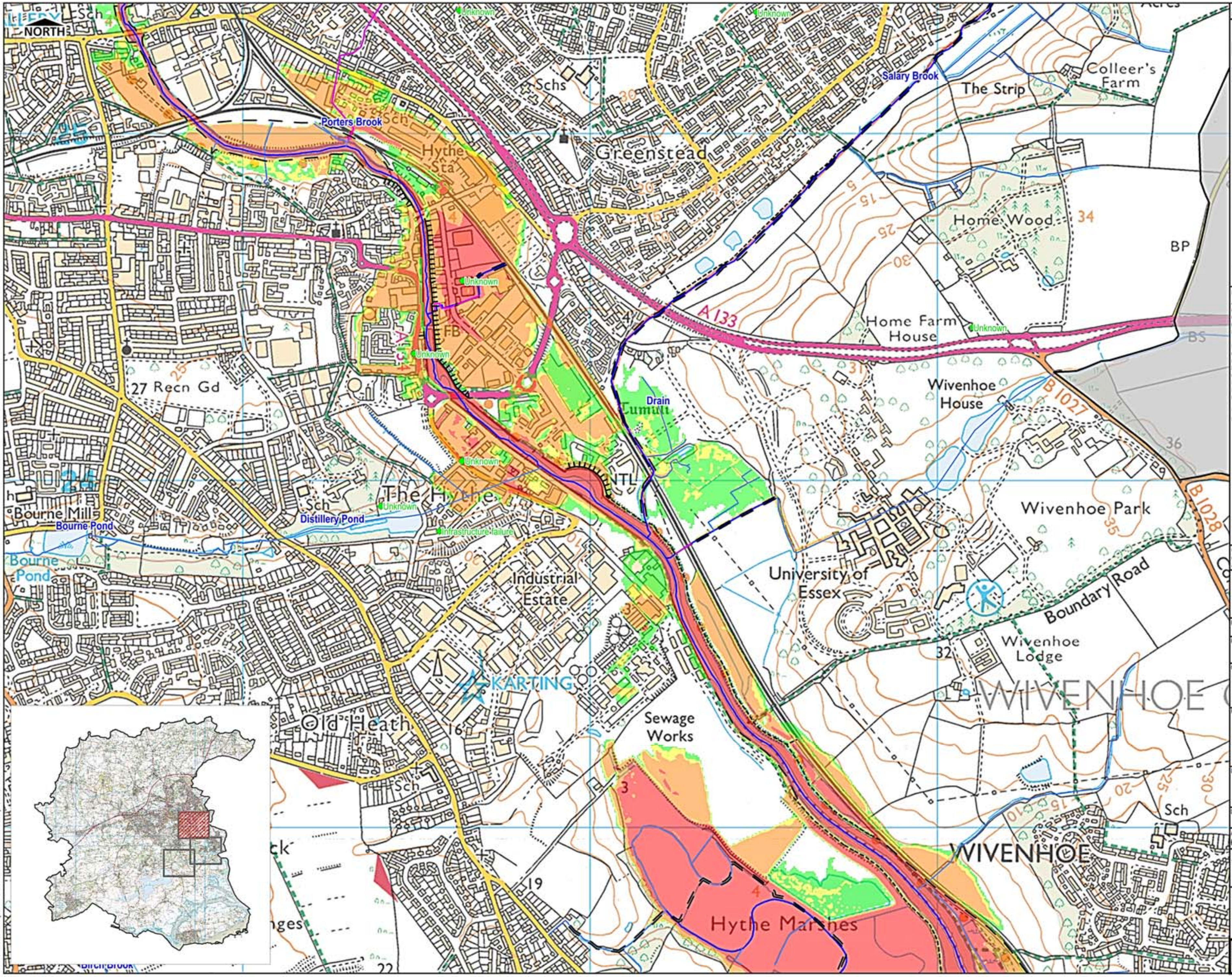

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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Hazard Rating

Flood hazard is calculated as a function of the flood depth and flow velocity at a particular point in the floodplain, along with a suitable debris factor, and is based on the methodology from Flood Risks to People FD2320 (Defra and Environment Agency, 2005).

- Low Hazard
- Moderate Hazard (Danger for Some)
- Significant Hazard (Danger for Most)
- Extreme Hazard (Danger for All)

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

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Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE BARRIER BREACH MODELLING MAXIMUM FLOOD HAZARD 0.1% AEP (1000YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
60473444	1:10,000

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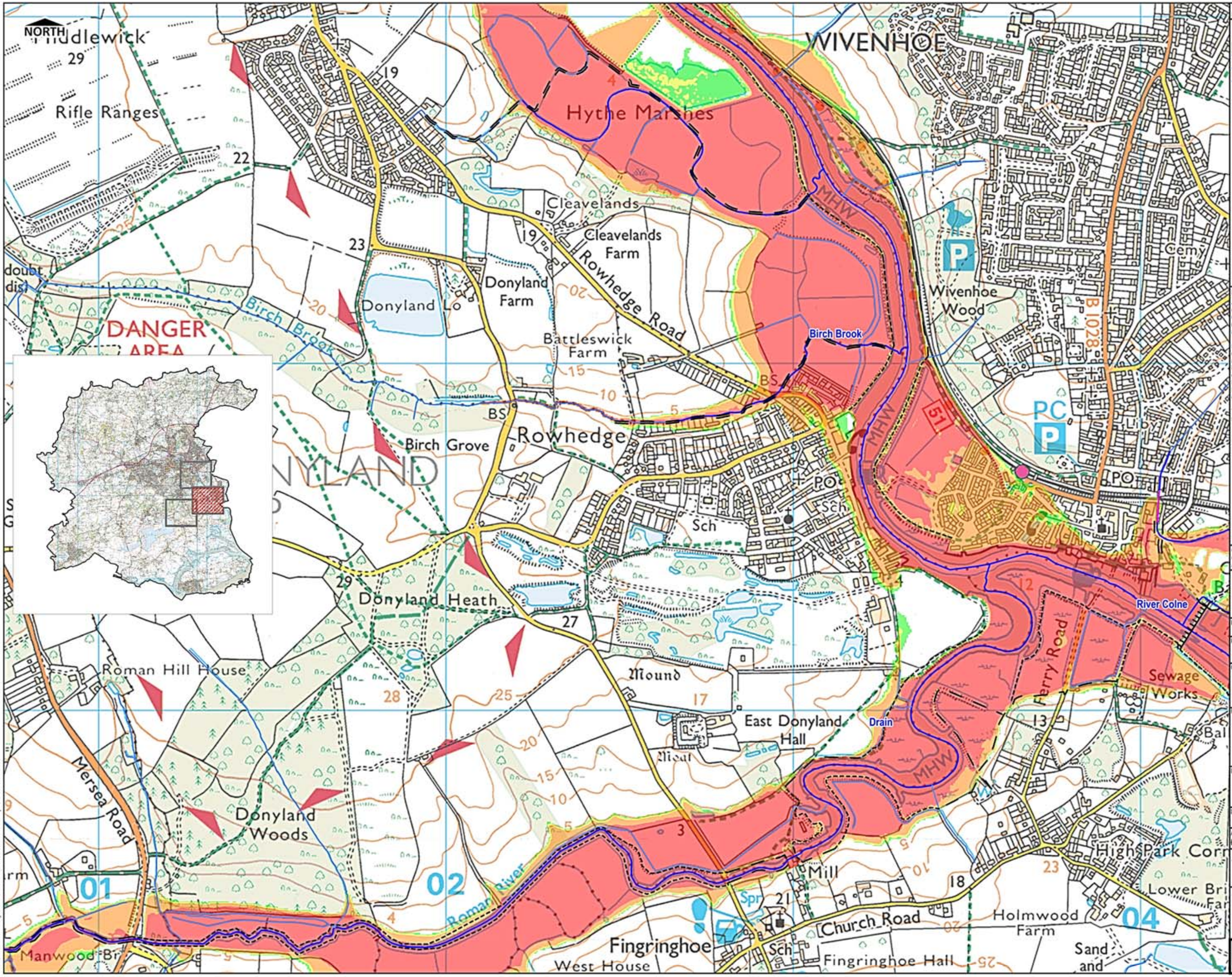
FIGURE A24	1



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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Hazard Rating

Flood hazard is calculated as a function of the flood depth and flow velocity at a particular point in the floodplain, along with a suitable debris factor, and is based on the methodology from Flood Risks to People FD2320 (Defra and Environment Agency, 2005).

- Low Hazard
- Moderate Hazard (Danger for Some)
- Significant Hazard (Danger for Most)
- Extreme Hazard (Danger for All)

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

As part of the update to the Level 2 Strategic Flood Risk Assessment (SFRA) for Colchester Borough Council (BC), revised modelling has been undertaken to provide an up to date assessment of the residual tidal flood risk to Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe. Details are provided in Appendix B.

Flood hazard is a function of the flood depth and flow velocity as well as a debris factor. Each grid cell within the TUFLOW model domain has been assigned one of four hazard categories: 'Extreme Hazard', 'Significant Hazard', 'Moderate Hazard', and 'Low Hazard'. The derivation of these categories is based on Flood Risks to People FD2321 (Defra & Environment Agency, 2005), using the following equation:
Flood Hazard Rating = ((v+0.5)*D) + DF
(Where v = velocity (m/s), D = depth (m) and DF = debris factor)

This map is intended to provide a strategic overview of flood risk and should not be used to assess flood risk for individual properties.

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue
VERSION 1

Client
Colchester, the place to live, learn, work, and visit.

Project Title
COLCHESTER BOROUGH COUNCIL
STRATEGIC FLOOD
RISK ASSESSMENT

Drawing Title
COLNE BARRIER BREACH MODELLING
MAXIMUM FLOOD HAZARD
0.1% AEP (1000YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
60473444	1:10,000

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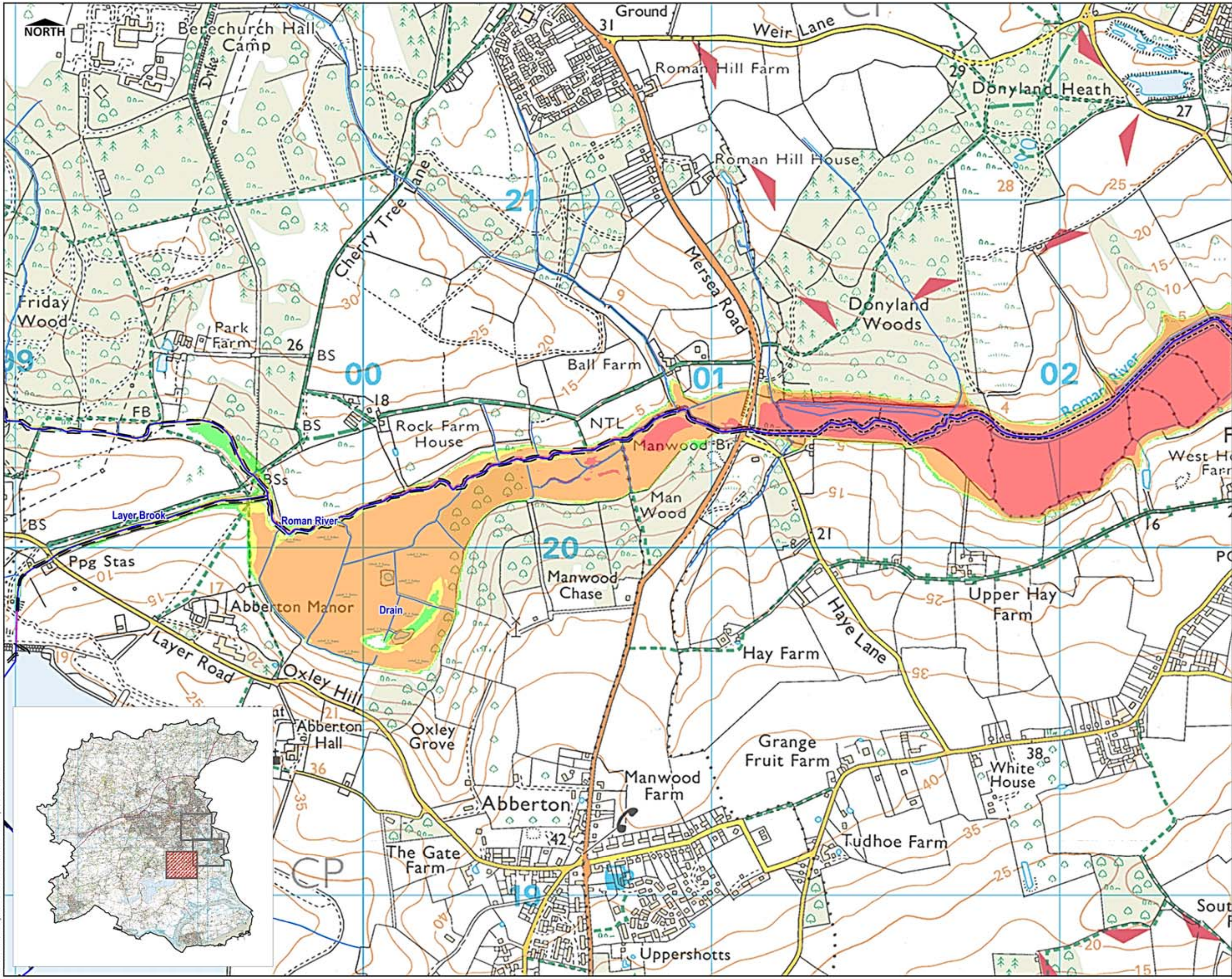
Drawing Number	Rev
FIGURE A25	1



LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Hazard Rating

Flood hazard is calculated as a function of the flood depth and flow velocity at a particular point in the floodplain, along with a suitable debris factor, and is based on the methodology from Flood Risks to People FD2320 (Defra and Environment Agency, 2005).

- Low Hazard
- Moderate Hazard (Danger for Some)
- Significant Hazard (Danger for Most)
- Extreme Hazard (Danger for All)

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

As part of the update to the Level 2 Strategic Flood Risk Assessment (SFRA) for Colchester Borough Council (BC), revised modelling has been undertaken to provide an up to date assessment of the residual tidal flood risk to Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe. Details are provided in Appendix B.

Flood hazard is a function of the flood depth and flow velocity as well as a debris factor. Each grid cell within the TUFLOW model domain has been assigned one of four hazard categories: 'Extreme Hazard', 'Significant Hazard', 'Moderate Hazard', and 'Low Hazard'. The derivation of these categories is based on Flood Risks to People FD2321 (Defra & Environment Agency, 2005), using the following equation:
Flood Hazard Rating = ((v+0.5)*D) + DF
(Where v = velocity (m/s), D = depth (m) and DF = debris factor)

This map is intended to provide a strategic overview of flood risk and should not be used to assess flood risk for individual properties.

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE BARRIER BREACH MODELLING MAXIMUM FLOOD HAZARD 0.1% AEP (1000YR) 2015

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

AECOM Internal Project No.	Scale at A3
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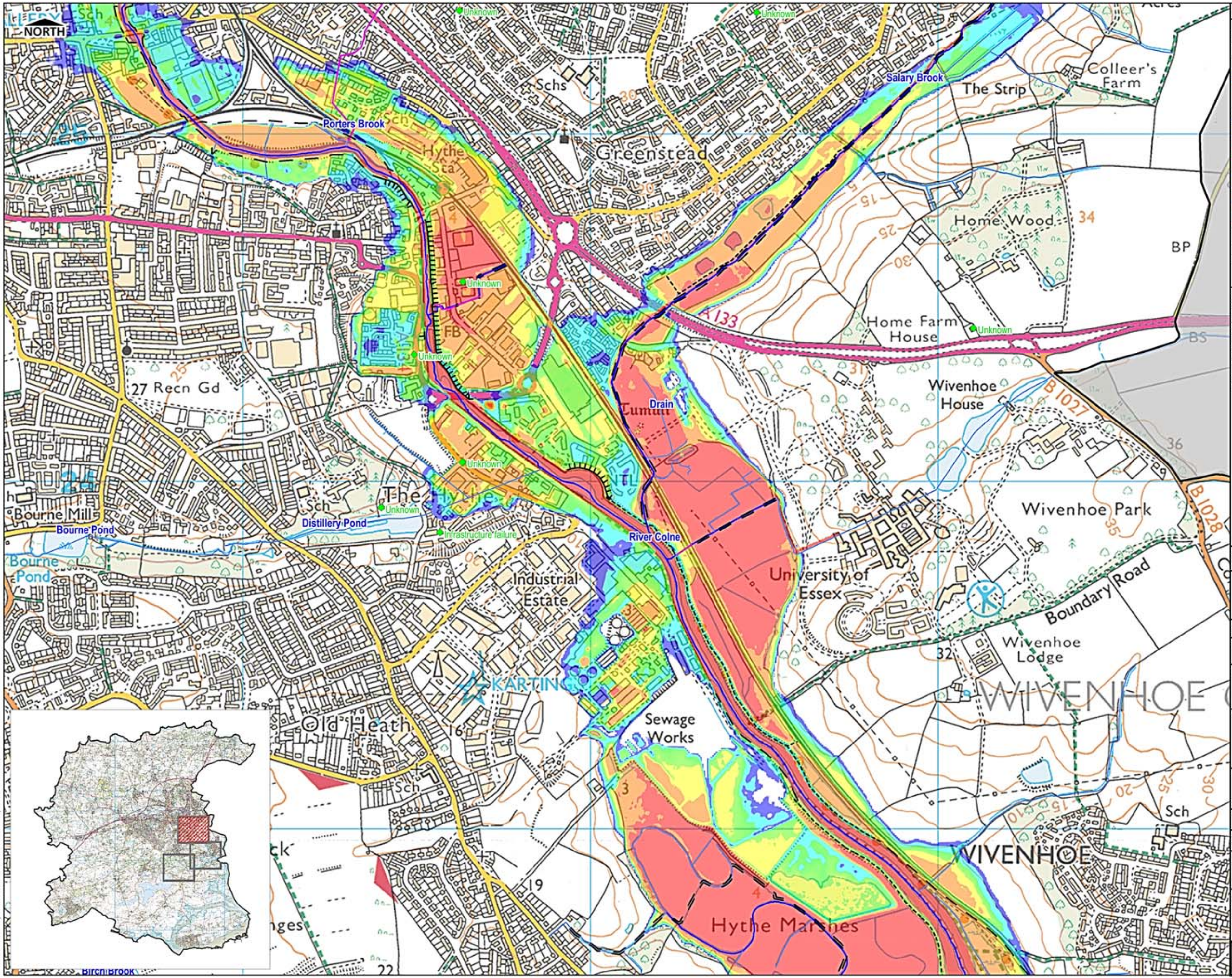

LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Maximum Flood Depth (m)

- 0.1 - 0.5m
- 0.5 - 1.0m
- 1.0 - 1.5m
- 1.5 - 2.0m
- 2.0 - 3.0m
- > 3.0m

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

As part of the update to the Level 2 Strategic Flood Risk Assessment (SFRA) for Colchester Borough Council (BC), revised modelling has been undertaken to provide an up to date assessment of the residual tidal flood risk to Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe. Details are provided in Appendix B.

Maximum flood depth mapping has been generated which shows the maximum depth of flooding experienced at each point in the floodplain throughout the entire model simulation.

This map is intended to provide a strategic overview of flood risk and should not be used to assess flood risk for individual properties.

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE BARRIER BREACH MODELLING MAXIMUM FLOOD DEPTH 0.1% AEP (1000YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
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AECOM Internal Project No.	Scale at A3
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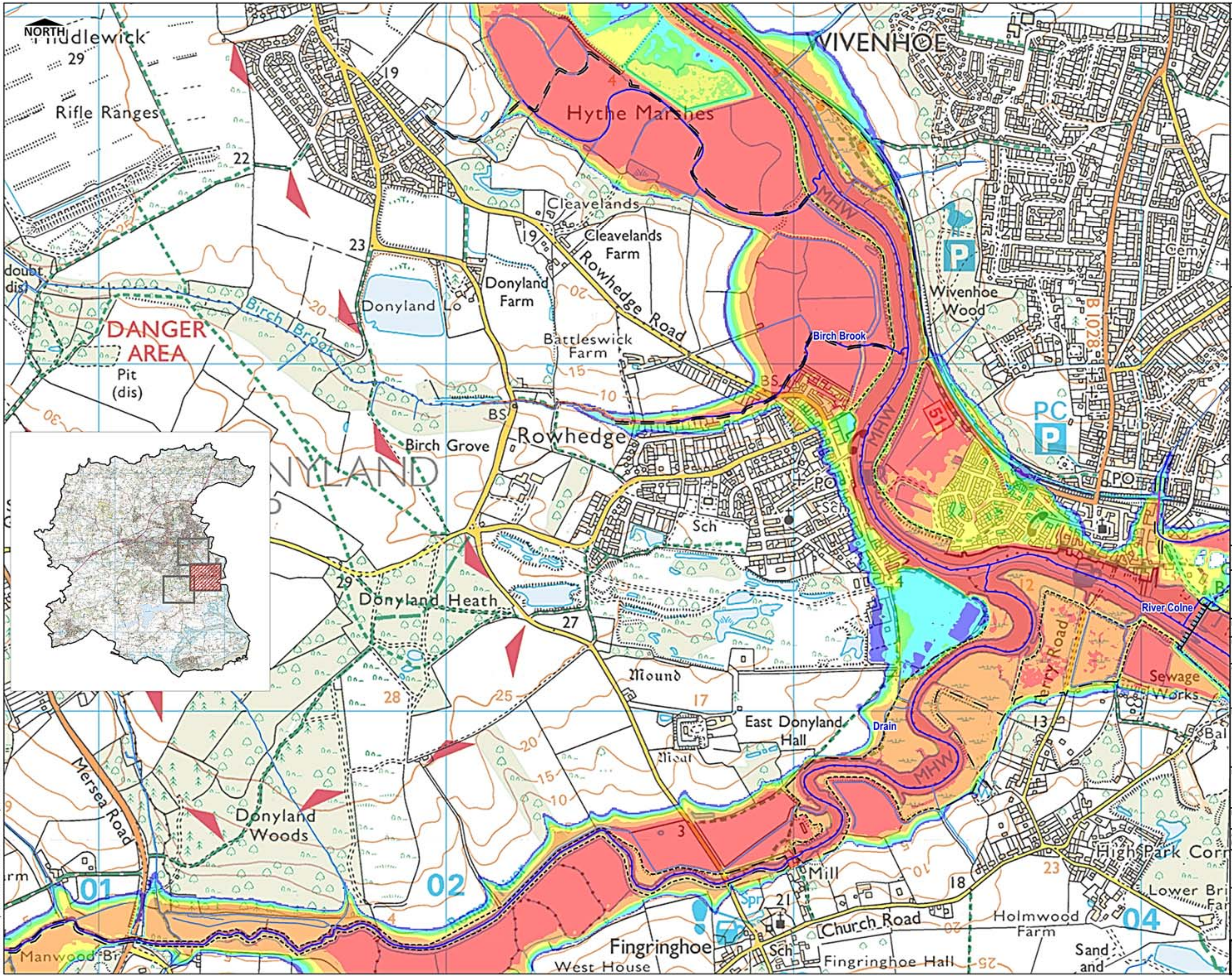
FIGURE A27	1



LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Maximum Flood Depth (m)

- 0.1 - 0.5m
- 0.5 - 1.0m
- 1.0 - 1.5m
- 1.5 - 2.0m
- 2.0 - 3.0m
- > 3.0m

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

As part of the update to the Level 2 Strategic Flood Risk Assessment (SFRA) for Colchester Borough Council (BC), revised modelling has been undertaken to provide an up to date assessment of the residual tidal flood risk to Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe. Details are provided in Appendix B.

Maximum flood depth mapping has been generated which shows the maximum depth of flooding experienced at each point in the floodplain throughout the entire model simulation.

This map is intended to provide a strategic overview of flood risk and should not be used to assess flood risk for individual properties.

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE BARRIER BREACH MODELLING MAXIMUM FLOOD DEPTH 0.1% AEP (1000YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
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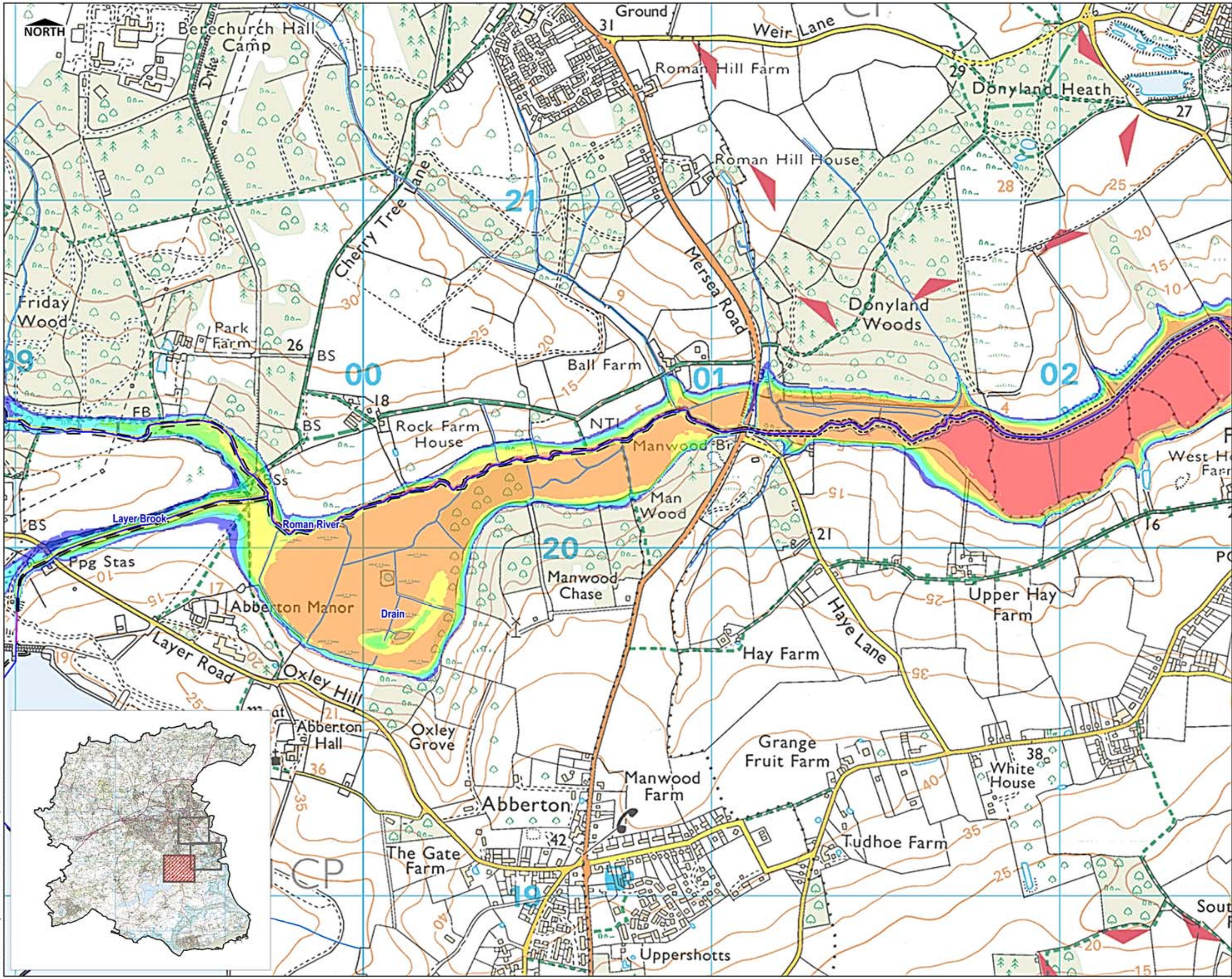
FIGURE A28	1



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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Maximum Flood Depth (m)

- 0.1 - 0.5m
- 0.5 - 1.0m
- 1.0 - 1.5m
- 1.5 - 2.0m
- 2.0 - 3.0m
- > 3.0m

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

As part of the update to the Level 2 Strategic Flood Risk Assessment (SFRA) for Colchester Borough Council (BC), revised modelling has been undertaken to provide an up to date assessment of the residual tidal flood risk to Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe. Details are provided in Appendix B.

Maximum flood depth mapping has been generated which shows the maximum depth of flooding experienced at each point in the floodplain throughout the entire model simulation.

This map is intended to provide a strategic overview of flood risk and should not be used to assess flood risk for individual properties.

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE BARRIER BREACH MODELLING MAXIMUM FLOOD DEPTH 0.1% AEP (1000YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
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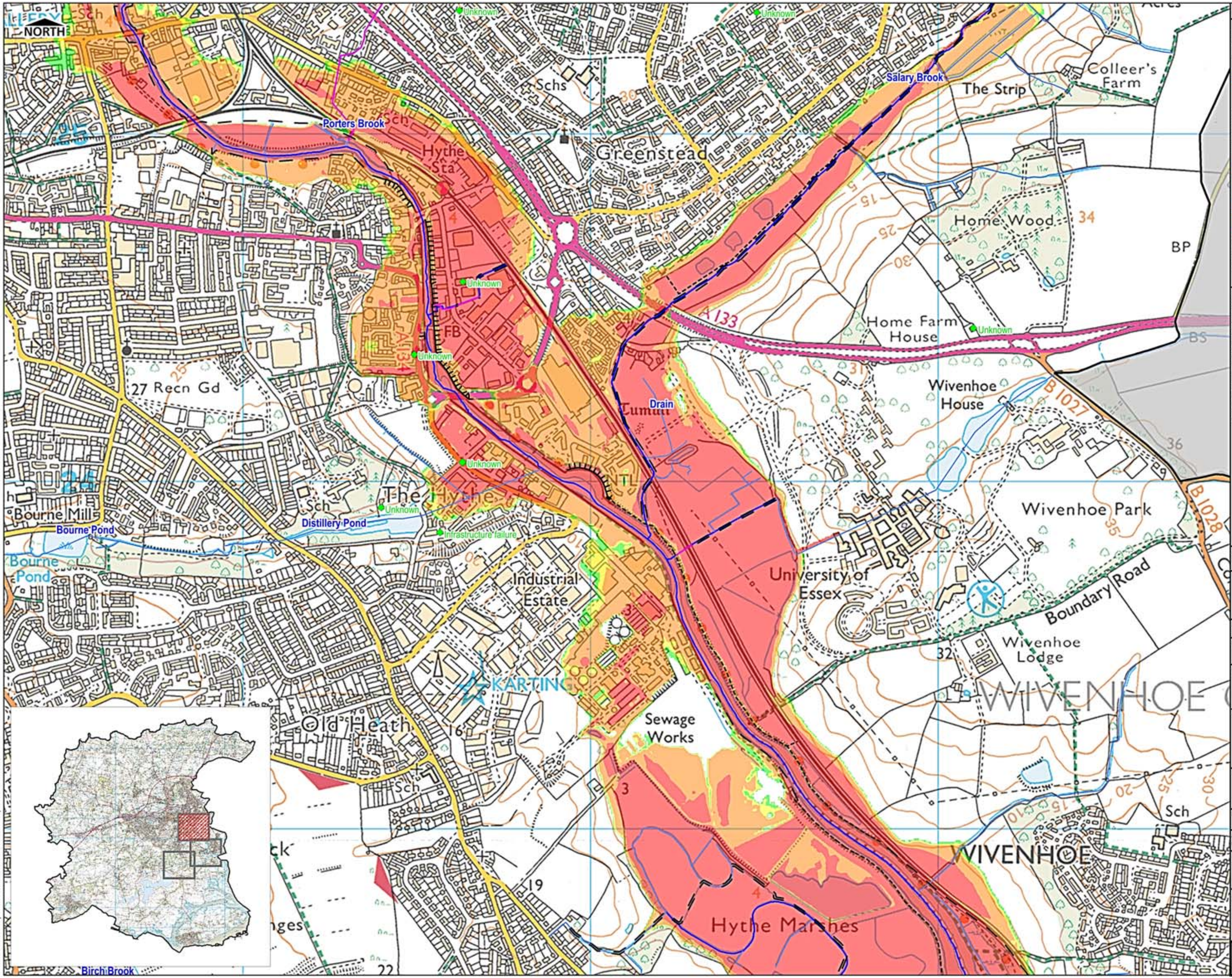
FIGURE A29	1



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LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Hazard Rating

Flood hazard is calculated as a function of the flood depth and flow velocity at a particular point in the floodplain, along with a suitable debris factor, and is based on the methodology from Flood Risks to People FD2320 (Defra and Environment Agency, 2005).

- Low Hazard
- Moderate Hazard (Danger for Some)
- Significant Hazard (Danger for Most)
- Extreme Hazard (Danger for All)

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

As part of the update to the Level 2 Strategic Flood Risk Assessment (SFRA) for Colchester Borough Council (BC), revised modelling has been undertaken to provide an up to date assessment of the residual tidal flood risk to Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe. Details are provided in Appendix B.

Flood hazard is a function of the flood depth and flow velocity as well as a debris factor. Each grid cell within the TUFLOW model domain has been assigned one of four hazard categories: 'Extreme Hazard', 'Significant Hazard', 'Moderate Hazard', and 'Low Hazard'. The derivation of these categories is based on Flood Risks to People FD2321 (Defra & Environment Agency, 2005), using the following equation:
Flood Hazard Rating = ((v+0.5)*D) + DF
(Where v = velocity (m/s), D = depth (m) and DF = debris factor)

This map is intended to provide a strategic overview of flood risk and should not be used to assess flood risk for individual properties.

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE BARRIER BREACH MODELLING MAXIMUM FLOOD HAZARD 0.1% AEP (1000YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
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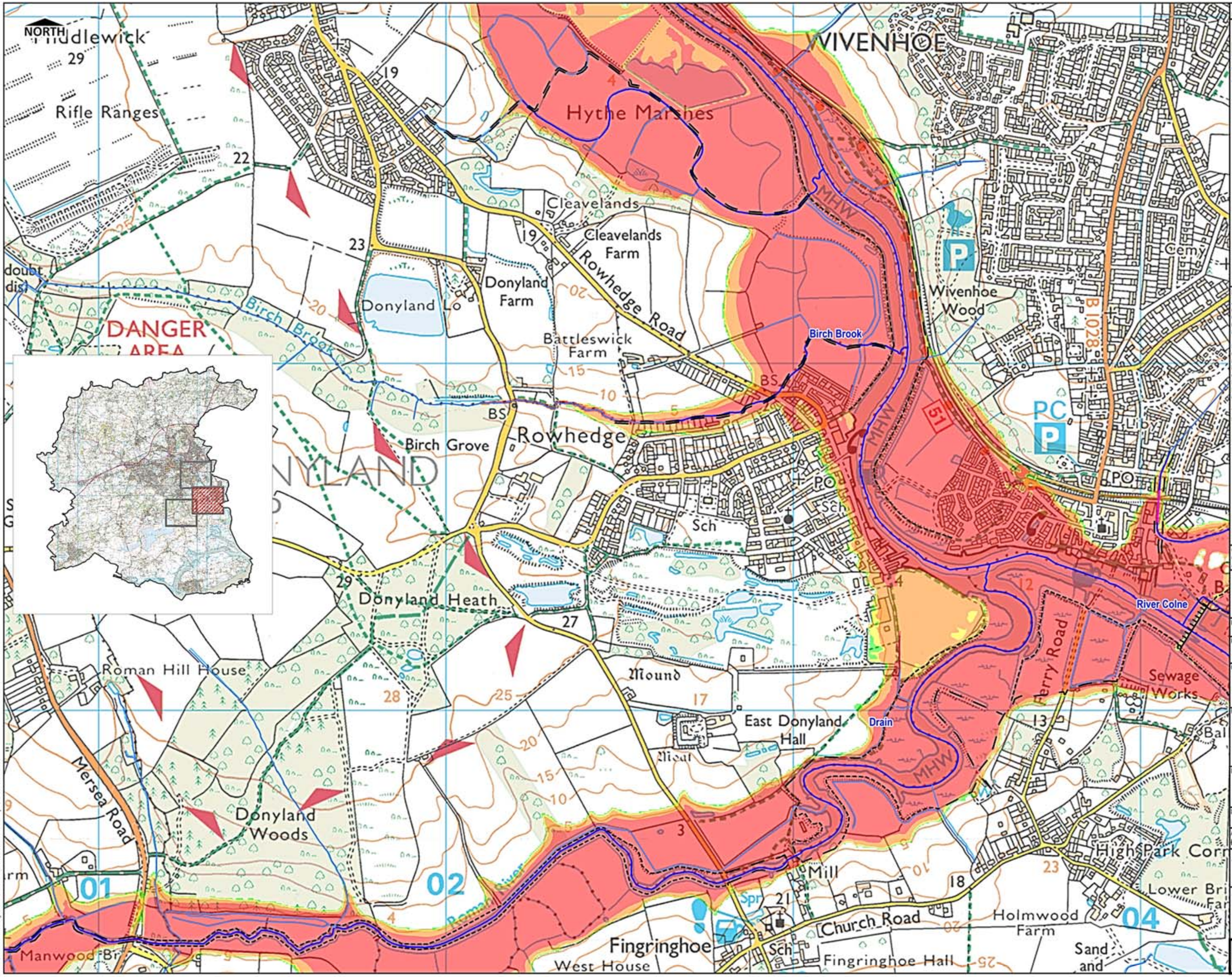

LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Hazard Rating

Flood hazard is calculated as a function of the flood depth and flow velocity at a particular point in the floodplain, along with a suitable debris factor, and is based on the methodology from Flood Risks to People FD2320 (Defra and Environment Agency, 2005).

- Low Hazard
- Moderate Hazard (Danger for Some)
- Significant Hazard (Danger for Most)
- Extreme Hazard (Danger for All)

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

As part of the update to the Level 2 Strategic Flood Risk Assessment (SFRA) for Colchester Borough Council (BC), revised modelling has been undertaken to provide an up to date assessment of the residual tidal flood risk to Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe. Details are provided in Appendix B.

Flood hazard is a function of the flood depth and flow velocity as well as a debris factor. Each grid cell within the TUFLOW model domain has been assigned one of four hazard categories: 'Extreme Hazard', 'Significant Hazard', 'Moderate Hazard', and 'Low Hazard'. The derivation of these categories is based on Flood Risks to People FD2321 (Defra & Environment Agency, 2005), using the following equation:
Flood Hazard Rating = $((v+0.5)*D) + DF$
(Where v = velocity (m/s), D = depth (m) and DF = debris factor)

This map is intended to provide a strategic overview of flood risk and should not be used to assess flood risk for individual properties.

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE BARRIER BREACH MODELLING MAXIMUM FLOOD HAZARD 0.1% AEP (1000YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

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Drawing Number	Rev
FIGURE A31	1

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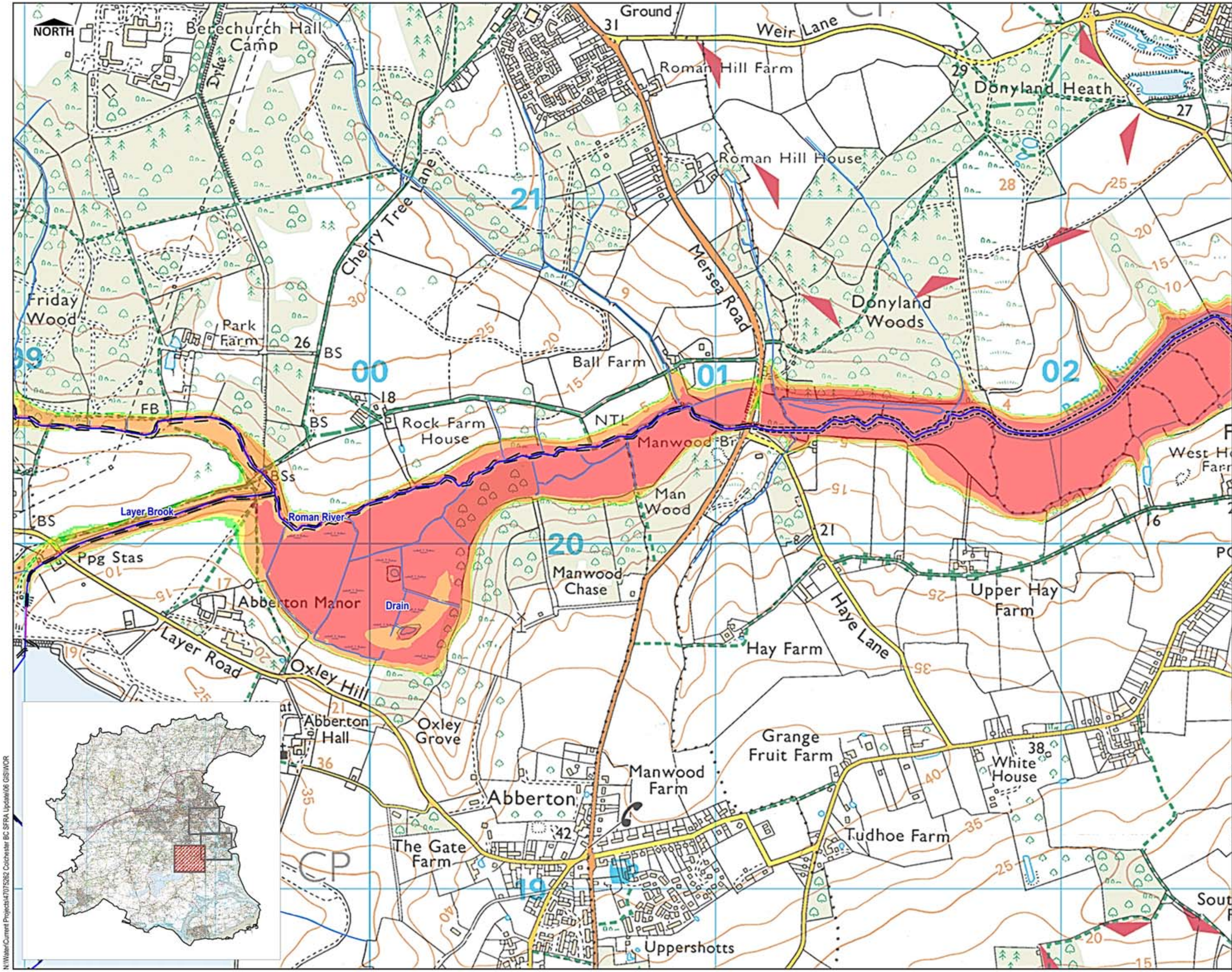

LEGEND

- Administrative Boundaries
- Main River
- Ordinary Watercourse
- Flood Records (Essex County Council)

Hazard Rating

Flood hazard is calculated as a function of the flood depth and flow velocity at a particular point in the floodplain, along with a suitable debris factor, and is based on the methodology from Flood Risks to People FD2320 (Defra and Environment Agency, 2005).

- Low Hazard
- Moderate Hazard (Danger for Some)
- Significant Hazard (Danger for Most)
- Extreme Hazard (Danger for All)

Asset Information Management System - Defences

- Embankment
- High Ground
- Flood Gate
- Wall

Notes

As part of the update to the Level 2 Strategic Flood Risk Assessment (SFRA) for Colchester Borough Council (BC), revised modelling has been undertaken to provide an up to date assessment of the residual tidal flood risk to Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe. Details are provided in Appendix B.

Flood hazard is a function of the flood depth and flow velocity as well as a debris factor. Each grid cell within the TUFLOW model domain has been assigned one of four hazard categories: 'Extreme Hazard', 'Significant Hazard', 'Moderate Hazard', and 'Low Hazard'. The derivation of these categories is based on Flood Risks to People FD2321 (Defra & Environment Agency, 2005), using the following equation:
Flood Hazard Rating = $((v+0.5)*D) + DF$
(Where v = velocity (m/s), D = depth (m) and DF = debris factor)

This map is intended to provide a strategic overview of flood risk and should not be used to assess flood risk for individual properties.

Revision Details | By / Check | Check Date | Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: COLNE BARRIER BREACH MODELLING MAXIMUM FLOOD HAZARD 0.1% AEP (1000YR) INCL. CLIMATE CHANGE 2115

Drawn	Checked	Approved	Date
SL	SK	CP	AUG 2016

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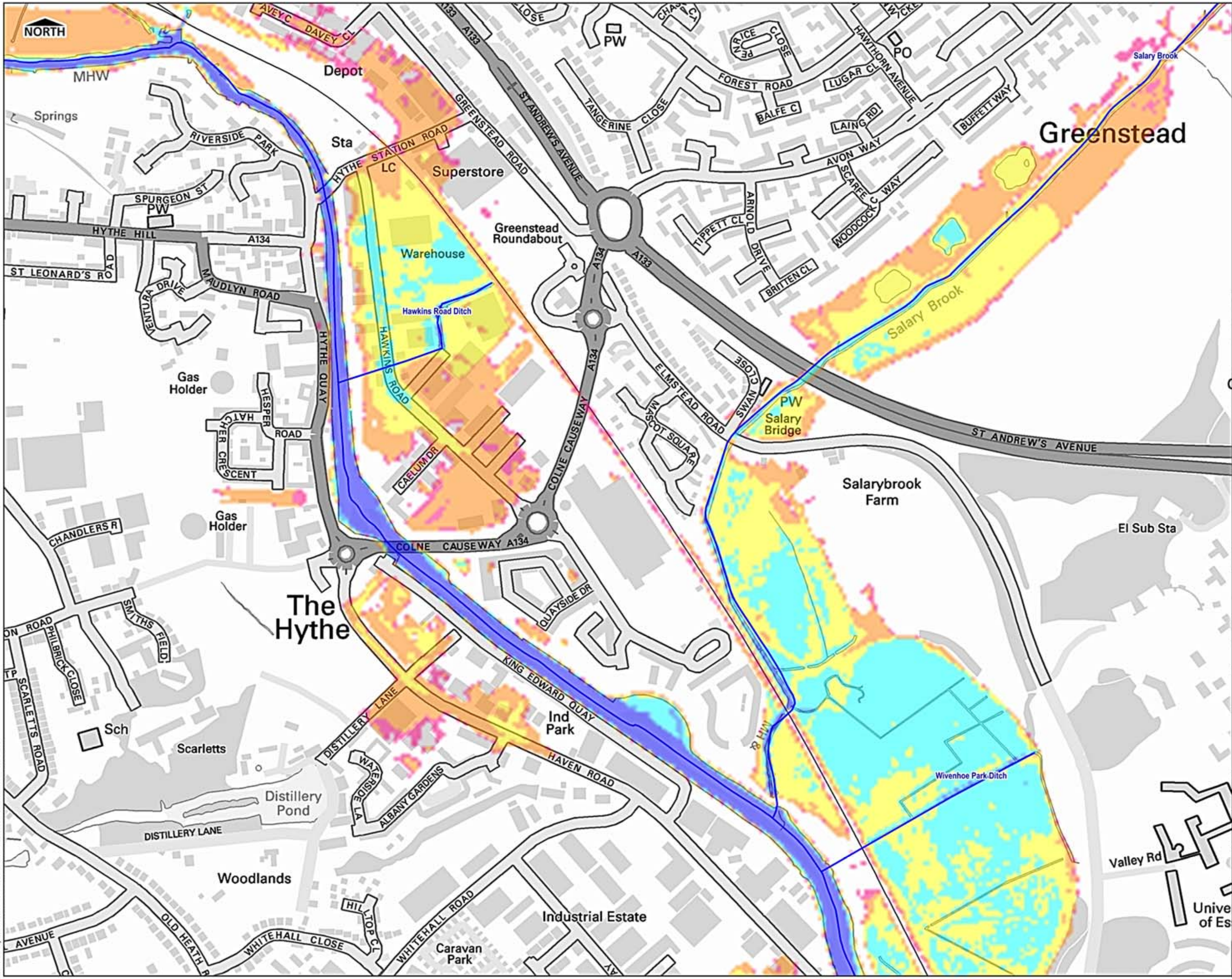
Drawing Number: FIGURE A32 | Rev: 1



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LEGEND

Low-lying areas in Colchester Town

Areas located below the threshold levels for operating the Colne Barrier, which may be susceptible to tidal flooding, as described in the Notes, and Section 1.3 of Appendix B. Ground Levels based on LiDAR Topography (mAOD).

- <1.25m
- 1.25 - 1.5m
- 1.5 - 2.0m
- 2.0 - 2.5m
- 2.5 - 3.1m
- 3.1 - 3.2m

Notes

This figure identifies those areas of Colchester upstream of the Colne Barrier that lie at a level below the manning and operating thresholds of the Barrier (3.1mAOD and 3.2mAOD respectively).
The ground levels have been determined based on LiDAR data.

These areas would be subject to flooding in the following circumstances:

1. Errors in advance storm tide forecasting and Environment Agency forecasting for tidal surge residuals at the barrier;

2. Tidal water inundation of Colchester due to ingress into the surface water drainage network via poorly maintained drainage outfalls (flap valves); or,

3. A rainfall event takes up available storage in the surface water drainage network whilst the system is tide locked.

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue: VERSION 1

Client: Colchester, the place to live, learn, work, and visit.

Project Title: COLCHESTER BOROUGH COUNCIL LEVEL 2 STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: AREAS BELOW THE COLNE BARRIER MANNING AND THRESHOLD LEVELS

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SL	MI	SK	AUG 2016

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FIGURE A33	1

Appendix B. Colne Barrier Breach Modelling Methodology

Prepared by: Sarah Littlewood
Flood Risk Consultant

Checked by: Gemma Hoad
Senior Water Consultant

Approved by: Carl Pelling
Associate Director

Rev No	Comments	Checked by	Approved by	Date
1	Draft for client and stakeholder comment	MI	CP	June 2016
2	Final Report	GH	CP	February 2017

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Telephone: 01256 310 200 Website: http://www.aecom.com

Job No	Reference	Date Created
60473444		February 2017

1 Colne Barrier Breach Modelling Approach

1.1 Background

As part of the update to the Level 2 Strategic Flood Risk Assessment (SFRA) for Colchester Borough Council (BC), modelling has been undertaken to assess the residual tidal flood risk to Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe. This document details the modelling methodology, assumptions and findings, and forms Appendix B to the Level 2 SFRA.

In the 2008 Level 2 SFRA for Colchester BC, a similar assessment of the residual risk of tidal flooding was undertaken using the hydrodynamic modelling software MIKE21. The revised modelled presented in this version of the Level 2 SFRA uses a 2010 TUFLOW model of the Blackwater and Colne Estuary, prepared on behalf of the Environment Agency.

1.2 Blackwater and Colne Estuary Model

The Environment Agency carries out a national programme of tidal and fluvial flood risk modelling studies which are used to inform Flood Zones and the Flood Map for Planning (Rivers and Sea). As part of this programme Halcrow were commission to update a hydraulic modelling study for the Blackwater and Colne Estuary in 2010.

Five principal watercourses drain into the Colne and Blackwater Estuary. The area covers 350 km^2 including Colchester, Maldon, Brightlingsea and Mersea Island. Most of the land adjacent to the Estuary is low-lying. The Estuary model domain includes 180km of flood defences which protect an estimated 11,500 properties currently considered at risk of flooding without defences.

The Blackwater and Colne Estuary model (the 'Estuary Model') covers the Colchester BC administrative area and has been used as a basis for developing a smaller model for Colchester town, in order to assess the risk associated with a failure of the Colne Barrier.

1.3 Consultation

The Environment Agency Asset Performance team were consulted to determine the most likely scenario resulting in a failure of the Colne Barrier and to agree the parameters for the breach modelling.

The Asset Performance team confirmed that the Barrier has a number of backup systems and procedures in place, and therefore a failure of the asset is considered highly unlikely. In the event a breach did occur, this is most likely to happen on the most frequent tide that would trigger closure of the Barrier. The two counter walls which tie the barrier into high ground also have defences to the front and rear and a review of the design by the Environment Agency Asset Performance team confirms they provide enough resilience to overtopping. The counter walls are recorded to have standard of protection of 1 in 1000 years in the Environment Agency's Asset Information Management System (AIMS).

Although considered unlikely, an assessment of the residual risk of a failure of the barrier was required to inform future development and emergency planning procedures in Colchester. It was therefore agreed with the Environment Agency and Colchester BC to model the impact of failure of the Colne Barrier to close during an extreme tidal flood event..

It was also agreed with the Environment Agency and Colchester BC that an assessment is made of those areas of Colchester upstream of the Colne Barrier at a level below the manning and operating thresholds of the Barrier (3.1 Metres Above Ordnance Datum (mAOD) and 3.2mAOD respectively). These areas would be subject to flooding in the following circumstances:

1. Errors in advance storm tide forecasting and Environment Agency forecasting for tidal surge residuals at the barrier;

2. Tidal water inundation of Colchester due to ingress into the surface water drainage network via poorly maintained drainage outfalls (flap valves); or,

3. A rainfall event takes up available storage in the surface water drainage network whilst the system is tide locked.

1.4 Aims and Objectives

The aim of the modelling exercise for this Level 2 SFRA is to construct a 2-dimensional (2D) hydraulic model to:

- Determine the residual risk of tidal flooding to Colchester town centre in the event of a failure of the Colne Barrier;
- Identify flow routes and flood depths; and,
- Generate depth and hazard mapping for the Level 2 SFRA.

The following tasks were undertaken:

- Generation of new tidal boundary conditions for the Estuary Model using revised present day water levels for 2015, and revised climate change water levels for the year 2115;
- Re-run the Estuary Model using revised water levels with the Barrier open to generate water levels downstream of the Colne Barrier at Wivenhoe;
- Extract water levels from the Estuary Model results immediately downstream of the Colne Barrier to generate the inputs for the new Colne Barrier Breach Model;
- Use the existing Estuary Model to generate a new truncated model for Colchester town centre with improved grid size, topographical survey and Light Detection and Ranging (LiDAR) data;
- Produce mapping of flood extent, maximum flood depth and hazard rating; and,
- Prepare a Modelling Report.

2 Modelling Methodology

2.1 Software Selection

The Blackwater and Colne Estuary Model was constructed in TUFLOW which is a modelling package for simulating depth averaged 2D free-surface flows. TUFLOW is widely used in the UK for fluvial and tidal inundation modelling. The model simulations for the truncated model have been run using TUFLOW build 2013-12-AC-iDP-w64.

2.2 Data Sources

The following information and data have been gathered and used to inform the construction and development of the hydraulic model:

- Environment Agency TUFLOW Blackwater and Colne Estuary model files (Halcrow 2010);
- $1m^2$ and $2m^2$ resolution LiDAR topographic survey data obtained between 1998 and 2011, provided by the Environment Agency;
- Environment Agency Coastal Boundary Extreme Sea Levels (Base Year 2008); and,
- UKCP09 sea level rise and storm surge data.

2.3 Model Domain

Figure 2-1 below shows the coverage of the Blackwater and Colne Estuary Model, which extended across the estuary of both rivers, encompassing Maldon, Mersea, Colchester and Brightlingsea. The revised model for the Colchester town centre includes the Colchester domain and the extent covering the Roman River. The model domain has been extended approximately 1km to the north of East Street to enable mapping of the maximum tidal flood extent. The revised model domain covers an area of approximately 10.8 km^2, the extent of which is shown overleaf in Figure 2-2.

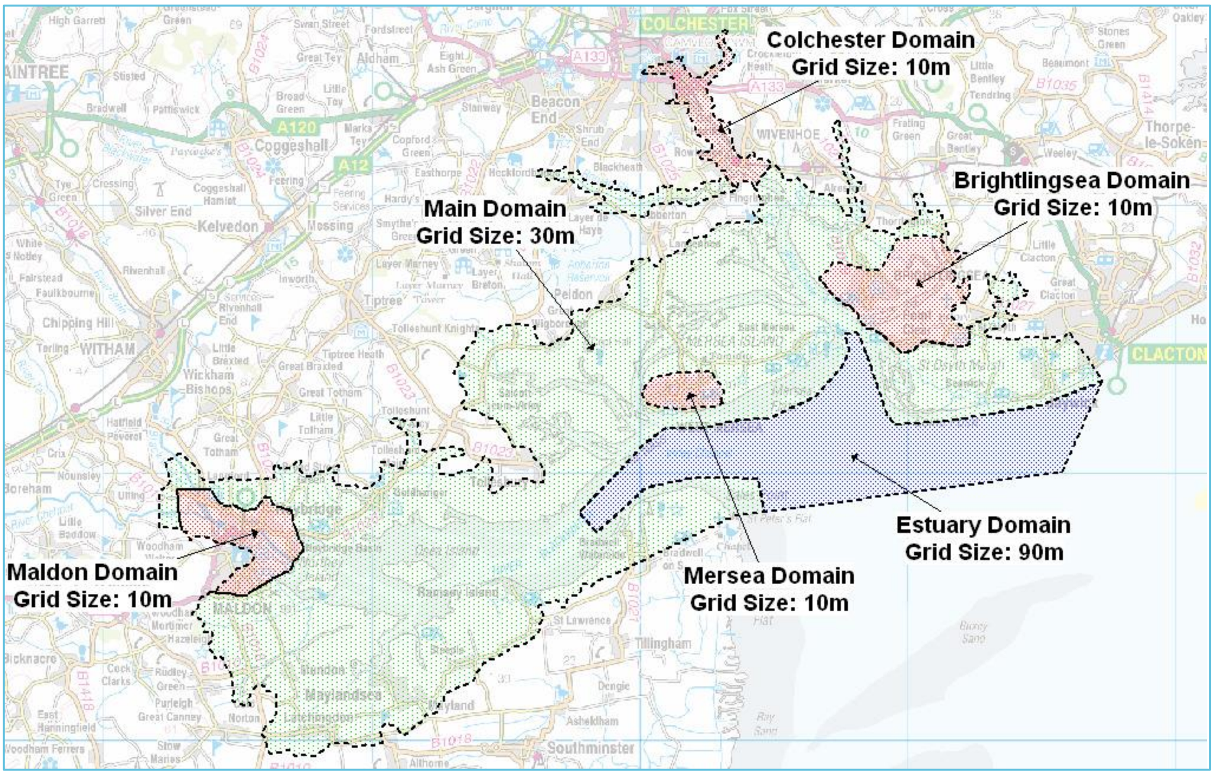

Figure 2-1 Estuary Model Domains and Grid Sizes (Source: Halcrow 2010).

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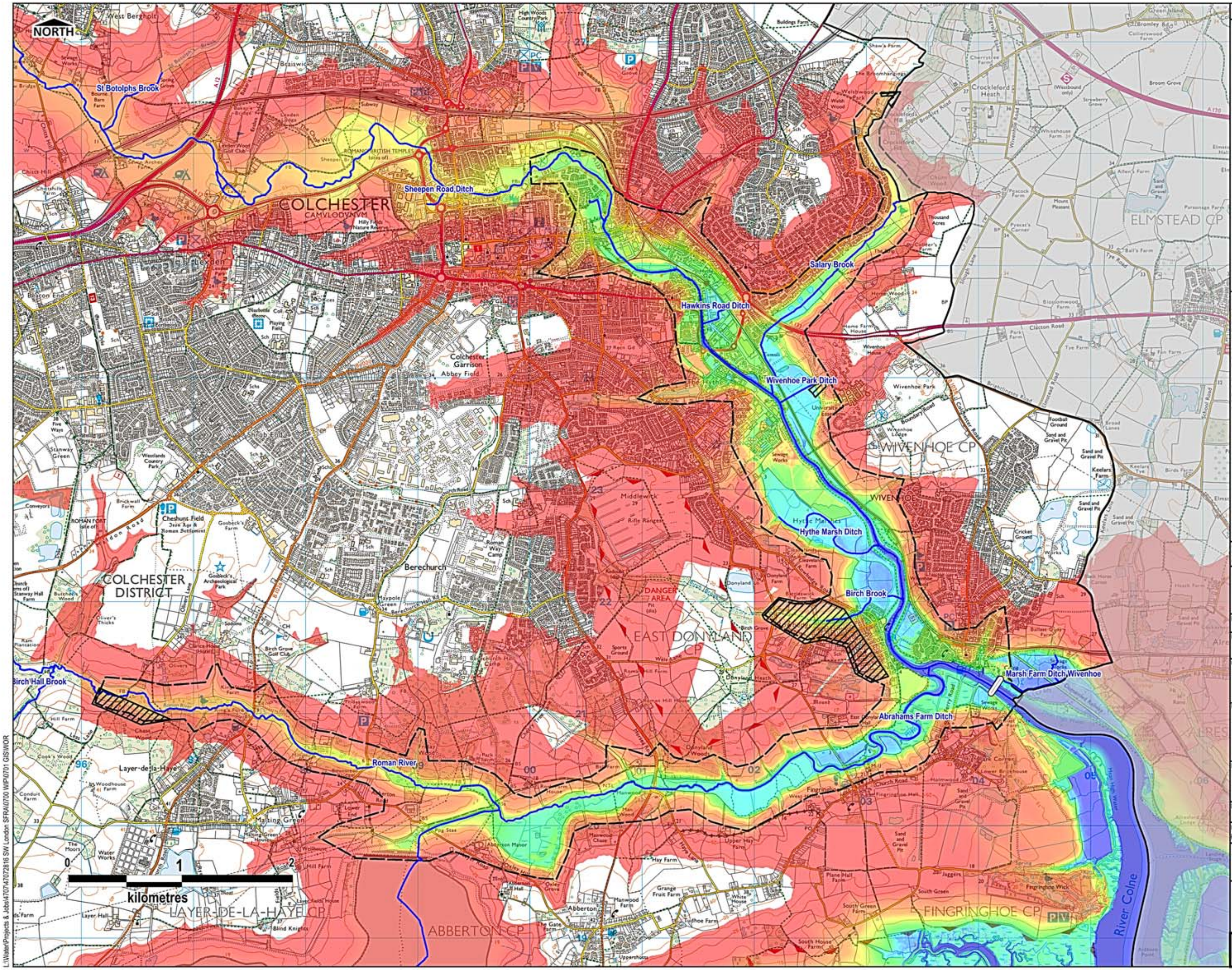

THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT

LEGEND

- Borough Boundary
- Main River Centreline
- Colne Barrier at Wivenhoe
- Breach Model Domain

LiDAR Topography (mAOD)

- <= 1m
- 2m
- 3m
- 6m
- 8m
- 20m - 32m
- Areas of 2m2 resolution LiDAR

Notes

As part of the update to the Level 2 Strategic Flood Risk Assessment (SFRA) for Colchester Borough Council (BC), revised modelling has been undertaken to provide an up to date assessment of the residual tidal flood risk to Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe.

This figure shows the model domain for the breach model, which includes the tidal part of the River Colne floodplain, as well as the floodplain of the Roman River (to the west) and Salary Brook (to the north east).

Up to date Light Detection and Ranging (LiDAR) data was obtained for the model area and used to generate the DTM. LiDAR data with 1m2 resolution is available for the majority of the model domain. Where there were gaps, 2m2 LiDAR has been used to provide complete coverage; these areas are shown in the adjacent figure.

Revision Details	By / Check	Check Date	Suffix

Purpose of Issue

VERSION 1

Client

Colchester, the place to live, learn, work, and visit.

Project Title

COLCHESTER BOROUGH COUNCIL
LEVEL 2 STRATEGIC
FLOOD RISK ASSESSMENT

Drawing Title

MODEL DOMAIN AND
LIDAR COVERAGE

Drawn	Checked	Approved	Date
SL	MI	SK	AUG 2016

URS Internal Project No.	Scale at A3
60473444	1:20,000

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Drawing Number	Rev
FIGURE 2-2	1

2.5 Model Domain Grid Size

The Environment Agency Estuary Model utilised multiple 2D domains with variable grid sizes to enable better resolution of flood extents in urban areas, whilst maintaining reasonable run times. The main grid size is 30m^2 with high resolution areas around Colchester, Brightlingsea, Maldon and Mersea of 10m^2. The wider estuary has a 90m^2 grid resolution.

During the development of the Colchester Town model, there was opportunity to refine the grid size and enable a slightly improved representation of the model domain.

A 5m^2 grid size was selected and used across the entire model domain for the Colchester Town model, as it represented a good balance between the degree of accuracy (i.e. ability to model overland flow paths across the study area) whilst maintaining reasonable model run times.

2.6 Digital Terrain Model (DTM) Generation

LiDAR data was obtained for the model area and used to generate the DTM. LiDAR data with 1m^2 resolution is available from the Environment Agency for the majority of the model domain. Where there were gaps, 2m^2 resolution LiDAR has been used to provide complete coverage, as shown in Figure 2-2.

2.7 Water Level Derivation

For the Colne and Blackwater Estuary Model, the base tide shape was derived from astronomical tide predictions at Clacton. A surge residual was then added and scaled to obtain the extreme tide level for each design run. The shape of the surge residual was determined by reviewing gauge data of surges recorded at Clacton-on-Sea.

The extreme tide levels estimated for Colne Point and Sales Point, (taken from the Anglian Region Eastern and Central Areas Extreme Tide Levels report (Haskoning, 2007)), were used as the maximum level in the head-time tidal boundary. The extreme tide levels for Colne Point were imposed at the eastern boundary of the domain and tide levels for Sales Point imposed at the western boundary of the domain. Levels along the southern boundary were interpolated along the length of the tidal boundary.

In order to generate a suitable tidal boundary for the Breach Model, the Estuary Model was first re-run with revised water levels using the latest extreme water level data for the region and the latest climate change datasets (UKCP09). For this simulation, the Colne Barrier was modelled to be open, to provide a suitable tidal boundary for the Breach Model (which assumes that the Barrier fails to close). The base tide shape derived for the original Colne and Blackwater Estuary Model was retained. Extreme sea level data supplied by the Environment Agency (Environment Agency Coastal Boundary Extreme Sea Levels (Base Year 2008)) was used to determine the extreme water levels at Colne Point and Sales Point either end of the Estuary Model tidal boundary. Onto this, a surge residual and allowance for sea level rise allowances have been applied in line with the data obtained from the UK Climate Projections (UKCP09) for the years 2015 and 2115.

The original tidal boundaries for the Estuary Model were scaled to match the new peak water levels shown in Table 2-1 overleaf, by applying the predicted increase across the entire tidal boundary. The green shaded cells highlight the water levels for the return periods that have been considered in this modelling exercise.

Table 2-1 Extreme Water Level Derivation for Estuary Model

	EWL (mAOD)						EWL + Storm Surge (mAOD)			
	2008		2015		2115		2015		2115	
	Colne_Pt	Sales_Pt	Colne_Pt	Sales_Pt	Colne_Pt	Sales_Pt	Colne_Pt	Sales_Pt	Colne_Pt	Sales_Pt
Return Period (Years)	4262	4276	4262	4276	4262	4276	4262	4276	4262	4276
1	3.09	3.31	3.13	3.35	3.87	4.09	3.13	3.35	3.87	4.09
2	3.22	3.42	3.26	3.46	4.00	4.20	3.26	3.46	4.01	4.21
5	3.39	3.58	3.43	3.62	4.17	4.36	3.43	3.62	4.18	4.37
10	3.53	3.72	3.57	3.76	4.31	4.50	3.57	3.76	4.32	4.51
20	3.67	3.84	3.71	3.88	4.45	4.62	3.71	3.88	4.46	4.63
25	3.72	3.89	3.76	3.93	4.50	4.67	3.76	3.93	4.51	4.68
50	3.87	4.02	3.91	4.06	4.65	4.80	3.91	4.06	4.67	4.82
75	3.95	4.10	3.99	4.14	4.73	4.88	3.99	4.14	4.75	4.90
100	4.01	4.15	4.05	4.19	4.79	4.93	4.05	4.19	4.81	4.95
150	4.11	4.23	4.15	4.27	4.89	5.01	4.15	4.27	4.91	5.03
200	4.17	4.28	4.21	4.32	4.95	5.06	4.21	4.32	4.97	5.08
250	4.22	4.33	4.26	4.37	5.00	5.11	4.26	4.37	5.02	5.13
300	4.26	4.36	4.30	4.40	5.04	5.14	4.30	4.40	5.06	5.16
500	4.38	4.46	4.42	4.50	5.16	5.24	4.42	4.50	5.18	5.26
1000	4.54	4.58	4.58	4.62	5.32	5.36	4.58	4.62	5.34	5.38

2.8 Breach Model Boundary Conditions

The Estuary Model was run for the return periods and revised water levels shown in Table 2-1. A Plot Output (PO) line was added to the model to record the water level immediately downstream of the Colne Barrier. This data was then used to generate the boundary conditions for the Breach Model. The resulting peak water levels applied to the Breach Model are presented in Table 2-2. The time series data is shown in Figure 2-3.

Table 2-2 Peak water levels for Colne Barrier Breach Model

Return Period	Peak Water Level (mAOD)
0.5% AEP (1 in 200 year) for the year 2015	4.49
0.5% AEP (1 in 200 year) for the year 2115	5.34
0.1% AEP (1 in 1000 year) for the year 2015	4.79
0.1% AEP (1 in 1000 year) for the year 2115	6.23

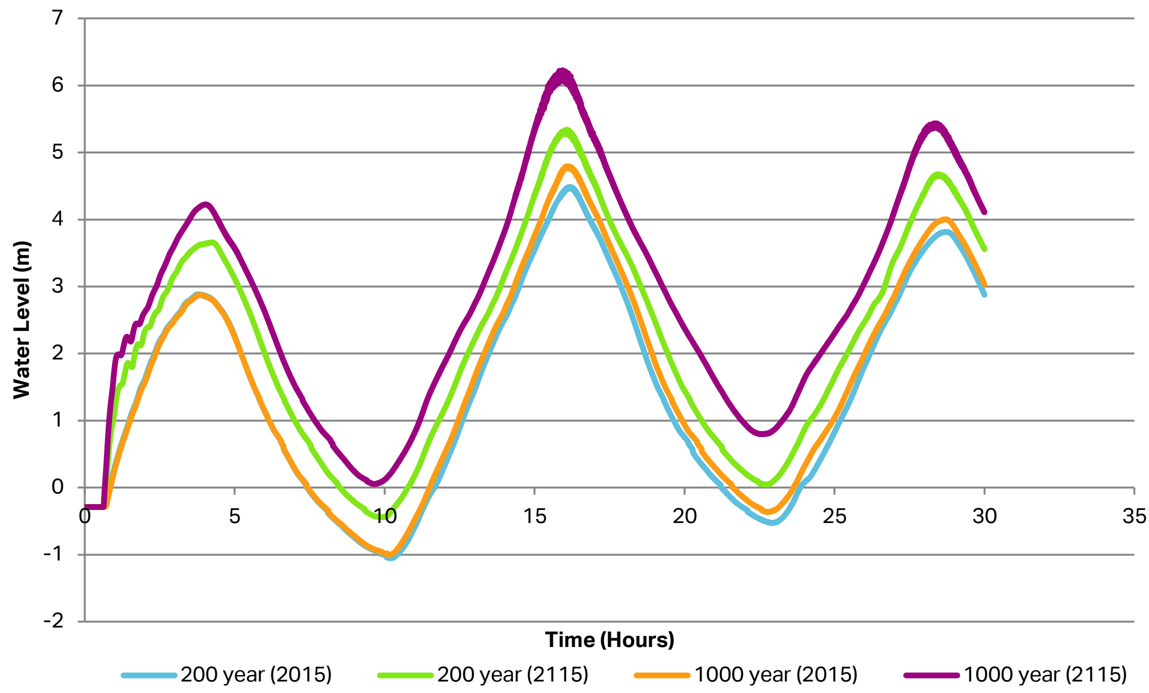

Figure 2-3 Boundary Conditions generated for the Colne Barrier Breach Model

2.9 Watercourses

In order to represent the inflows from the River Colne and Roman River, the fluvial boundaries have been retained from the Estuary Model. These are flow-time (QT) boundaries at the estimated base flow rates of $5m^3/s$ for the River Colne and $1m^3/s$ for the Roman River.

2.10 Modelling Outputs

2.10.1 Maximum Flood Depth

Maximum flood depth mapping has been generated to show the maximum depth of flooding across the floodplain during the entire model simulation.

2.10.2 Hazard Rating

Flood hazard mapping has also been prepared. Flood hazard is a function of flood depth, velocity and a debris factor. Each grid cell within the model domain has been assigned one of four hazard categories: 'Extreme Hazard', 'Significant Hazard', 'Moderate Hazard', and 'Low Hazard'. The derivation of these categories is set out in Table 2-3 and is based on Flood Risks to People FD2321 (Defra & Environment Agency, 2005), using the following equation:

*Flood Hazard Rating = ((v+0.5)*D) + DF*

(Where v = velocity (m/s), D = depth (m) and DF = debris factor)

For this study, a precautionary approach for the debris factor has been adopted in line with FD2321. A debris factor of 0.5 has been used for depths less than and equal to 0.25m, and a debris factor of 1.0 has been used for depths greater than 0.25m.

Table 2-3: Hazard categories based on FD2320, Defra & Environment Agency 2005

Hazard Rating		Description
HR < 0.75	**Low**	**Caution** – Flood zone with shallow flowing water or deep standing water
0.75 ≥ HR ≤ 1.25	**Moderate**	**Dangerous for some** (i.e. children) – Danger: flood zone with deep or fast flowing water
1.25 > HR ≤ 2.0	**Significant**	**Dangerous for most people** – Danger: flood zone with deep fast flowing water
HR > 2.0	**Extreme**	**Dangerous for all** – Extreme danger: flood zone with deep fast flowing water

2.11 Model Simulations

The design model simulations listed below were run on a fixed 2 second time step using TUFLOW Build 2013-12-AC-iDP-w64.

- 0.5% AEP (1 in 200 year) for Present Day (2015);
- 0.5% AEP (1 in 200 year) including allowance for Climate Change to 2115;
- 0.1% AEP (1 in 1000 year) for Present Day (2015); and,
- 0.1% AEP (1 in 1000 year) including allowance for Climate Change to 2115.

3 Mapping Outputs

3.1 Breach Modelling Results

The following maps have been prepared to present the findings of the breach modelling and are included within Appendix A of the Level 2 SFRA.

Modelled Scenario 0.5% AEP (Present Day 2015)

Figure A9	0.5% AEP (Present Day 2015) Maximum Flood Depth View 1
Figure A10	0.5% AEP (Present Day 2015) Maximum Flood Depth View 2
Figure A11	0.5% AEP (Present Day 2015) Maximum Flood Depth View 3
Figure A12	0.5% AEP (Present Day 2015) Hazard Rating View 1
Figure A13	0.5% AEP (Present Day 2015) Hazard Rating View 2
Figure A14	0.5% AEP (Present Day 2015) Hazard Rating View 3

Modelled Scenario 0.5% AEP (Climate Change 2115)

Figure A15	0.5% AEP (Climate Change to 2115) Maximum Flood Depth View 1
Figure A16	0.5% AEP (Climate Change to 2115) Maximum Flood Depth View 2
Figure A17	0.5% AEP (Climate Change to 2115) Maximum Flood Depth View 3
Figure A18	0.5% AEP (Climate Change to 2115) Hazard Rating View 1
Figure A19	0.5% AEP (Climate Change to 2115) Hazard Rating View 2
Figure A20	0.5% AEP (Climate Change to 2115) Hazard Rating View 3

Modelled Scenario 0.1% AEP (Present Day 2015)

Figure A21	0.1% AEP (Present Day 2015) Maximum Flood Depth View 1
Figure A22	0.1% AEP (Present Day 2015) Maximum Flood Depth View 2
Figure A23	0.1% AEP (Present Day 2015) Maximum Flood Depth View 3
Figure A24	0.1% AEP (Present Day 2015) Hazard Rating View 1
Figure A25	0.1% AEP (Present Day 2015) Hazard Rating View 2
Figure A26	0.1% AEP (Present Day 2015) Hazard Rating View 3

Modelled Scenario 0.1% AEP (Climate Change 2115)

Figure A27	0.1% AEP (Climate Change to 2115) Maximum Flood Depth View 1
Figure A28	0.1% AEP (Climate Change to 2115) Maximum Flood Depth View 2
Figure A29	0.1% AEP (Climate Change to 2115) Maximum Flood Depth View 3
Figure A30	0.1% AEP (Climate Change to 2115) Hazard Rating View 1
Figure A31	0.1% AEP (Climate Change to 2115) Hazard Rating View 2
Figure A32	0.1% AEP (Climate Change to 2115) Hazard Rating View 3

3.2 Areas Susceptible to Tidal Flooding

In addition, Figure A33 has been prepared to identify those areas of Colchester upstream of the Colne Barrier at a level below 3.2mAOD and could be subject to flooding on a more regular basis, as described in Section 1.3.

Figure A33 Areas below the manning threshold of the Barrier (3.1mAOD)

The figure shows areas along Haven Road and Hawkins Road, which are particularly low-lying and may be susceptible to tidal flooding.

Haven Road has been identified by Colchester BC and the Environment Agency as an area which experiences flooding during high tides, which is exacerbated during periods of heavy rainfall. Further details are included in Section 4.3 of the Level 1 SFRA Report.

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