



Thurrock Flexible Generation Plant

**Preliminary Environmental Information Report
Appendix 15.2: Flood Zones and Model Data**

Date: September 2018

Environmental Impact Assessment
Preliminary Environmental Information Report

Volume 6
Appendix 15.2

Report Number: JER1638

Version: Final

Date: September 2018

This report is also downloadable from the Thurrock Flexible Generation Plant website at:
<http://www.thurrockpower.co.uk>

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Contributors: -

Checked by: Richard Chalmers and Tom Dearing

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Summary

This document presents publicly available data used to inform the assessment in Volume 3, Chapter 15: Hydrology and Flood Risk.

Qualifications

This document has been prepared by Jonathan Morley, a Principal Consultant, who has 12 years' experience of environmental impact assessment.

It has been checked by Richard Chalmers who is a Chartered Engineer and Royal Academy of Engineering Teaching Fellow, with over 30 years' professional experience in consultancy in the UK.

1. Introduction

1.1.1 This appendix (appendix 15.2) presents the Environment Agency (EA) indicative Flood Zone information for the hydrology and flood risk study area for Thurrock Flexible Generation Plant (as defined in Volume 3, Chapter 15: Hydrology and Flood Risk).

1.1.2 EA Flood Zone mapping has been used to inform the baseline and impact assessment of flood risk associated with the Thurrock Flexible Generation Plant presented in Volume 3, Chapter 15: Hydrology and Flood Risk.

1.1.3 The EA indicative Flood Zones show the probability of river and sea flooding, and do not consider the presence of defences. They are shown on the EA's Flood Map for Planning (Rivers and Sea)¹. Flood Zone definitions are:

- Zone 1 Low Probability Land which has a less than 1 in 1,000 annual probability of river or sea flooding;
- Zone 2 Medium Probability Land which has between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding;
- Zone 3a High Probability Land which has a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding; and
- Zone 3b The Functional Floodplain which comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the EA.

1.1.4 The majority of the hydrology and flood risk study area is categorised as Zone 2 and 3, as shown in Section 2 – EA flood maps. Note that these maps shown an earlier iteration of the proposed development boundary but do include the entire area of the current application boundary, which is shown in Volume 2, Chapter 2: Project Description of the PEIR.

1.1.5 The EA flood maps show the location of main rivers, and ordinary watercourses, including Lead Local Flood Authority (LLFA) watercourses within the hydrology and flood risk study area. They are defined as:

- Main rivers – watercourses where the EA has permissive powers over their management; and
- Ordinary watercourses – includes rivers, streams, ditches, drains which do not form part of a main river and are managed by Essex County Council, as Lead Local Flood Authority.

1.1.6 The main rivers are listed in Table 1.1.

Table 1.1: Main Rivers or IDB watercourses in the hydrology and flood risk study area.

Watercourse name	EA main river or LLFA watercourse
West Tilbury Drain	EA
Mardyke & Fobbing	EA
River Thames	EA

1.1.7 Section 3 presents the tidal breach model outputs extracted from the Thurrock Strategic Flood Risk Assessment (February 2010).

1.1.8 Section 4 presents the tidal breach model outputs extracted from the Tilbury 2 ES Appendix 16.B Level 3 Flood Risk Assessment, Document ref 6.2 16.B (September 2017).

¹ <http://environment.data.gov.uk/ds/catalogue/index.jsp#/catalogue>

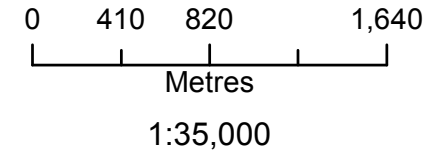
2. EA flood maps

Flood Map for Planning centred on 566300,176685







Created 23/07/2018 - Ref: EAn/2018/92748



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD



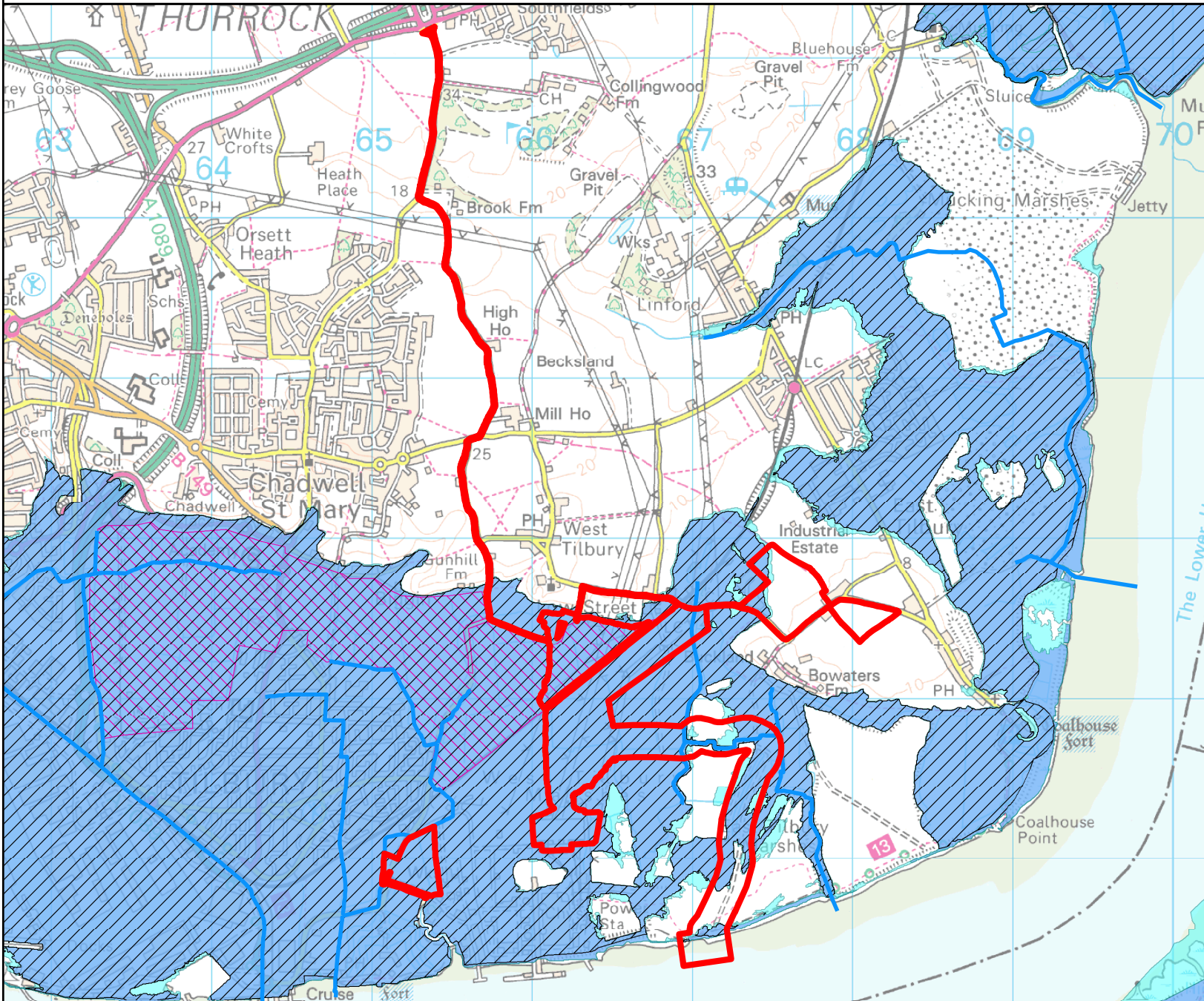
Legend

-  Site Location
-  Main Rivers
-  Areas Benefiting from Defence
-  Flood Storage Area
-  Flood Zone 3
-  Flood Zone 2

Flood Map for Planning (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

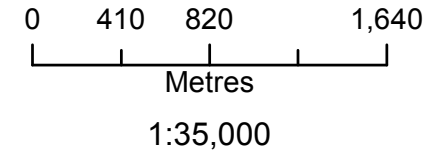


Recorded Flood Events Outlines Map centred on 566300,176685

Created 23/07/2018 - Ref: EAn/2018/92748

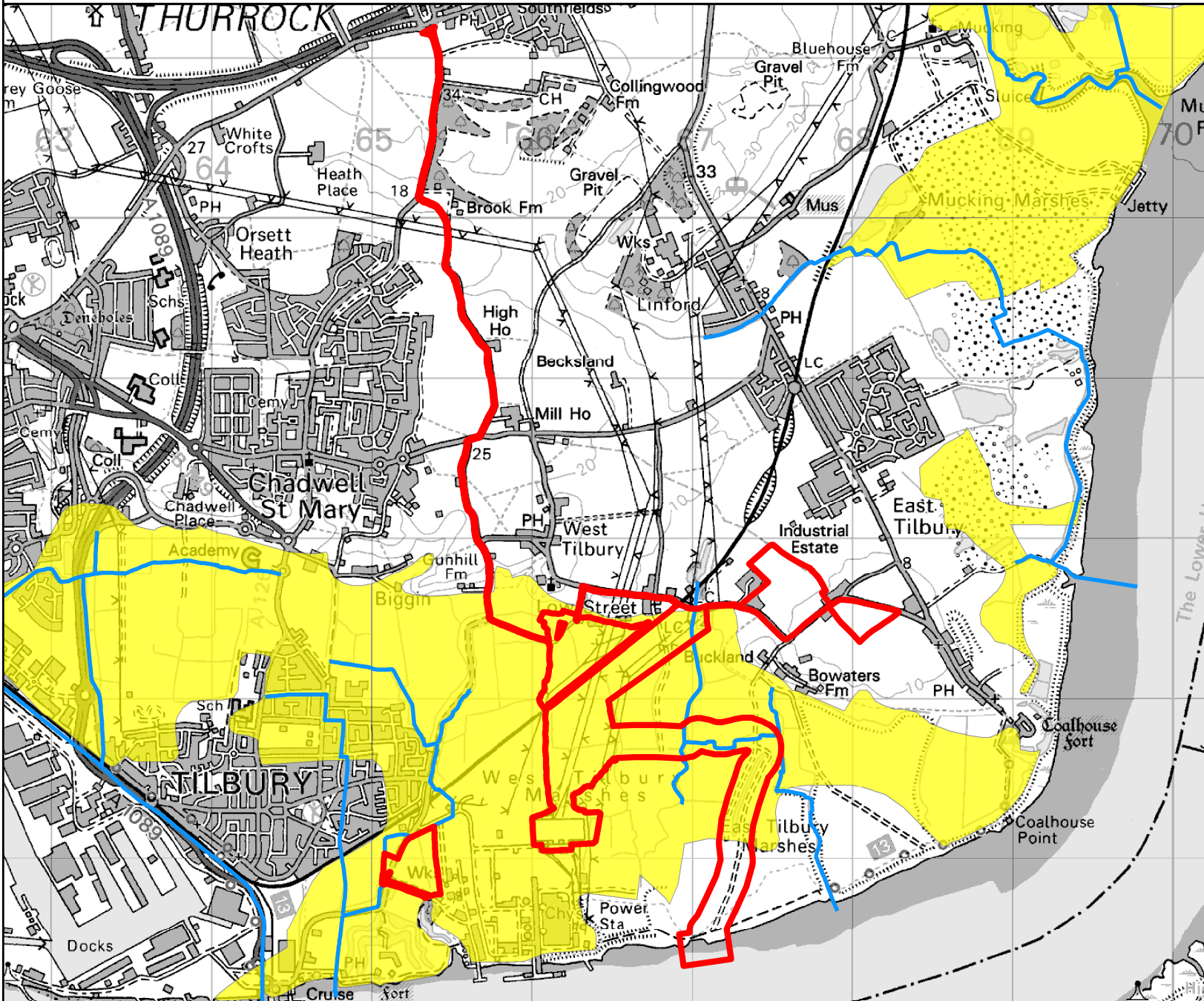


Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD



Legend

- Site Location
- Main Rivers
- 1953 Outline

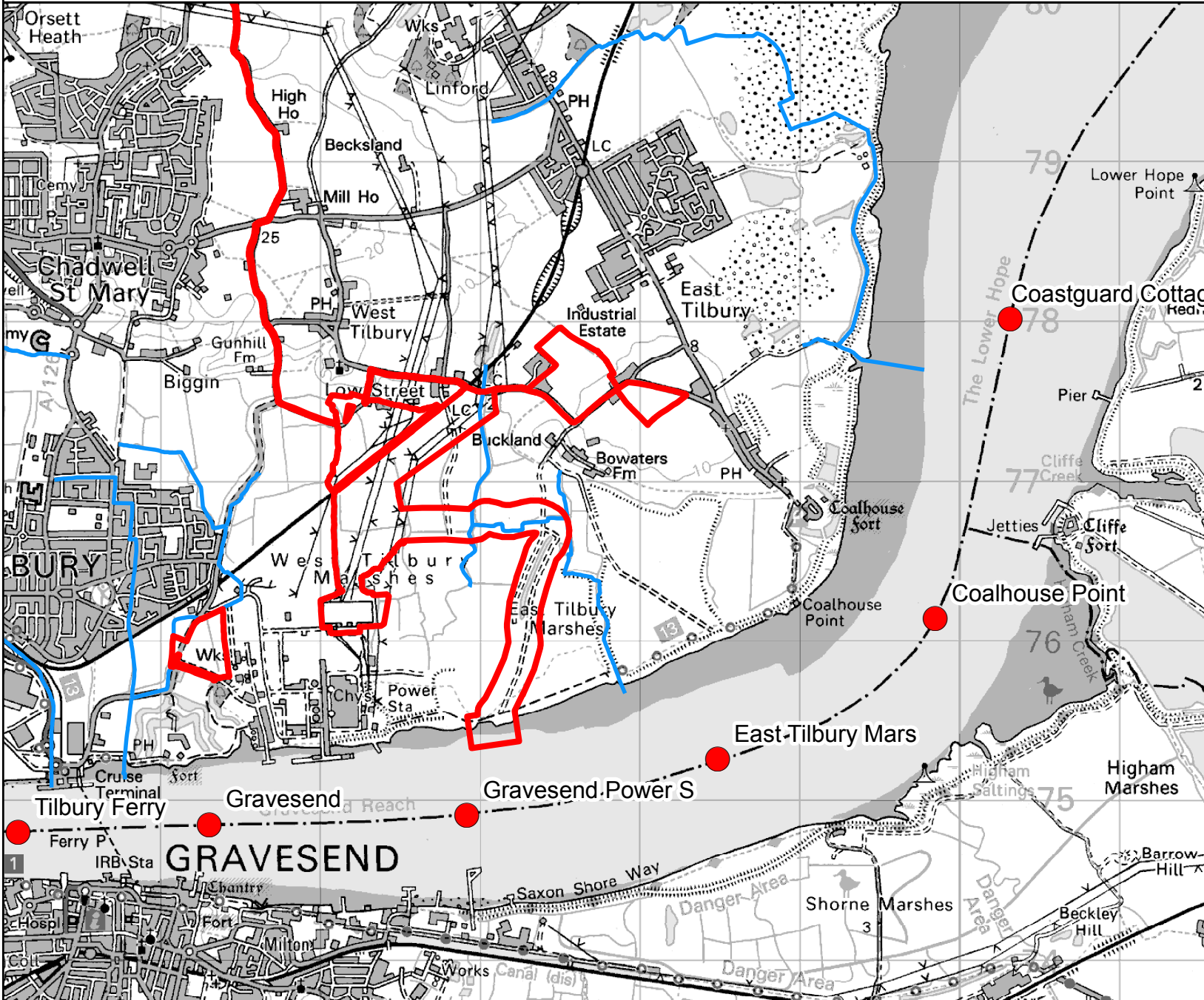


The historic flood event outlines are based on a combination of anecdotal evidence, Environment Agency staff observations and survey.

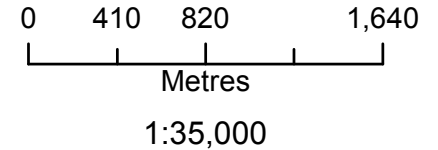
Our historic flood event outlines do not provide a definitive record of flooding. It is possible that there will be an absence of datain places where we have not been able to record the extent of flooding. It is also possible for errors occur in the digitisation of historic records of flooding.

Thames TE2100 Nodes

Map centred on 566300,176685 Created 23/07/2018 - Ref: EAn/2018/92748



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

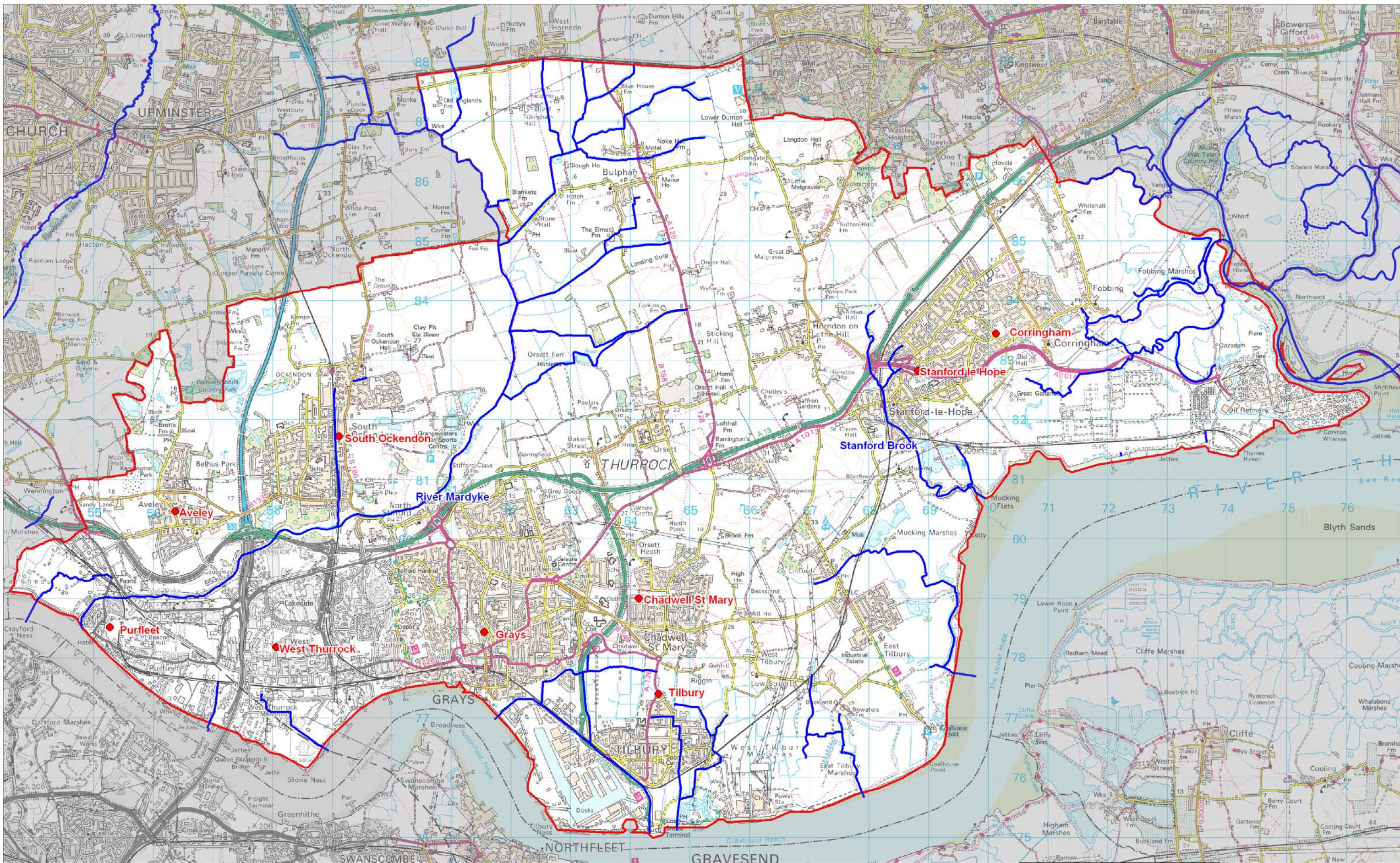


Legend

- TE2100 Nodes
- Site Location
- Main Rivers

This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences if present.

3. Thurrock Strategic Flood Risk Assessment (February 2010)



Project:

Thurrock Borough
Council SFRA Level 1

Title:

Study Area

- Main Watercourses
- Main Urban Centres
- Thurrock Borough Council Boundary



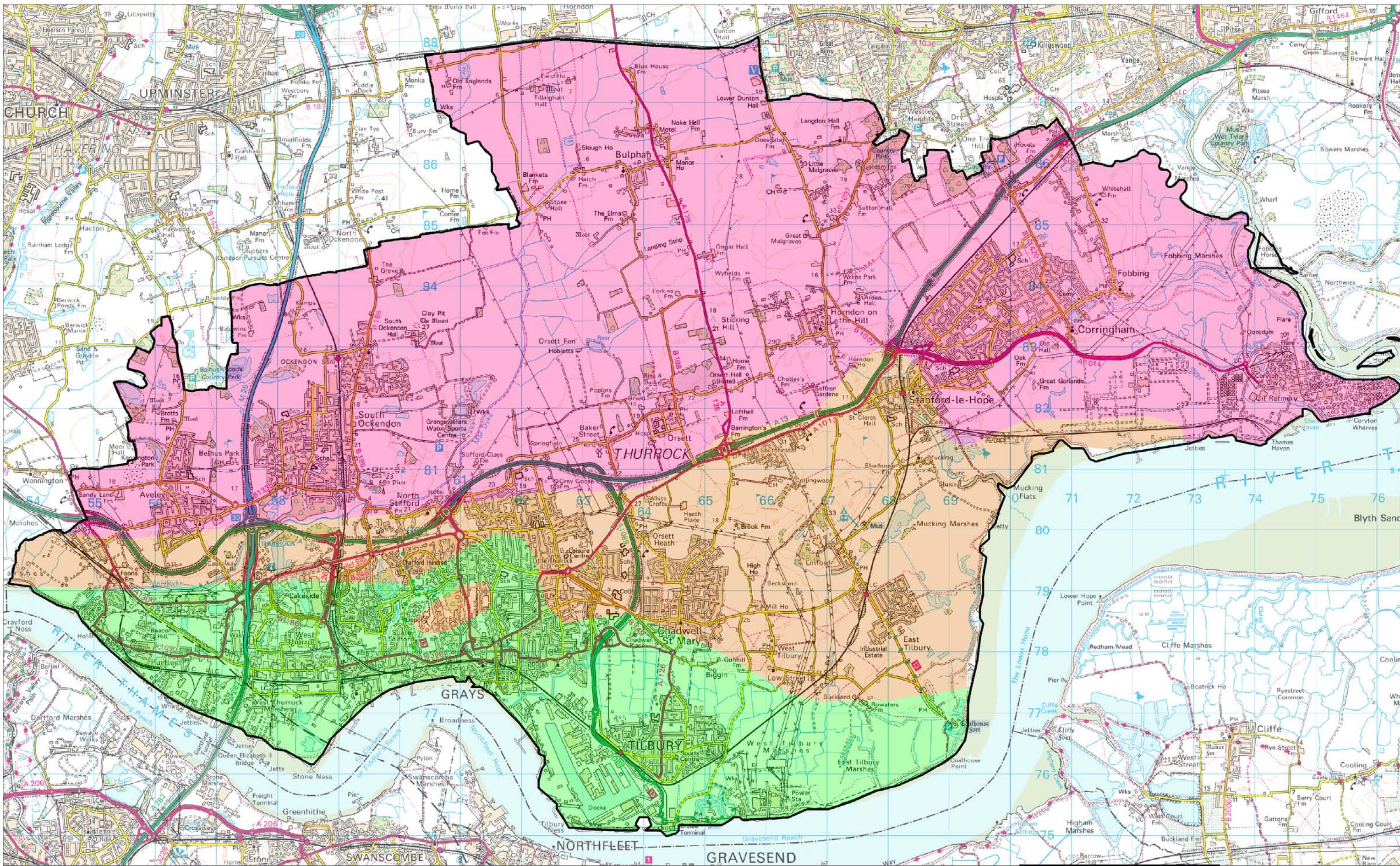
FIGURE 1

Scale: 1:100,000 @ A3

Drw SW Date 05/09 Rev 1



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Project:

Thurrock Borough
Council SFRA Level 1

Title:

Solid Geology

- Thurrock Borough Council Boundary
- London Clay
- Lambeth Group and Thanet Beds
- Chalk



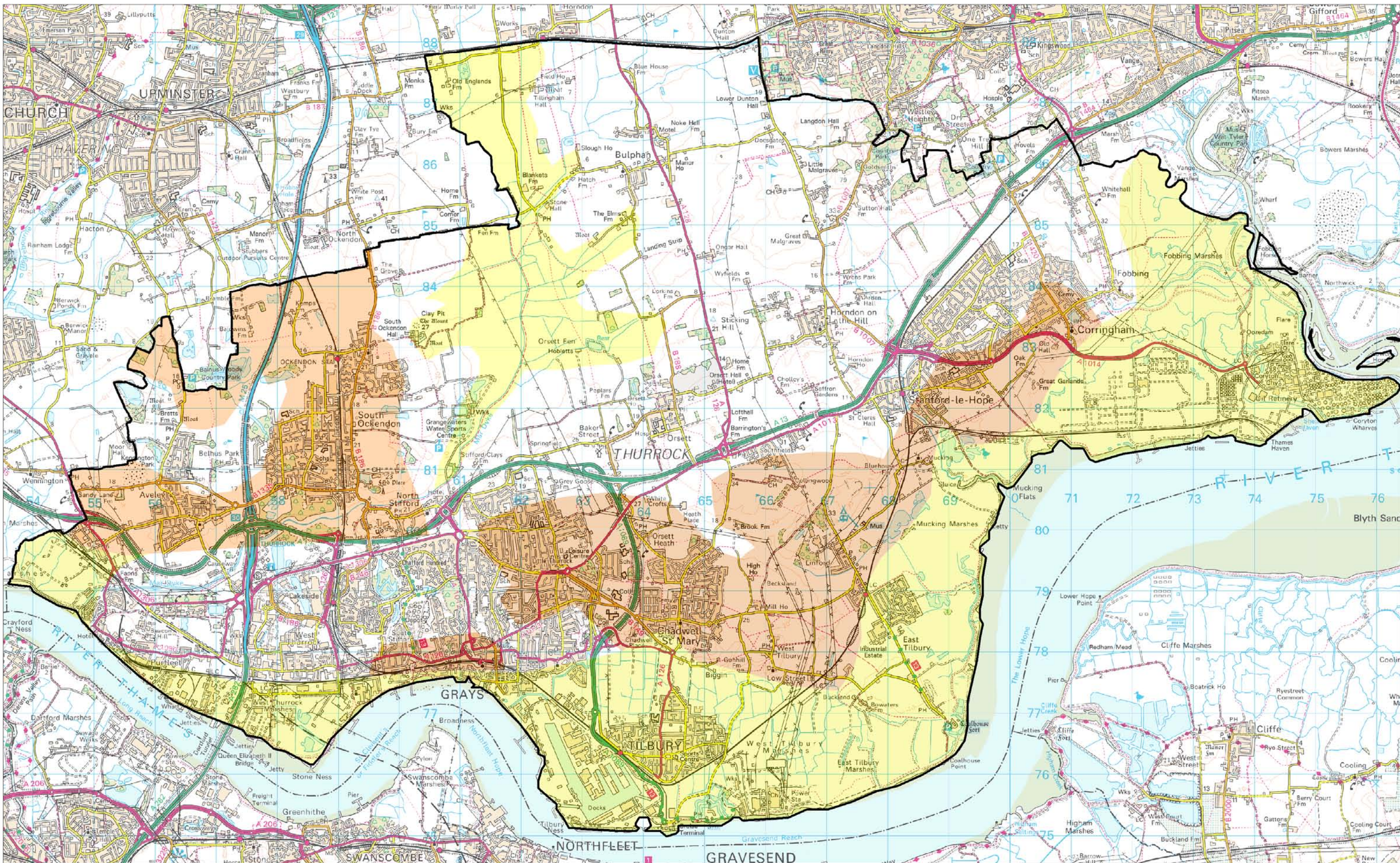
FIGURE 2A

Scale: 1:100,000 @ A3

Drw SW Date 05/09 Rev 1



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Project:

Thurrock Borough
Council SFRA Level 1

Title:

Drift Geology

- Thurrock Borough Council Boundary
- Alluvium
- River Terrace Deposits
- Drift Geology not mapped



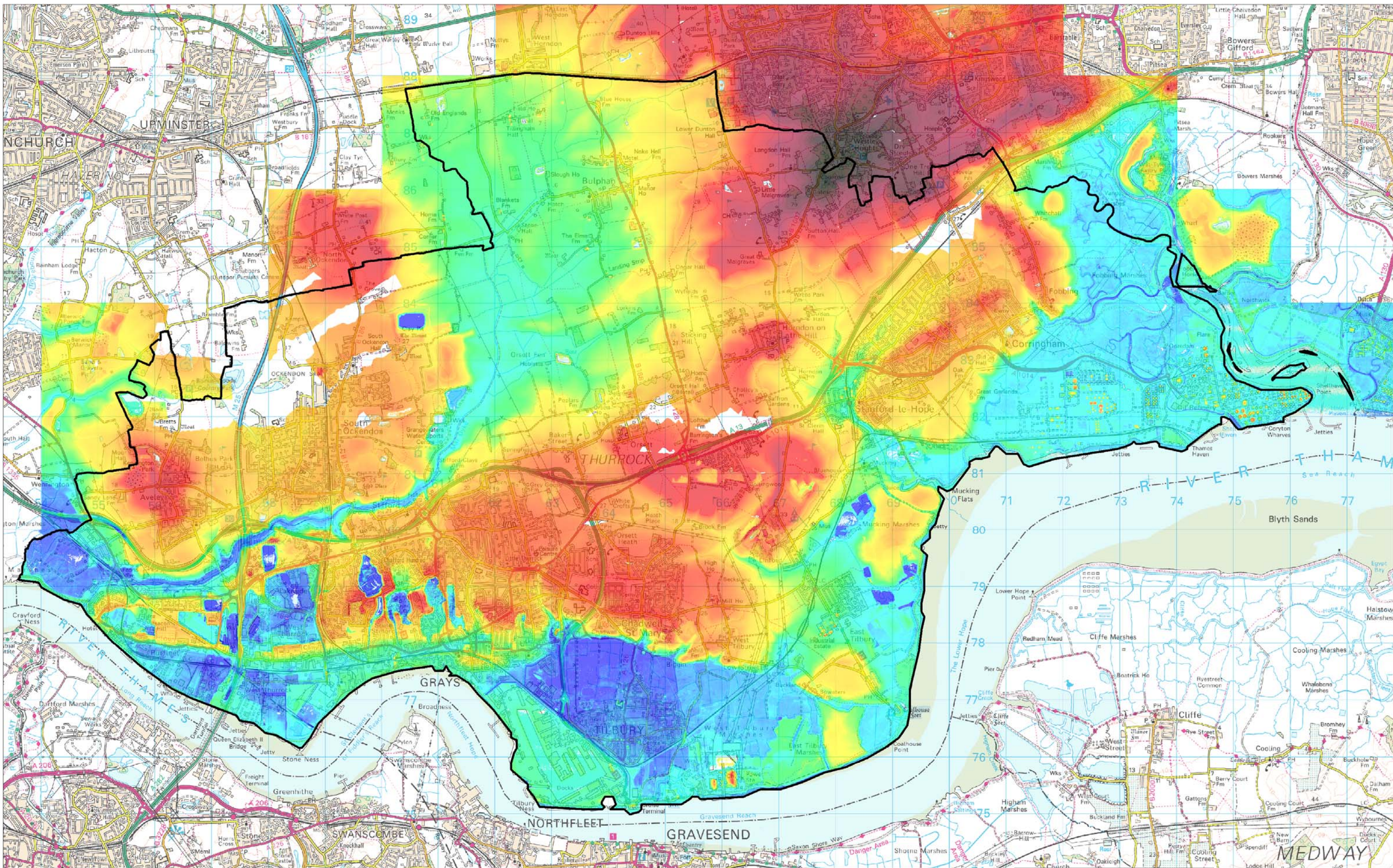
FIGURE 2B

Scale: 1:100,000 @ A3

Drw SW Date 05/09 Rev 1



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Project:

Thurrock Borough
Council SFRA Level 1

Title:

Aerial Survey LiDAR
Topographic Data

Elevation [m AOD]:



Thurrock Borough Council Boundary



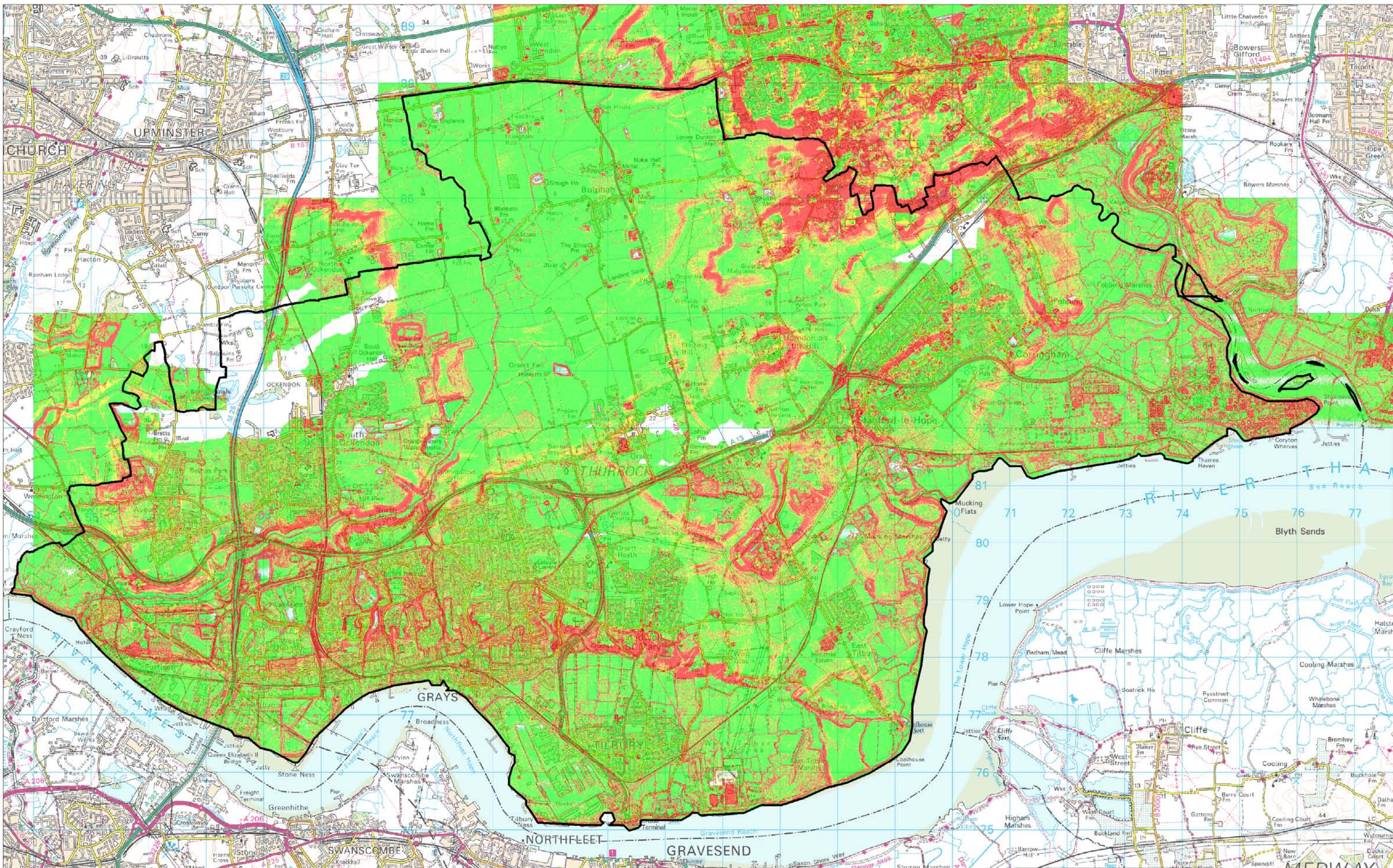
FIGURE 3

Scale: 1:100,000 @ A3

Drw SW Date 05/09 Rev 1



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Project:
**Thurrock Borough
 Council SFRA Level 1**

Title:
**Digital Terrain Model
 Slope Analysis**






- | | | | |
|---|-----------------------------------|---|---------------|
|  | Thurrock Borough Council Boundary |  | 3 - 4 degrees |
|  | 0 - 2 degrees |  | 4 + degrees |
|  | 2 - 3 degrees | | |



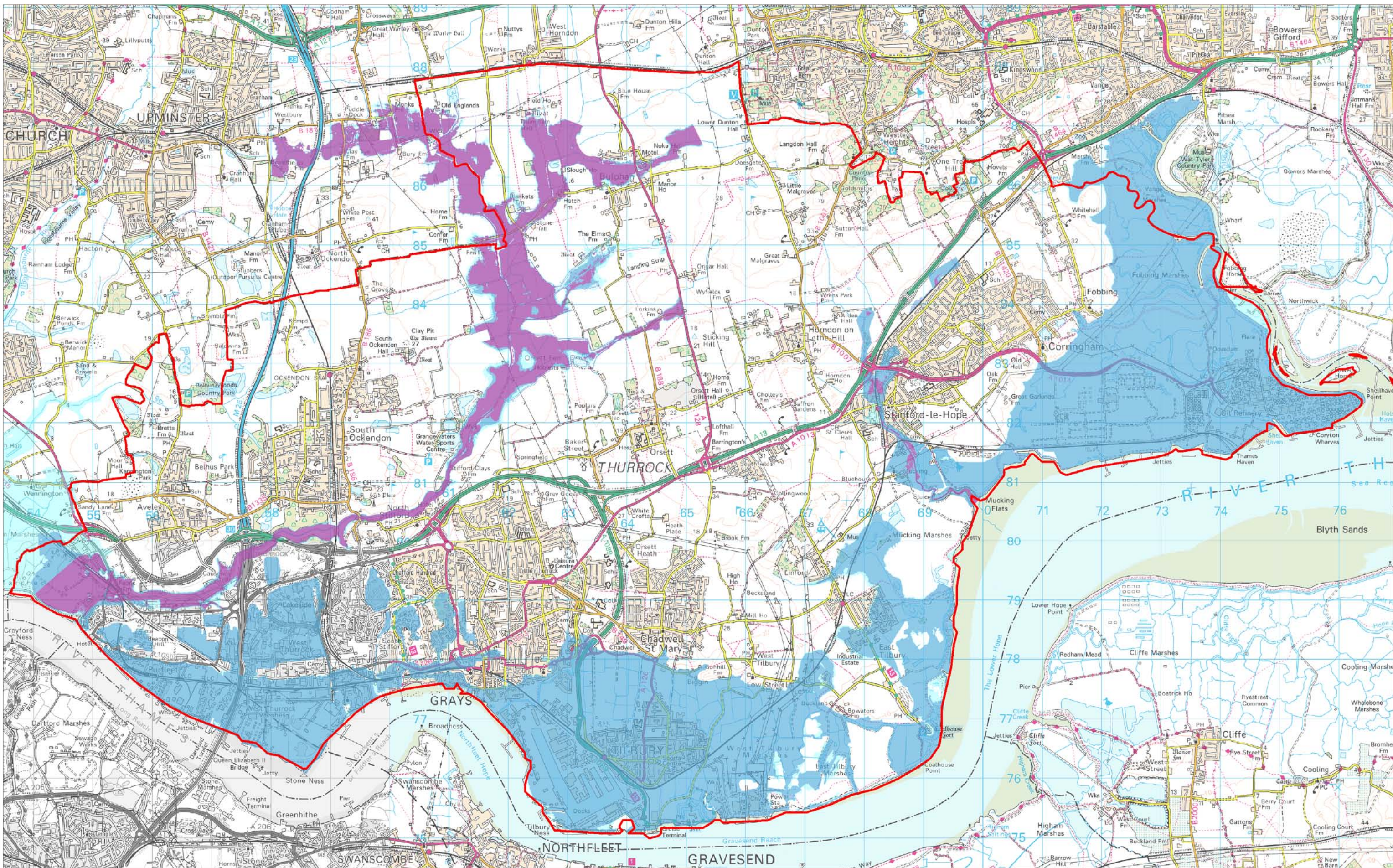
FIGURE 4

Scale: 1:100,000 @ A3

Drw SW Date 05/09 Rev 1



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Project:
**Thurrock Borough
 Council SFRA Level 1**

Title:
Flood Zones (2009)

- Flood Zone 2
- Flood Zone 3a
- Flood Zone 3b
- Thurrock Borough Council Boundary



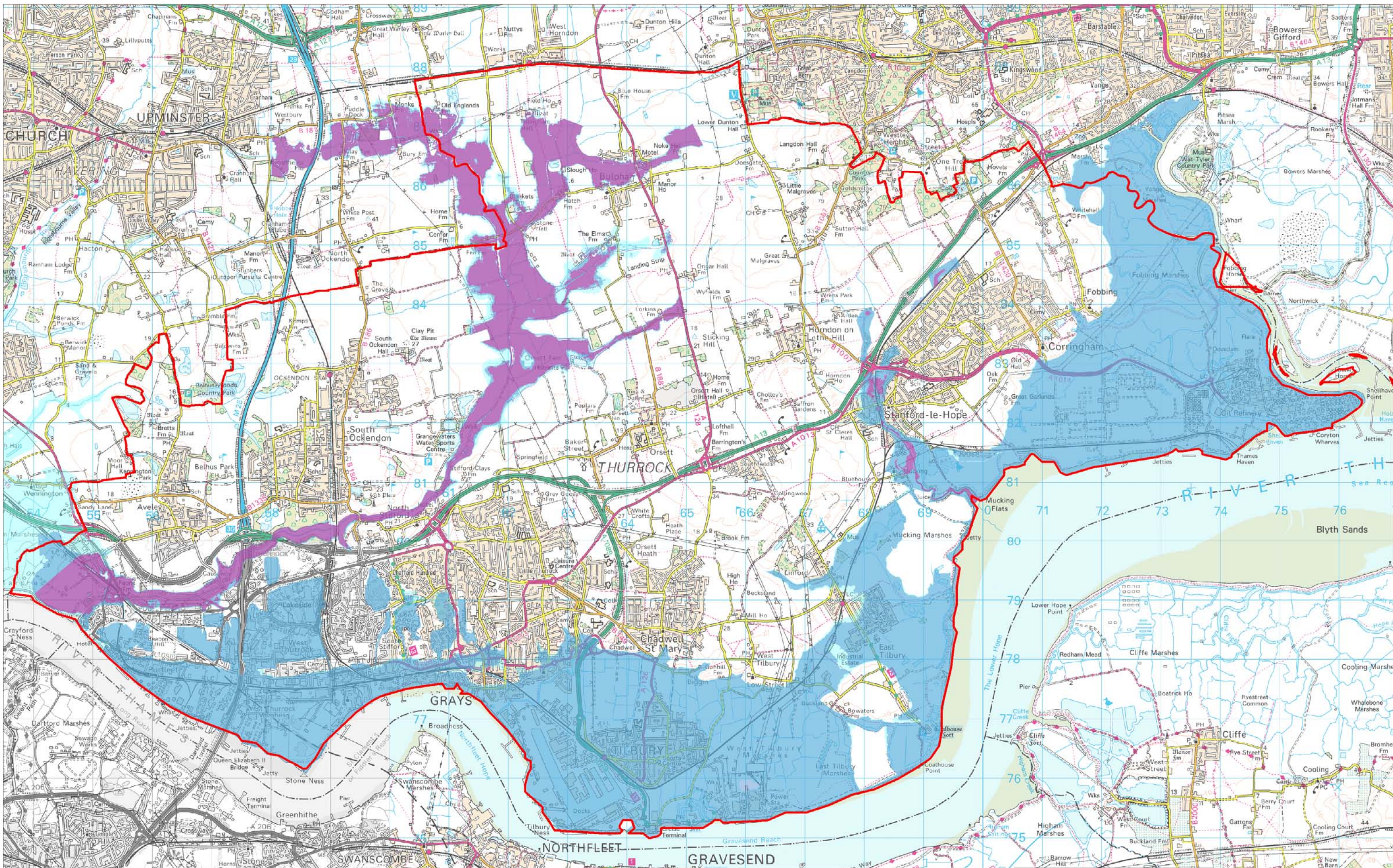
FIGURE 5

Scale: 1:100,000 @ A3

Drw SW Date 05/09 Rev 1



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Project:
**Thurrock Borough
 Council SFRA Level 1**

Title:
Flood Zones (2109)

- Flood Zone 2
- Flood Zone 3a
- Flood Zone 3b
- Thurrock Borough Council Boundary



FIGURE 6

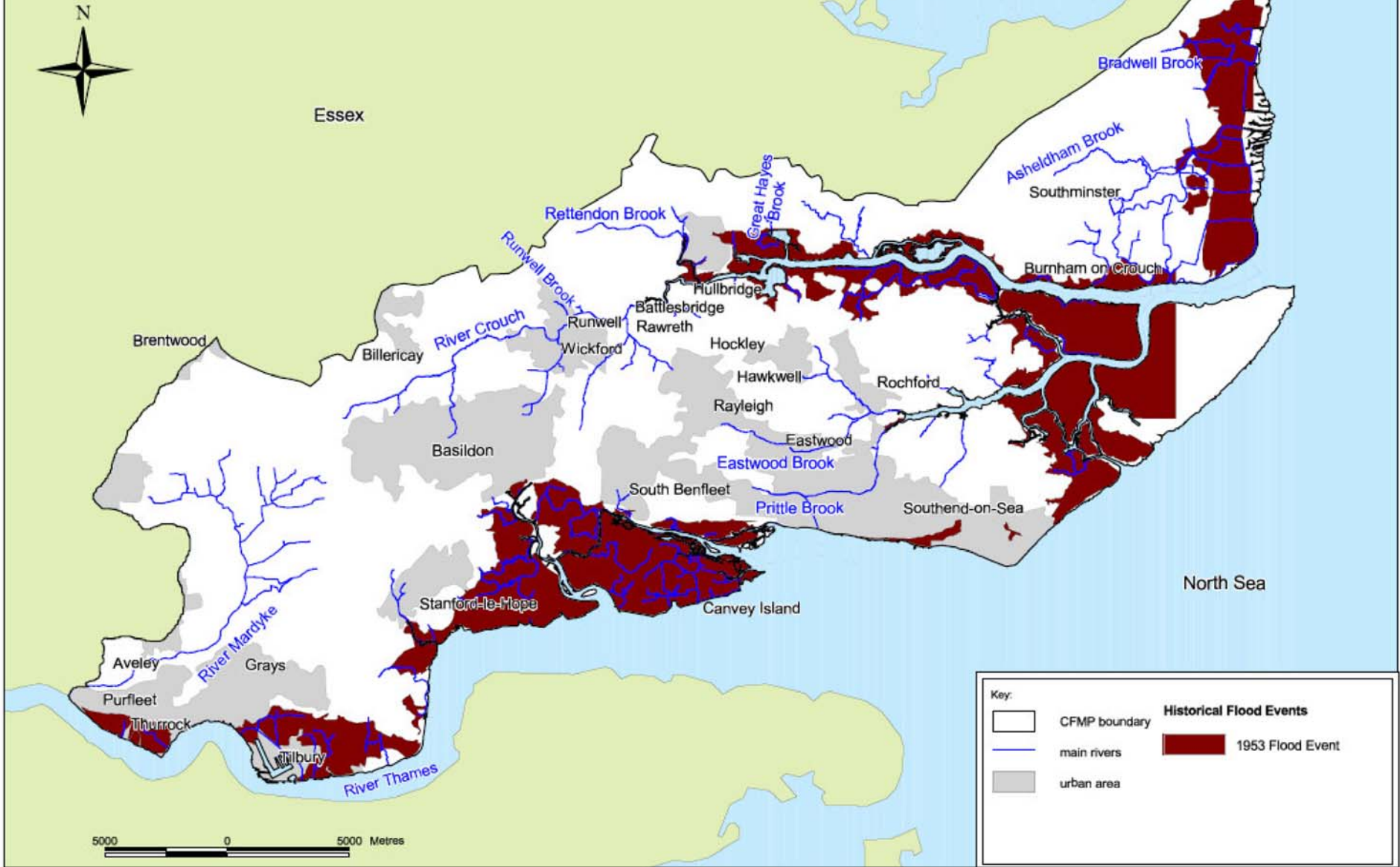
Scale: 1:100,000 @ A3

Drw SW Date 05/09 Rev 1



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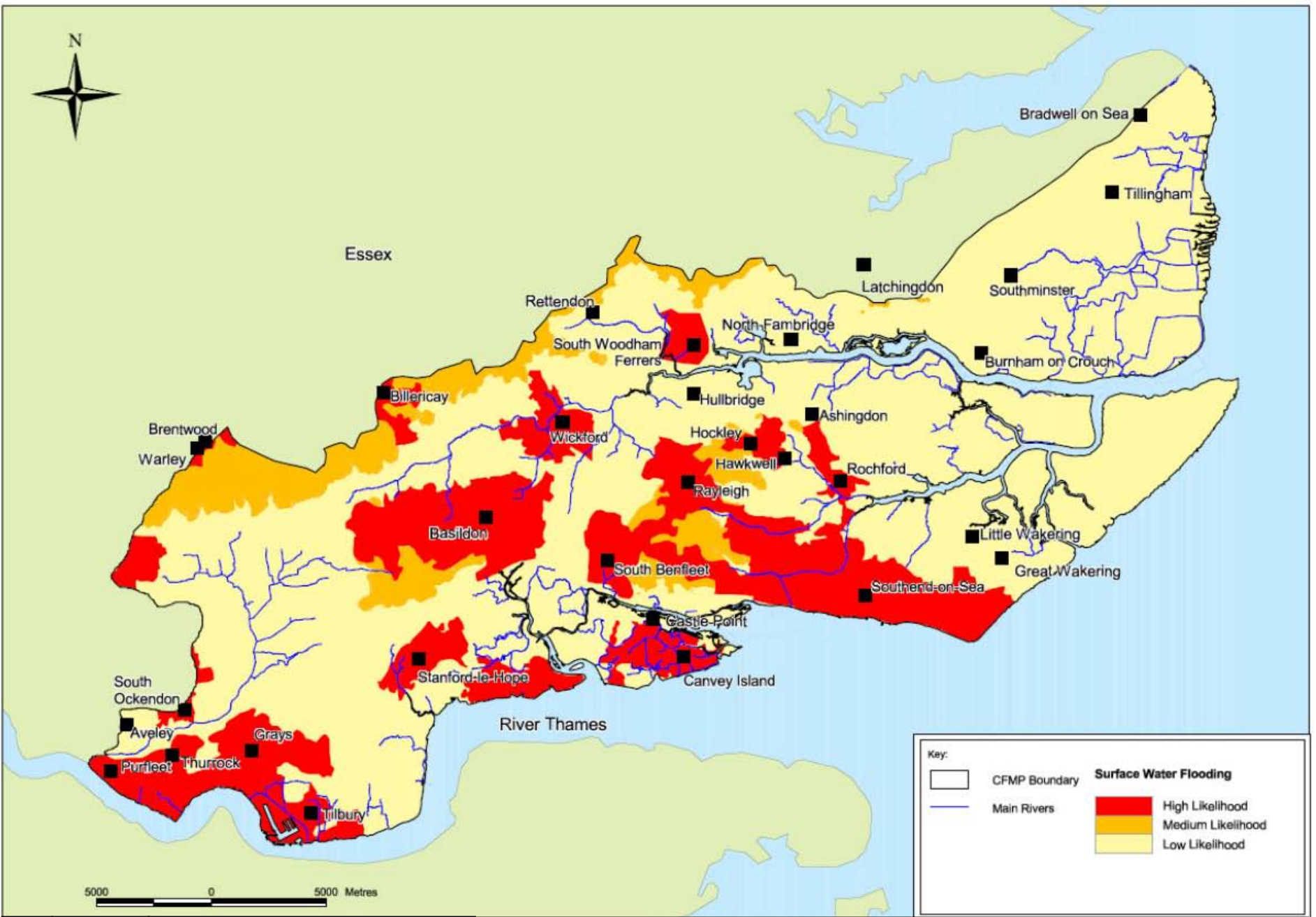


Extracted from South Essex CFMP August 2008

Flood Extent during 1953 Tidal Flood Event

THURROCK SFRA

FIGURE 7

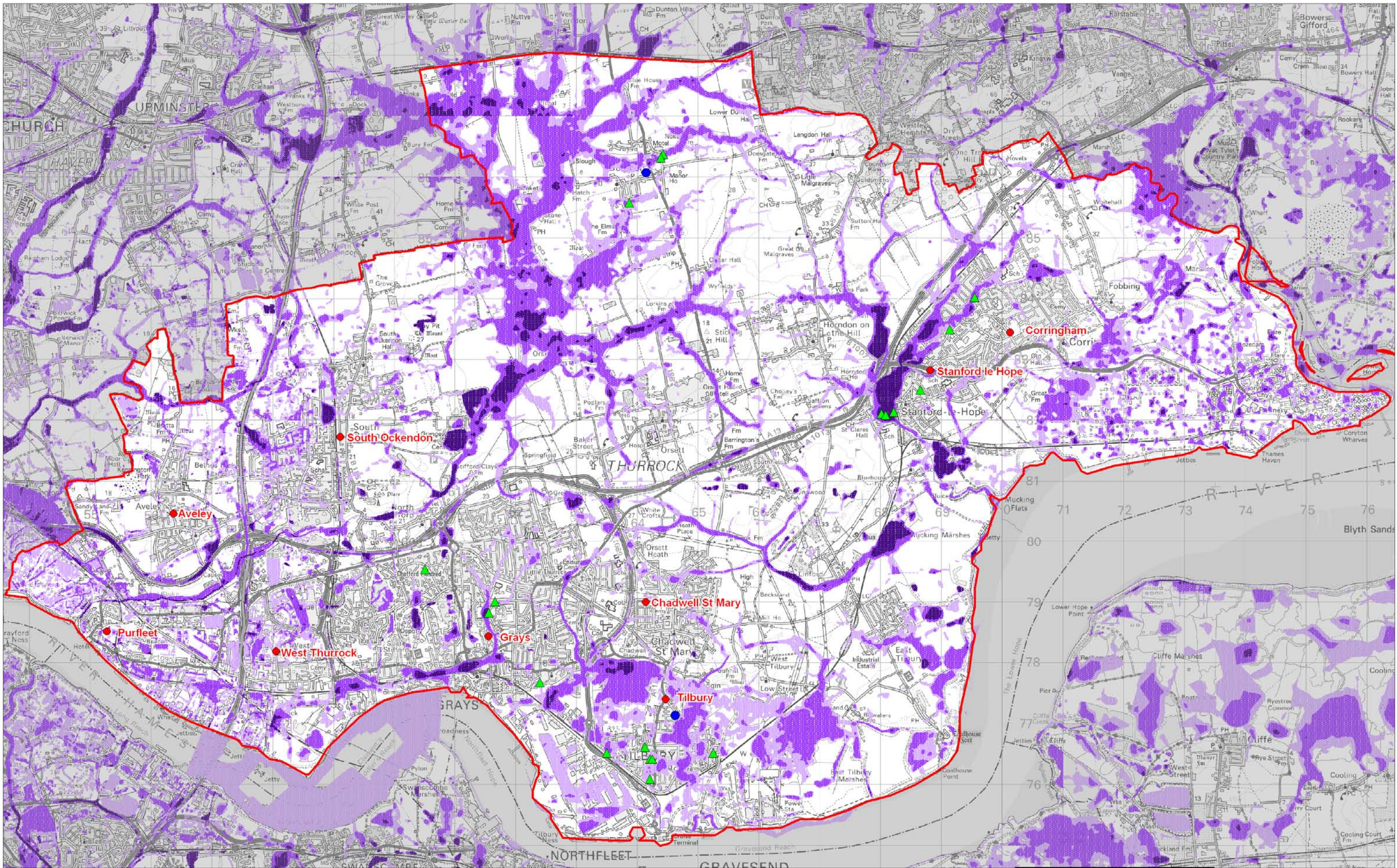


Typical likelihood of surface water flooding

Extracted from South Essex CFMP August 2008

THURROCK SFRA

FIGURE 8






Project:

Thurrock Borough
Council SFRA Level 1

Title:

Areas Susceptible to Surface Water
Flooding & Recorded Surface Water
& Sewer Flooding Events

 Thurrock Borough Council Boundary

-  Main Urban Centres
-  Surface Water Flood Event
-  Sewer Flooding Event

Areas Susceptible to Surface
Water Flooding (EA, 2009)

-  More
-  Intermediate
-  Less



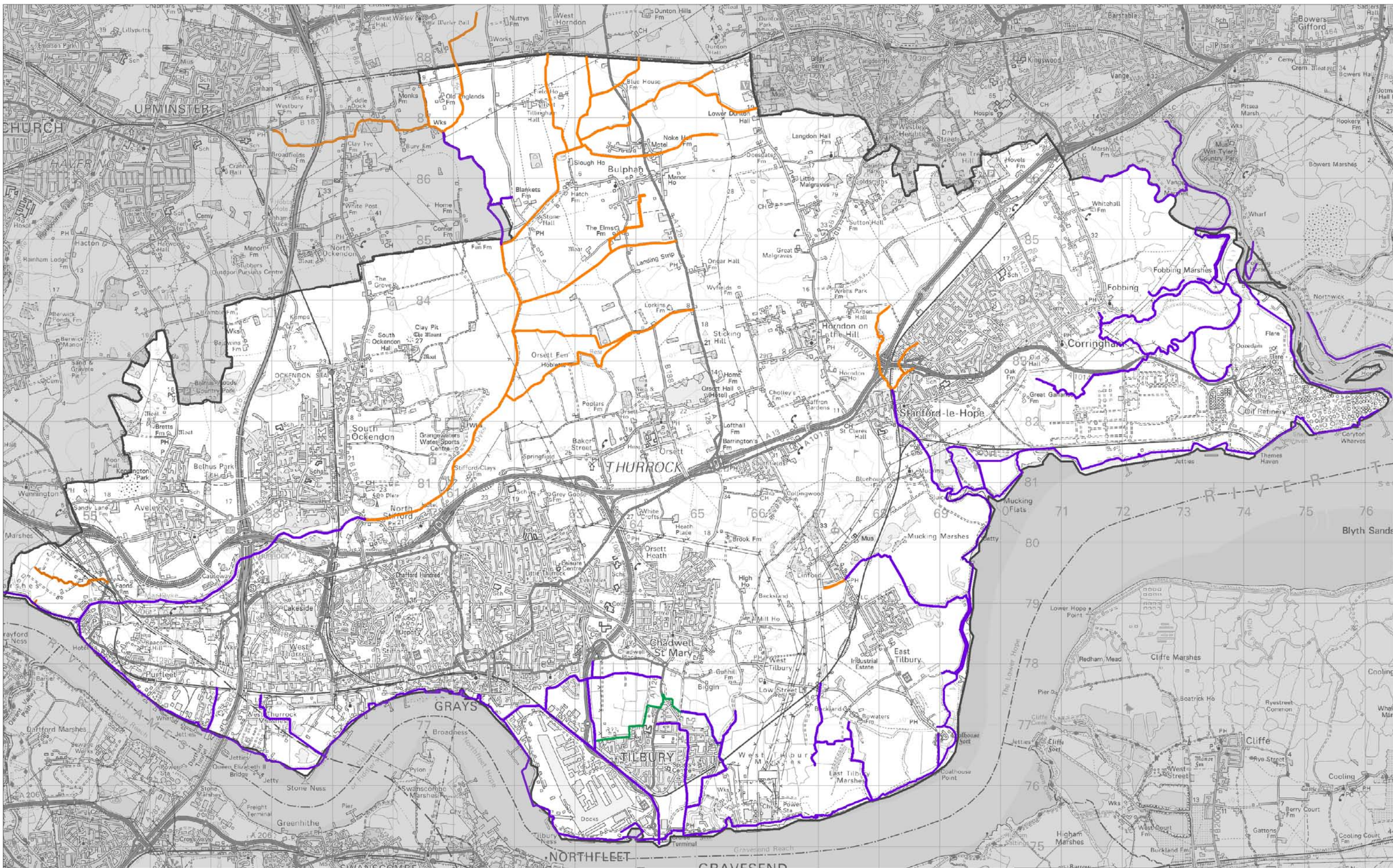
FIGURE 9

Scale: 1:100,000 @ A3

Drw SW Date 05/09 Rev 1




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Project:
**Thurrock Borough
 Council SFRA Level 1**

Title:
**NFCDD Flood Defences
 Design Standard**

 Thurrock Borough Council Boundary

Flood Defence Design Standard





-  1 in 1000 year
-  1 in 200 year
-  < 1 in 20 year
-  Unknown



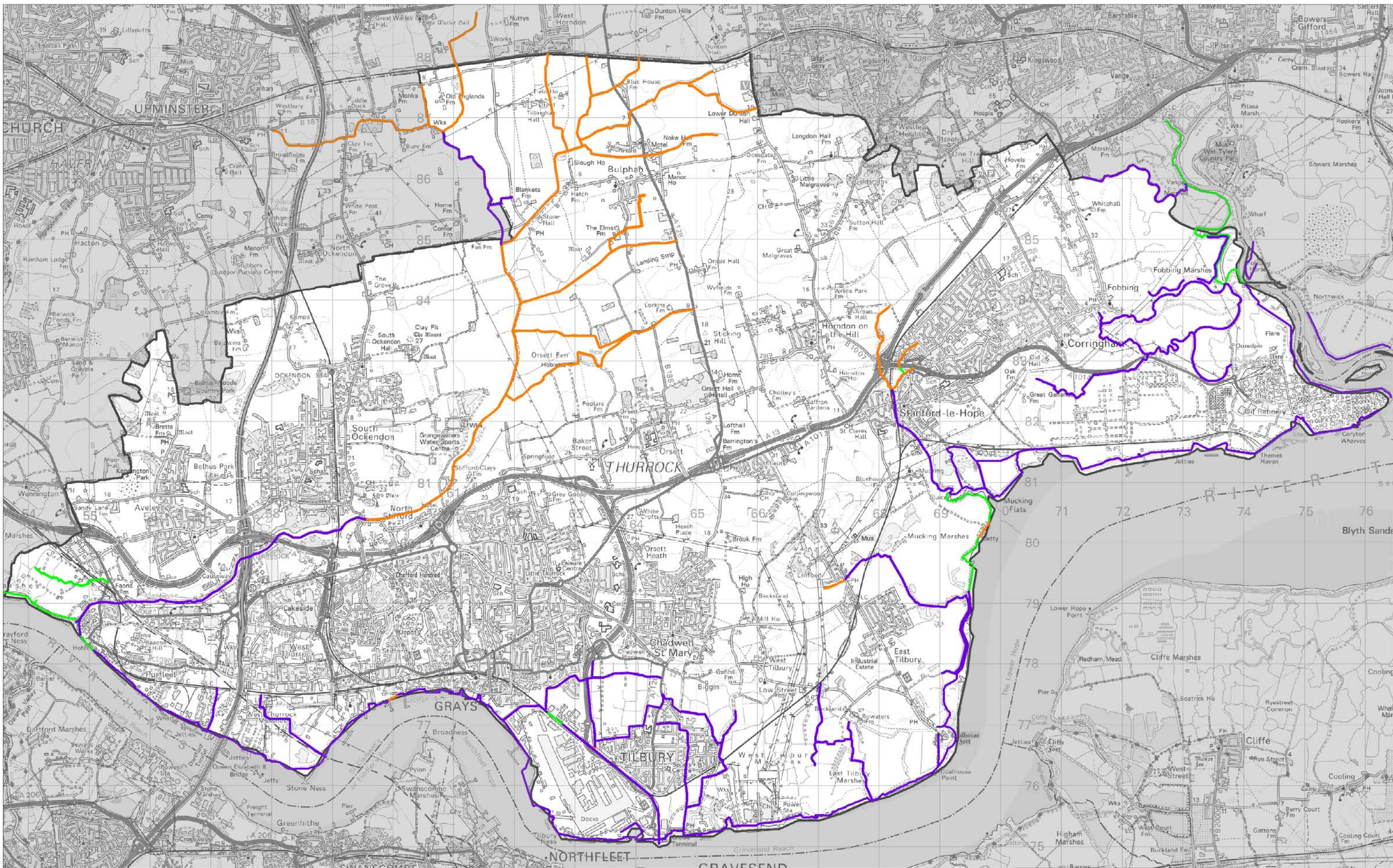
FIGURE 10A

Scale: 1:100,000 @ A3

Drw SW Date 05/09 Rev 1



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Project:
**Thurrock Borough
 Council SFRA Level 1**

Title:
**NFCDD Flood Defences
 Defences Maintainer**

Thurrock Borough Council Boundary

Flood Defence Maintainer

- Environment Agency
- Private
- Local Authority



FIGURE 10B

Scale: 1:100,000 @ A3

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Project:

Thurrock Borough
Council SFRA Level 1

Title:

Emergency Planning
Rest Centres

 Thurrock Borough Council Boundary

 Rest Centres



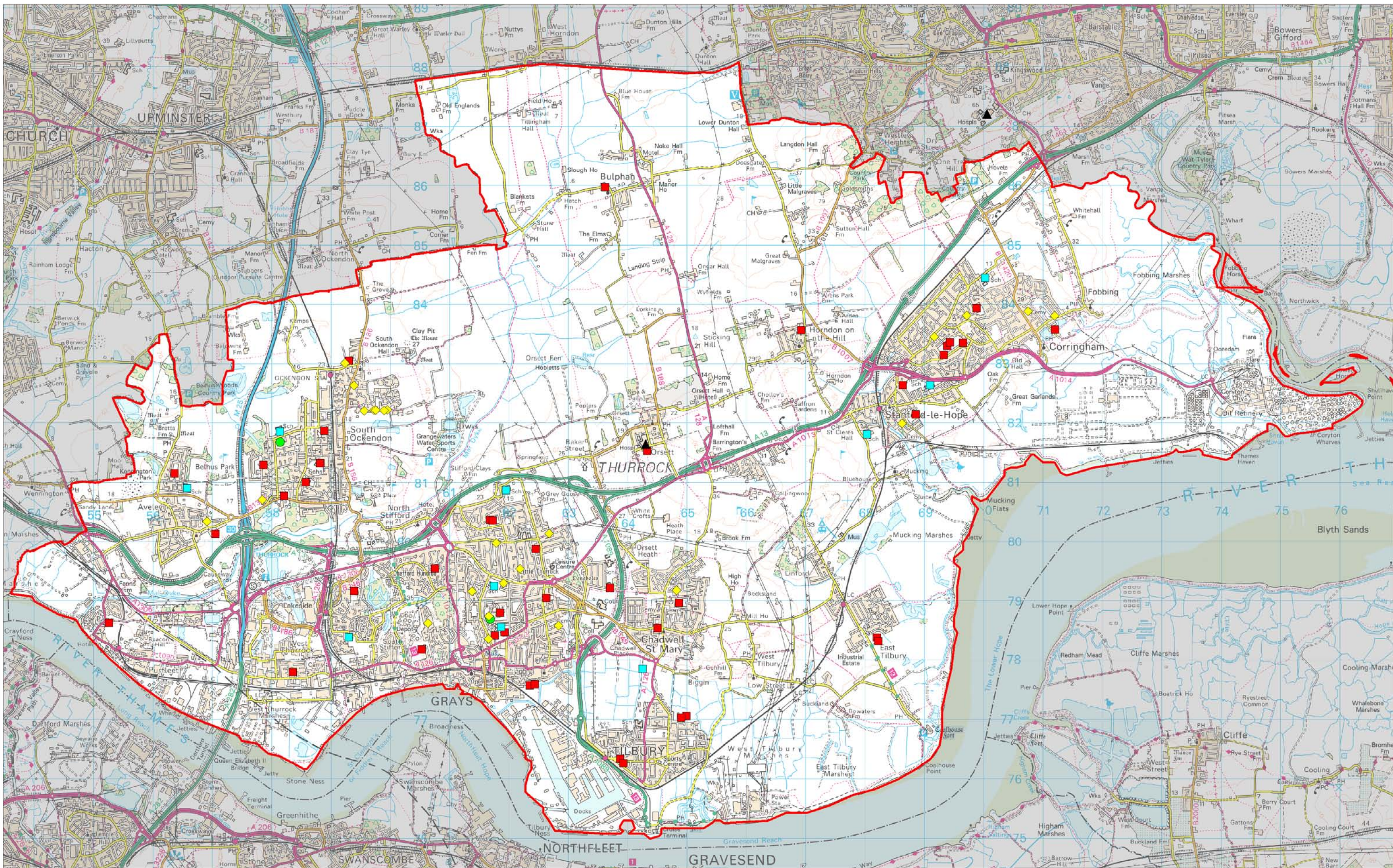
FIGURE 11

Scale: 1:100,000 @ A3

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Project:
**Thurrock Borough
 Council SFRA Level 1**

Title:
**Emergency Planning
 Vulnerable Development**

- Thurrock Borough Council Boundary
- Special Schools
- Secondary Schools
- Primary Schools
- ▲ Hospitals
- ◆ Adult Care Homes



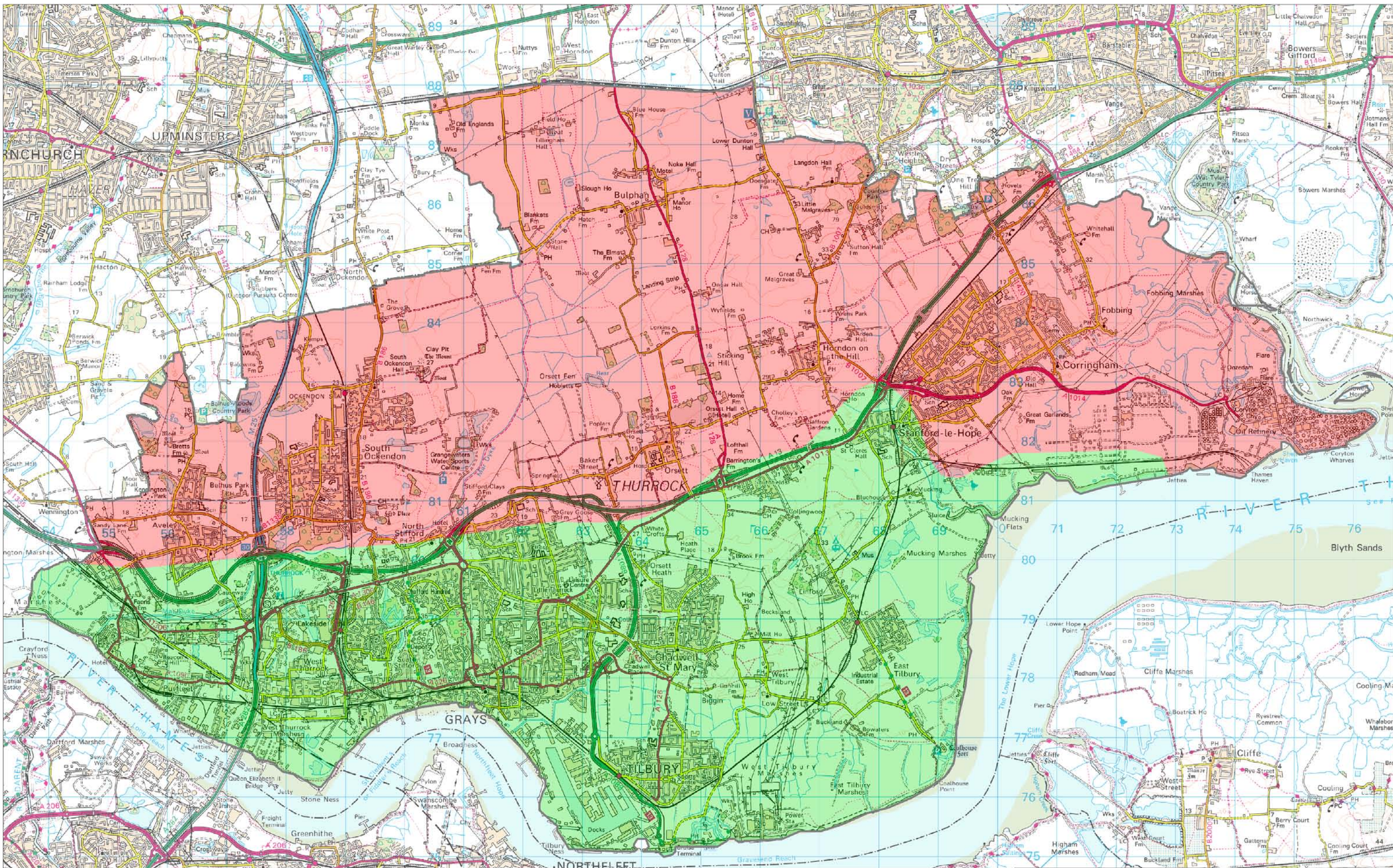
FIGURE 12

Scale: 1:100,000 @ A3

Drw SW Date 05/09 Rev 1



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Project:
**Thurrock Borough
 Council SFRA Level 1**

Title:
Sustainable Drainage Systems

Recommended SUDs

- Attenuation systems
- Infiltration systems and combined infiltration / attenuation systems

Thurrock Borough Council Boundary



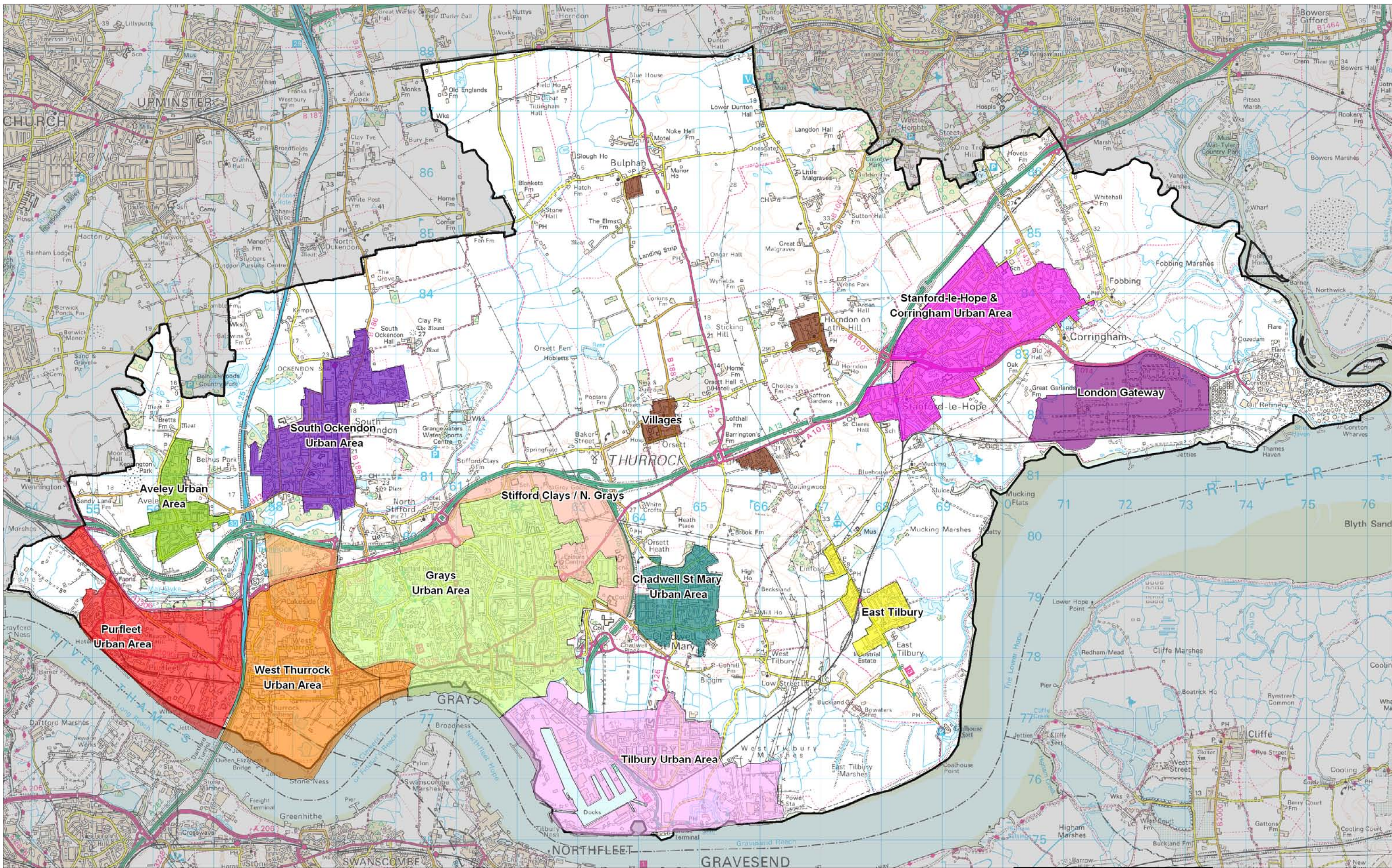
FIGURE 13

Scale: 1:100,000 @ A3

Drw SW Date 05/09 Rev 1



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Project:

Thurrock Borough
Council SFRA Level 1

Title:

Broad Areas for Regeneration



Thurrock Borough Council Boundary



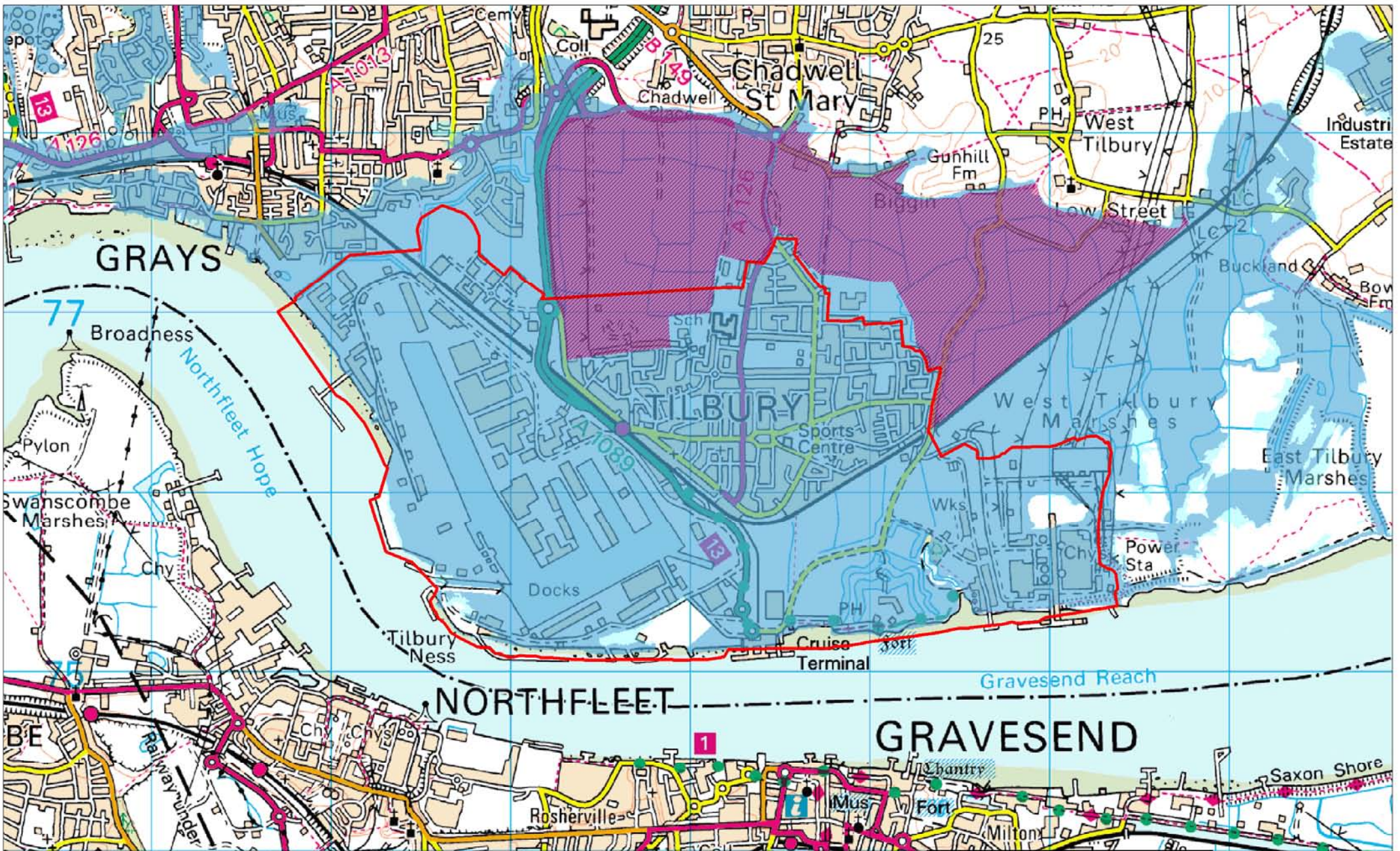
FIGURE C1

Scale: 1:100,000 @ A3

Drw SW Date 05/09 Rev 1



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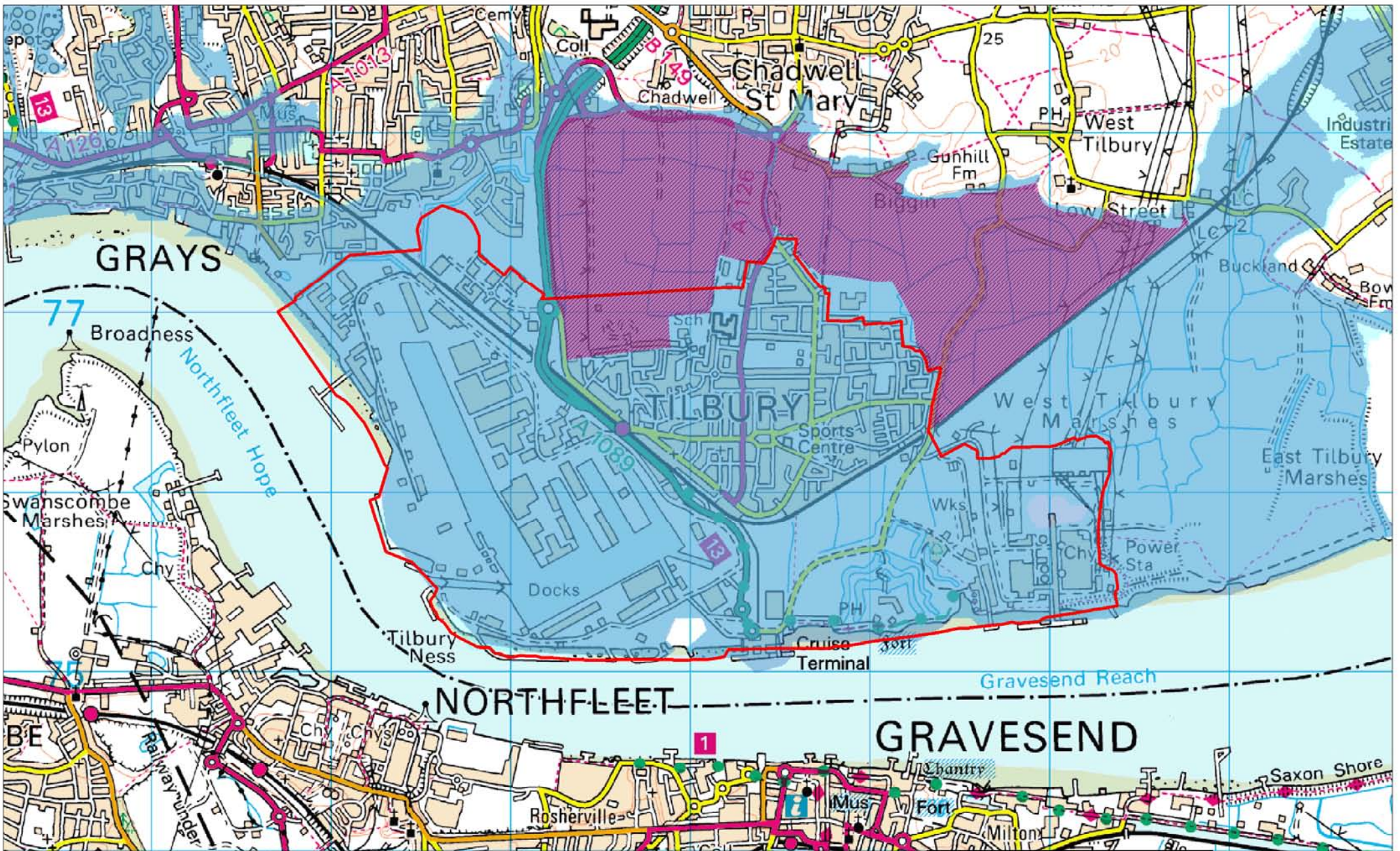
Project:
**Thurrock Borough
 Council SFRA Level 1**

Title:
**Tilbury Urban Area
 Flood Zones (2009)**

- Flood Zone 2
- Flood Zone 3a
- Flood Zone 3b
- Boundary of Broad Area for Regeneration
- Tilbury Flood Storage Area - designated 3b

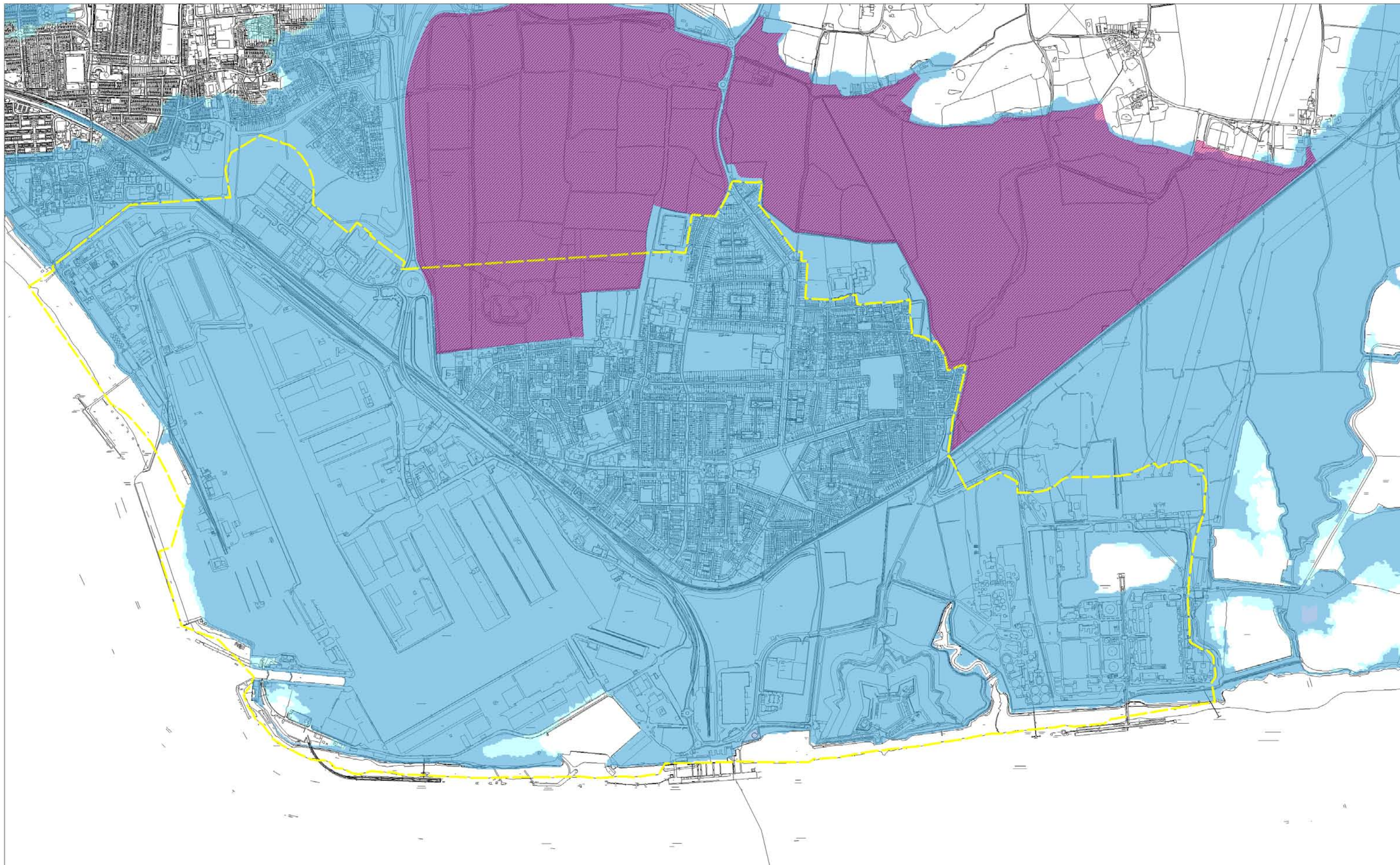
FIGURE 20
 Scale: 1:35,000 @ A4
 Drw SW Date 05/09 Rev 1

**Scott
 Wilson**
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<p>Project: Thurrock Borough Council SFRA Level 1</p>	<p>Title: Tilbury Urban Area Flood Zones (2109)</p>	<p> Flood Zone 2 Flood Zone 3a Flood Zone 3b Boundary of Broad Area for Regeneration Tilbury Flood Storage Area - designated 3b </p>	<p style="text-align: center;">FIGURE 21</p> <p>Scale: 1:35,000 @ A4</p> <p>Drw SW Date 05/09 Rev 1</p>	<p style="text-align: center;">Scott Wilson</p> <p style="text-align: center;">www.scottwilson.com</p>
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Project:

Thurrock Borough
Council SFRA Level 2

Title:


Tilbury Urban Area
Flood Zones
(2009)

 Broad Regeneration Area

 Flood Zone 3b

 Flood Zone 3a

 Flood Zone 2

 Tilbury Flood Storage
Area - designated 3b

TILBURY

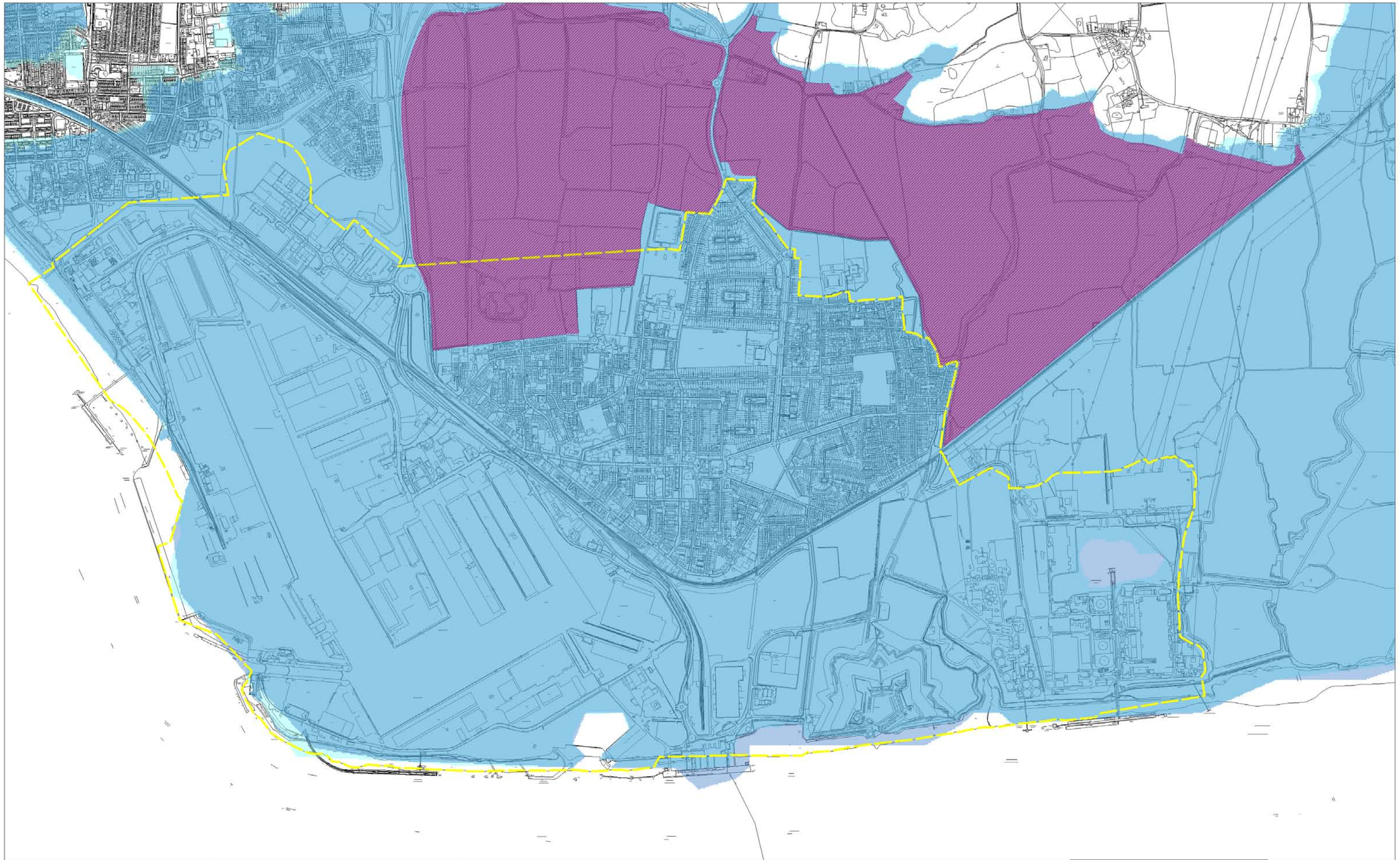
Scale 1:30,000 @ A3

Drw MV

Date 02/10



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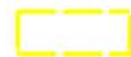


Project:

Thurrock Borough
Council SFRA Level 2

Title:

Tilbury Urban Area
Flood Zones
(2109)




Broad Regeneration Area

 Flood Zone 3b

 Flood Zone 3a

 Flood Zone 2

 Tilbury Flood Storage
Area - designated 3b

TILBURY

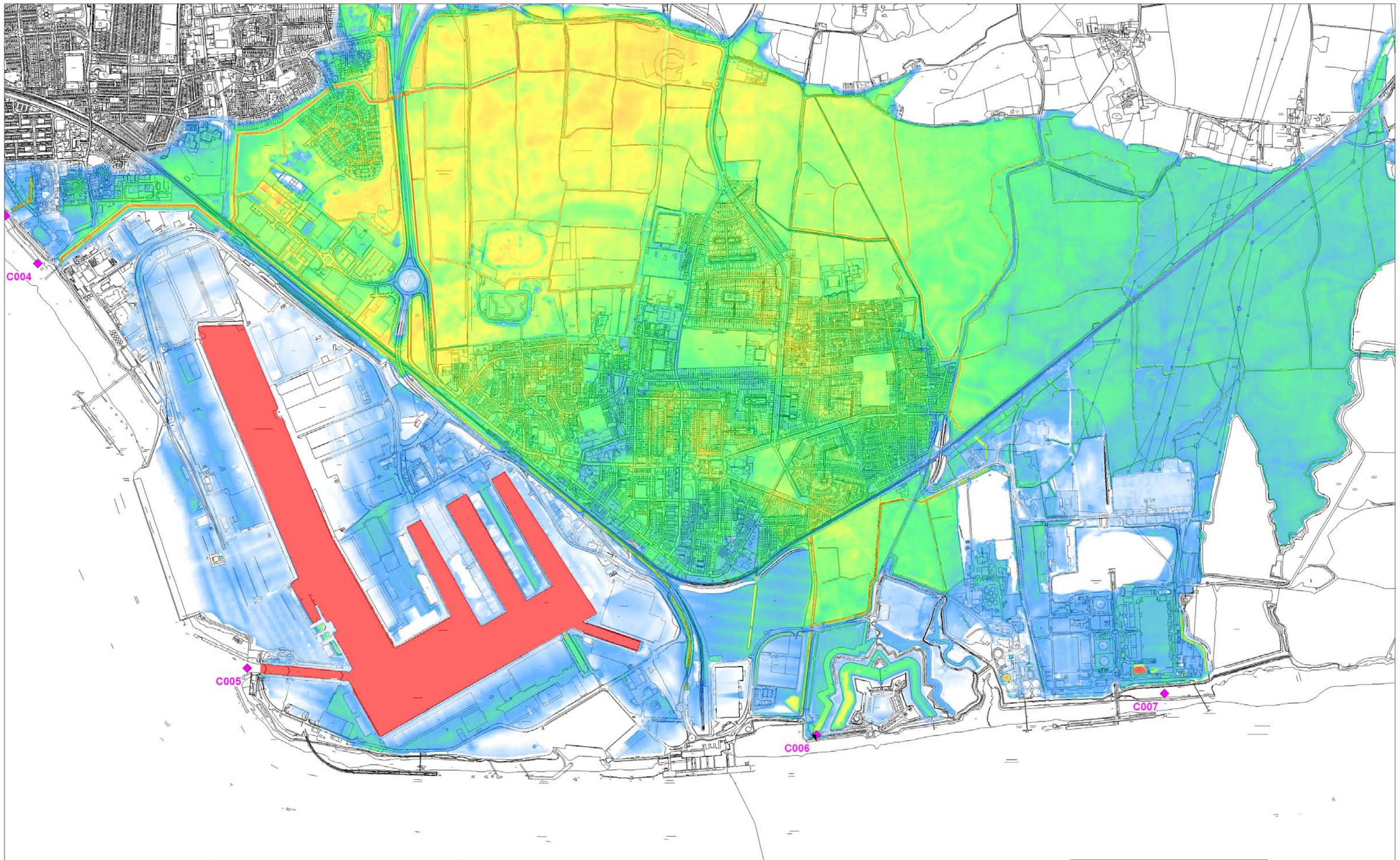
Scale 1:30,000 @ A3

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Project:

Thurrock Borough
Council SFRA Level 2

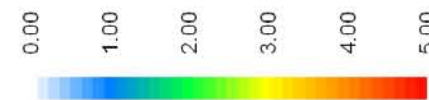
Title:

Tilbury Urban Area
Maximum Flood Depth
1 in 100 Year Fluvial / 1 in 200
Year Tidal Event (2109)



A001 Breach Location and Label

Maximum Flood Depth (m)



TILBURY

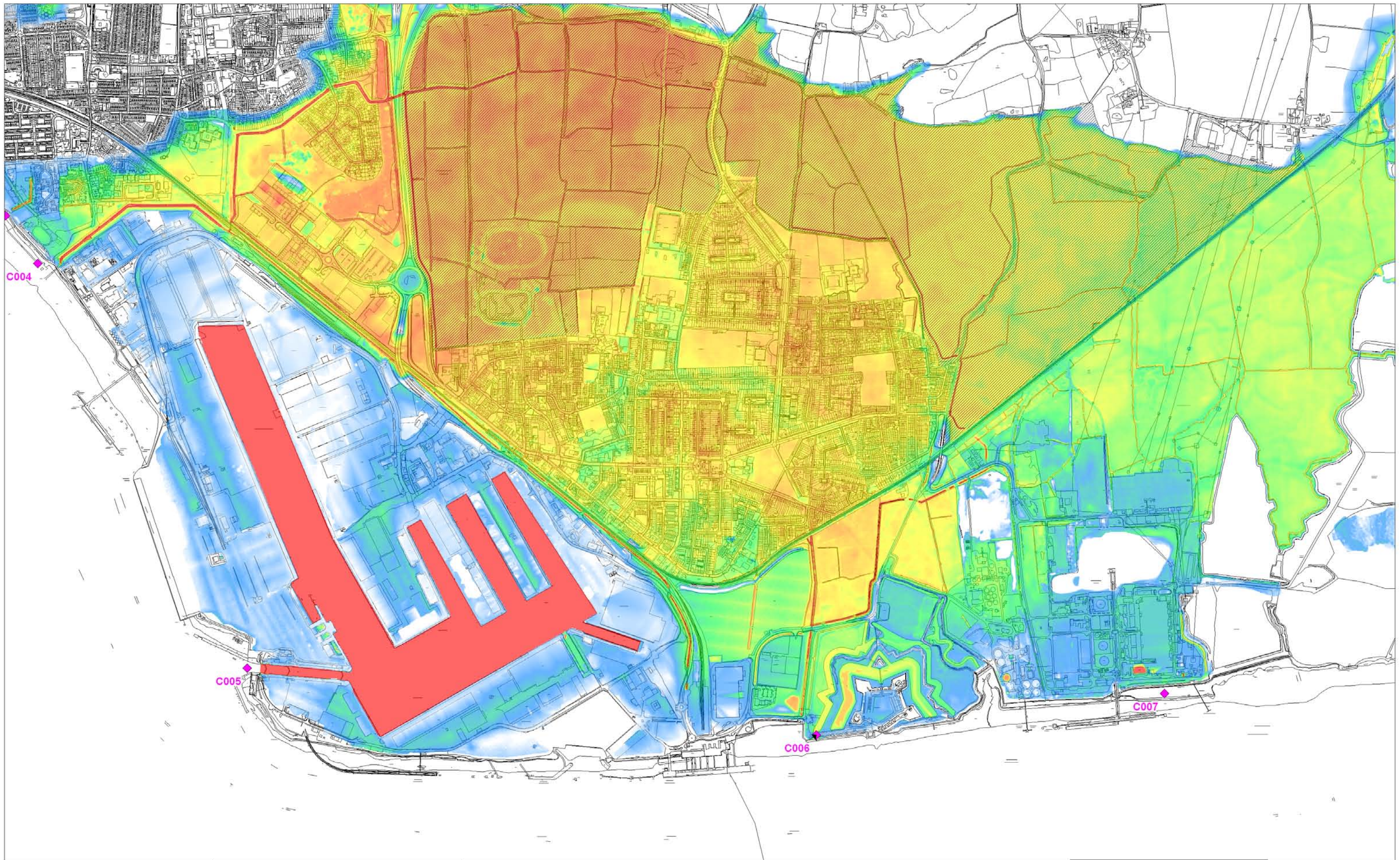
Scale 1:30,000 @ A3

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Project:

Thurrock Borough
Council SFRA Level 2

Title:

Tilbury Urban Area
Maximum Flood Depth
1 in 1000 Year Fluvial / 1 in 1000
Year Tidal Event (2109)



A001 Breach Location and Label

Maximum Flood Depth (m)



TILBURY

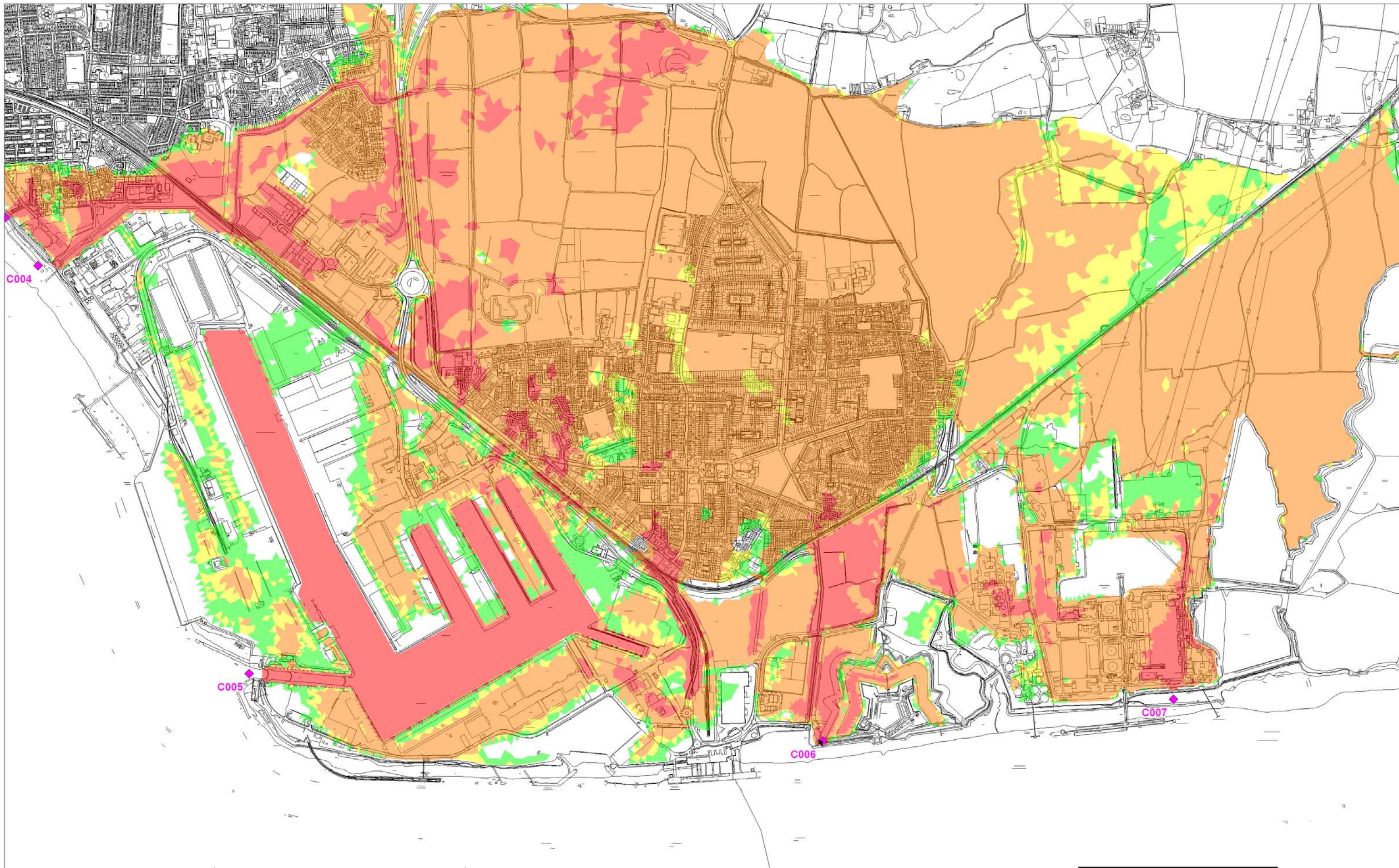
Scale 1:30,000 @ A3

Drw MV

Date 02/10



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Project:

Thurrock Borough
Council SFRA Level 2

Title:

Tilbury Urban Area
Hazard Rating
1 in 200yr Tidal / 1 in 100
Year Fluvial Event (2009)



A001 Breach Location and Label

Flood Hazard Rating

- Extreme Hazard
- Significant Hazard
- Moderate Hazard
- Low Hazard

TILBURY

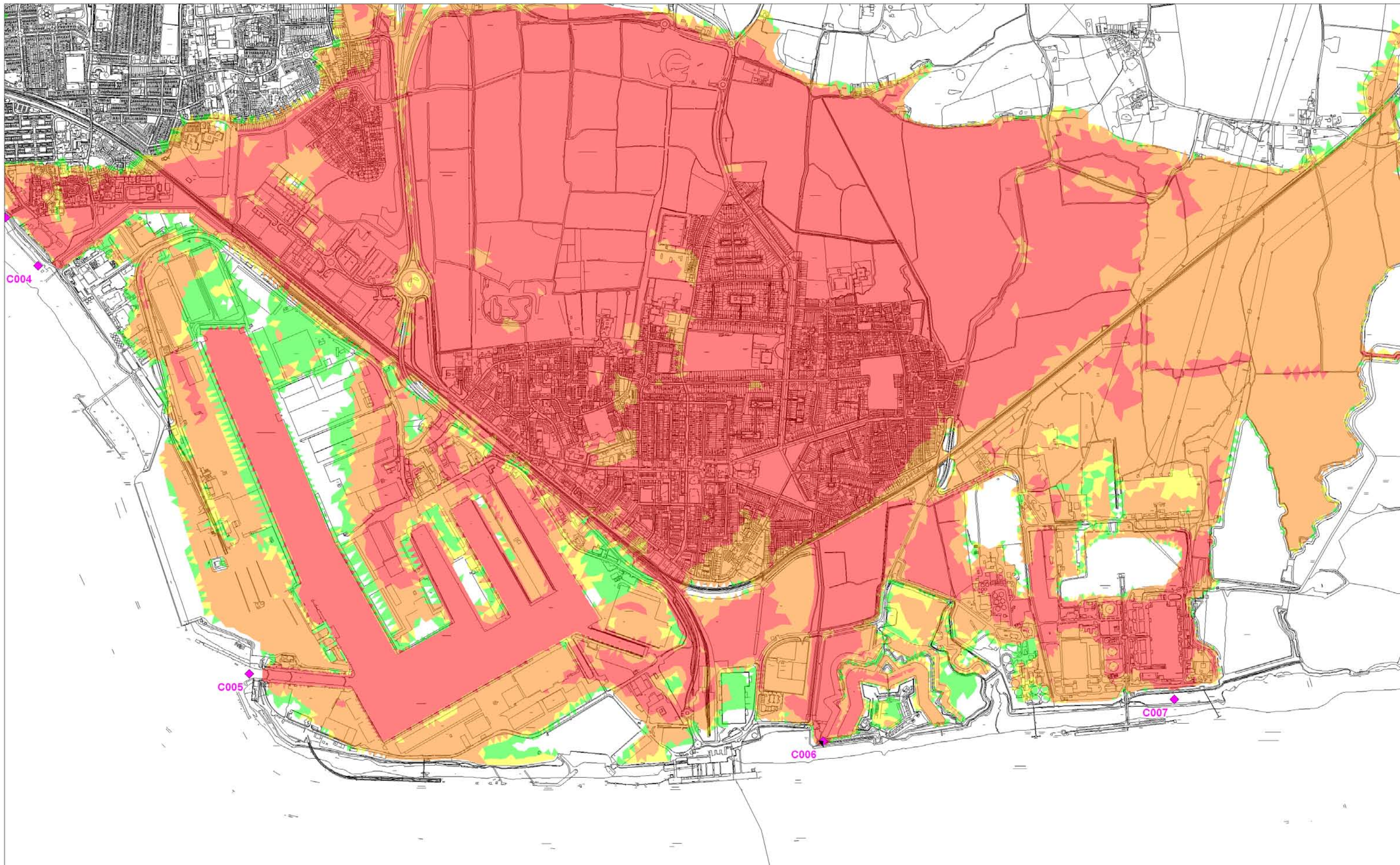
Scale 1:30,000 @ A3

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Date 02/10



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Project:

Thurrock Borough
Council SFRA Level 2

Title:

Tilbury Urban Area
Hazard Rating
1 in 200yr Tidal / 1 in 100
Year Fluvial Event (2109)

◆ A001 Breach Location and Label

Flood Hazard Rating

■ Extreme Hazard ■ Moderate Hazard
■ Significant Hazard ■ Low Hazard

TILBURY

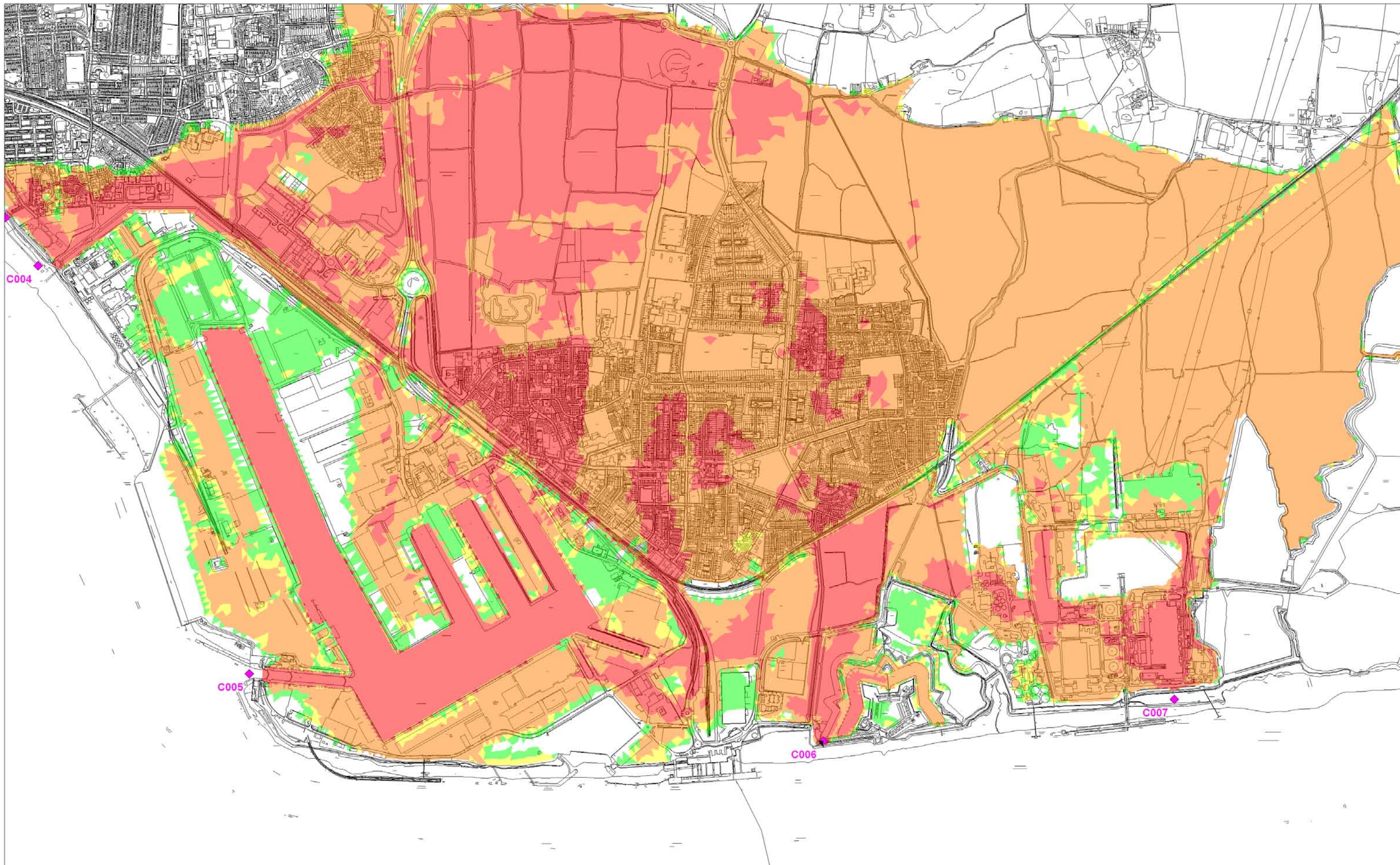
Scale 1:30,000 @ A3

Drw CA

Date 02/10



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Project:

Thurrock Borough
Council SFRA Level 2

Title:

Tilbury Urban Area
Hazard Rating
1 in 1000yr Tidal / 1 in 1000
Year Fluvial Event (2009)

◆ A001 Breach Location and Label

Flood Hazard Rating

■ Extreme Hazard ■ Moderate Hazard
■ Significant Hazard ■ Low Hazard

TILBURY

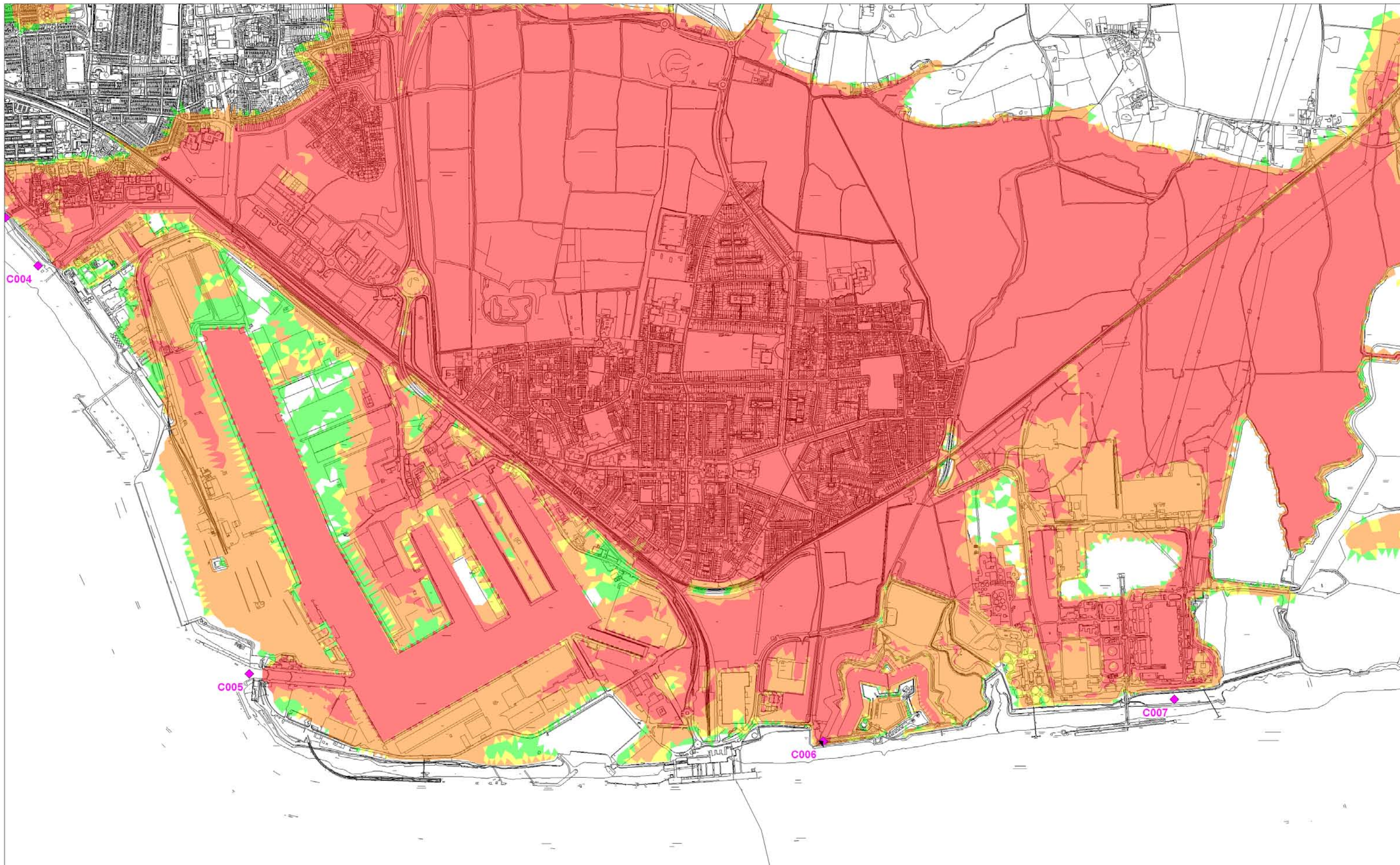
Scale 1:30,000 @ A3

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Project:

Thurrock Borough
Council SFRA Level 2

Title:

Tilbury Urban Area
Hazard Rating
1 in 1000yr Tidal / 1 in 1000
Year Fluvial Event (2109)



A001 Breach Location and Label

Flood Hazard Rating

Extreme Hazard

Significant Hazard

Moderate Hazard

Low Hazard

TILBURY

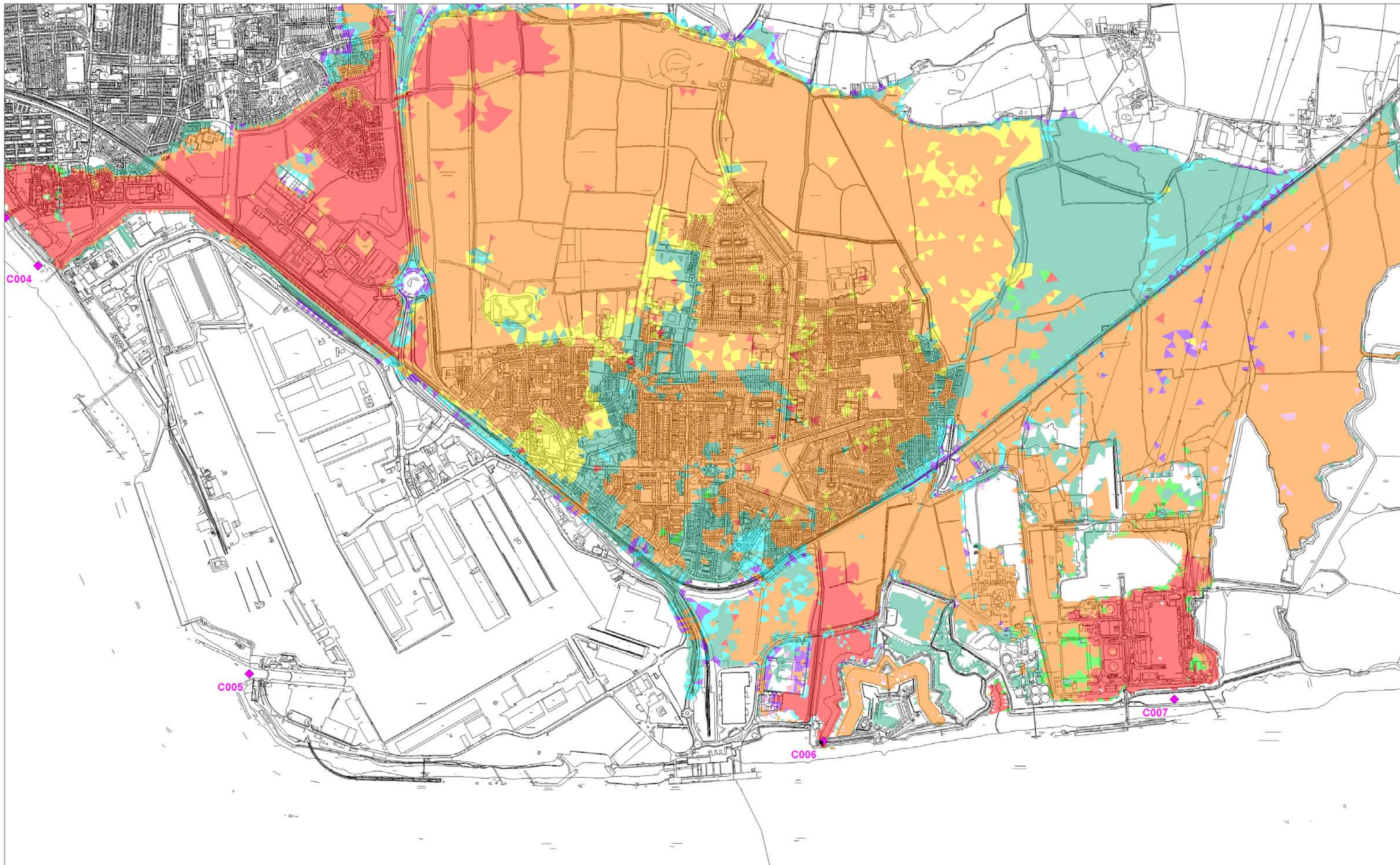
Scale 1:30,000 @ A3

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Project:

Thurrock Borough
Council SFRA Level 2

Title:

Tilbury Urban Area
Time to Inundation
1 in 200 Year Tidal Event (2109)

◆ A001 Breach Location and Label

Time to Inundation (hours)



TILBURY

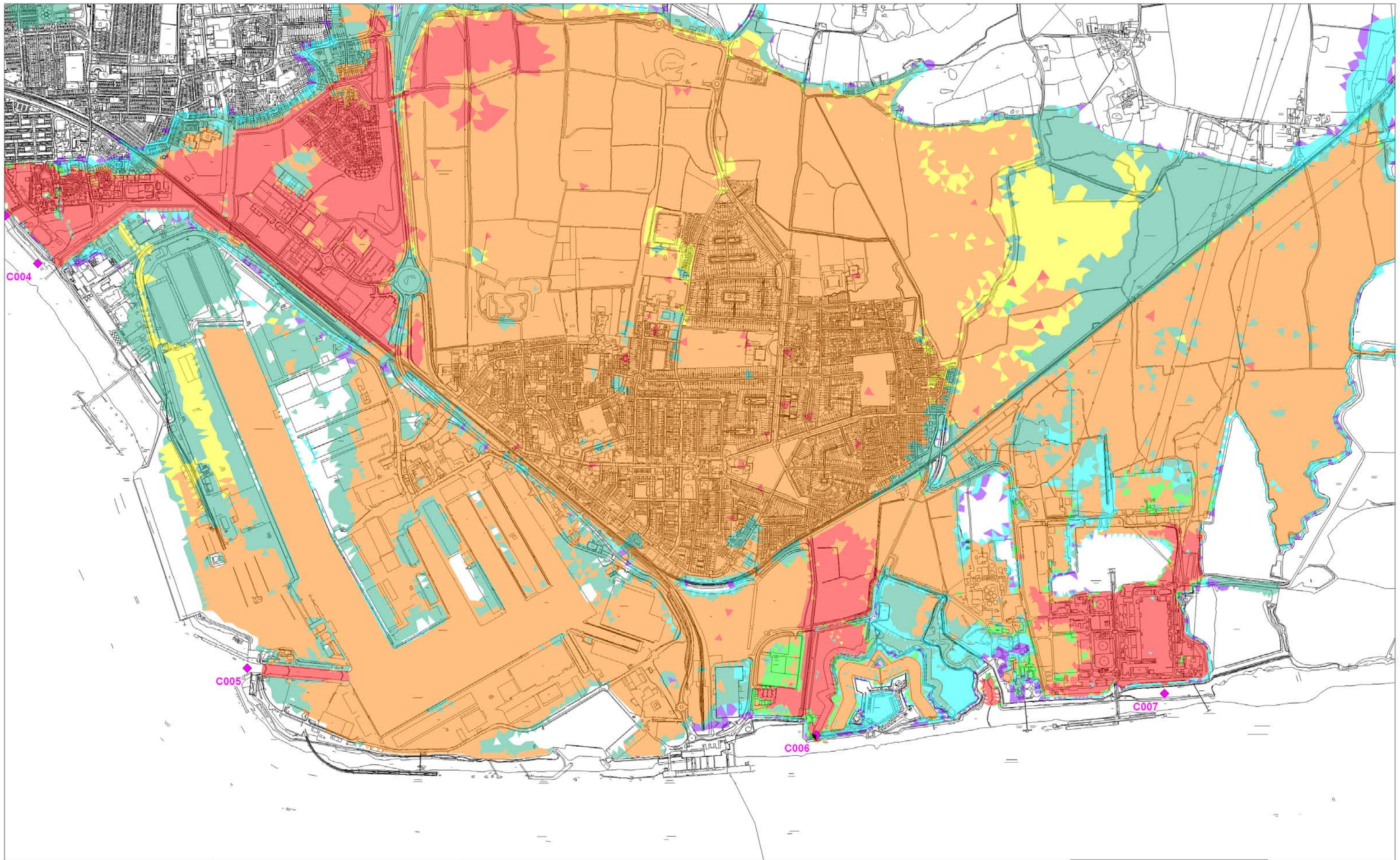
Scale 1:30,000 @ A3

Drw SW

Date 06/09



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Project:

Thurrock Borough
Council SFRA Level 2

Title:

Tilbury Urban Area
Time to Inundation
1 in 1000 Year Tidal Event (2109)

◆ A001

Breach Location and Label

Time to Inundation (hours)



TILBURY

Scale 1:30,000 @ A3

Drw MV

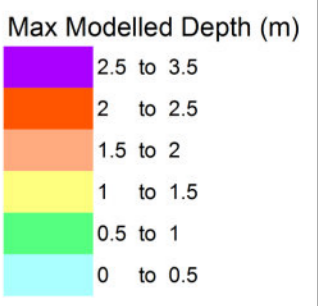
Date 02/10



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4. Tilbury 2 ES Appendix 16.B Level 3 Flood Risk Assessment, Breach maps (September 2017)

LEGEND



Notes
See Figure 5 for depth difference map

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Revision Details

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Purpose of Issue
Version 1

Client

Project Title
Tilbury Port 2 Expansion

Drawing Title
FIGURE 1: 200yr 2017
Max Modelled Depth

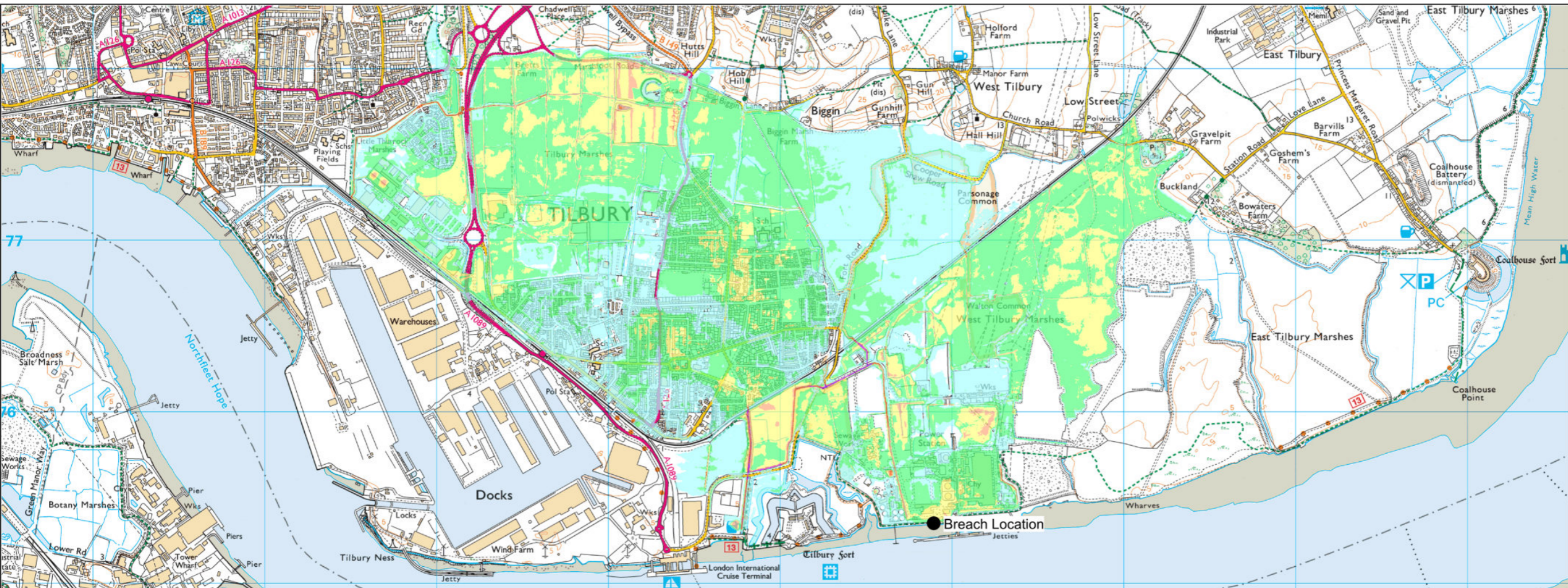
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Scale at A3 1:2600

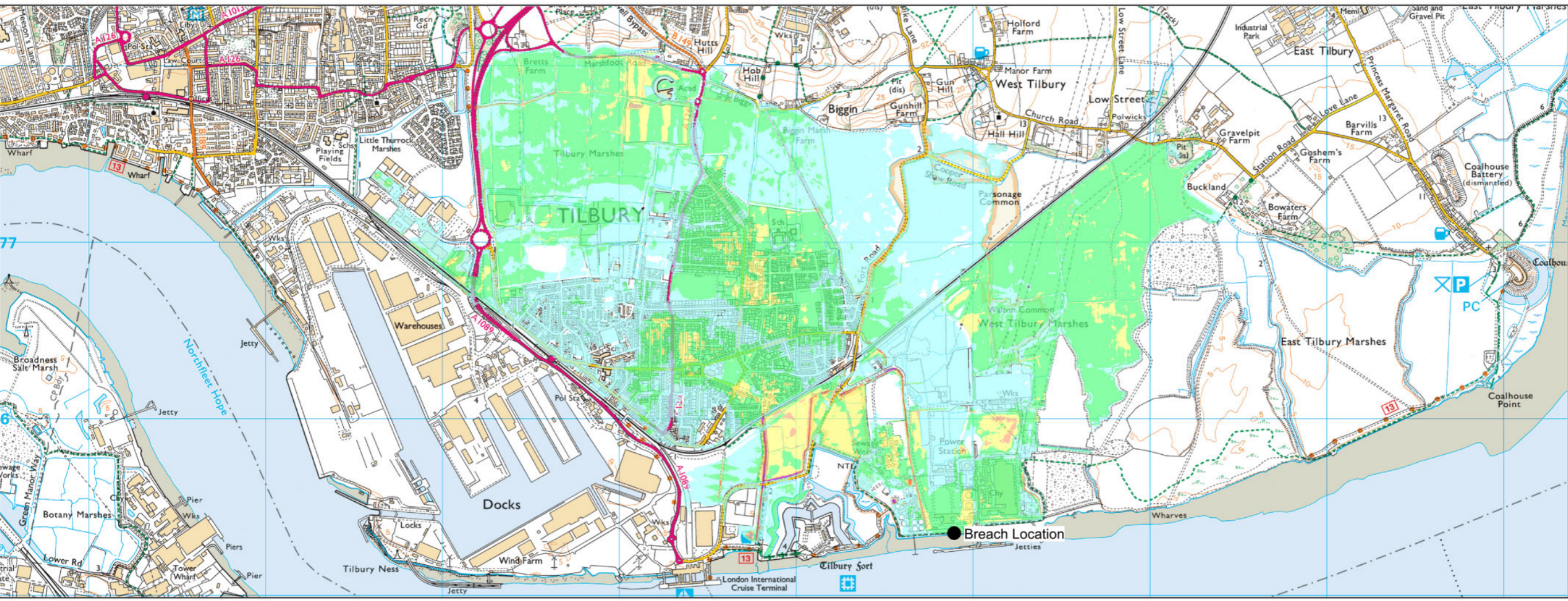
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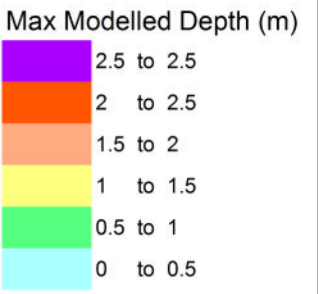


Baseline Model



Proposed Development Model

LEGEND



Notes
See Figure 6 for depth difference map

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Tilbury Port 2 Expansion

Drawing Title
**FIGURE 2: 200yr 2117
Max Modelled Depth**

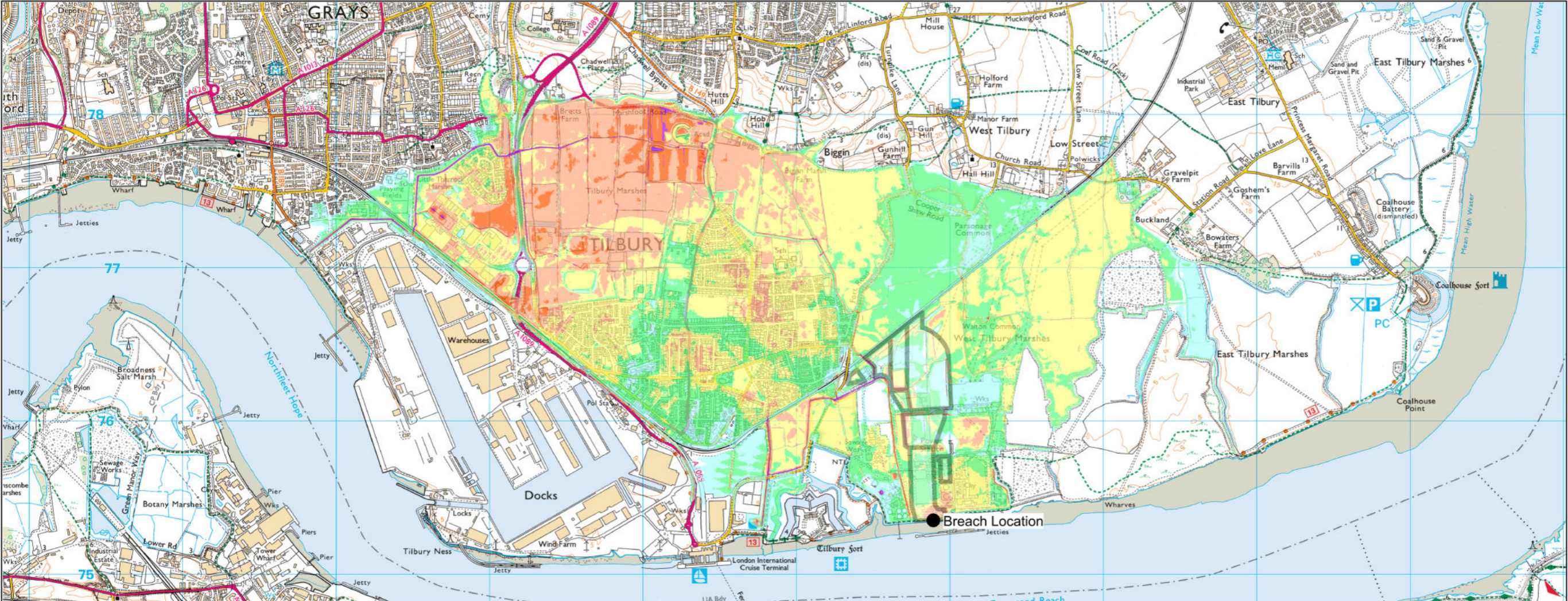
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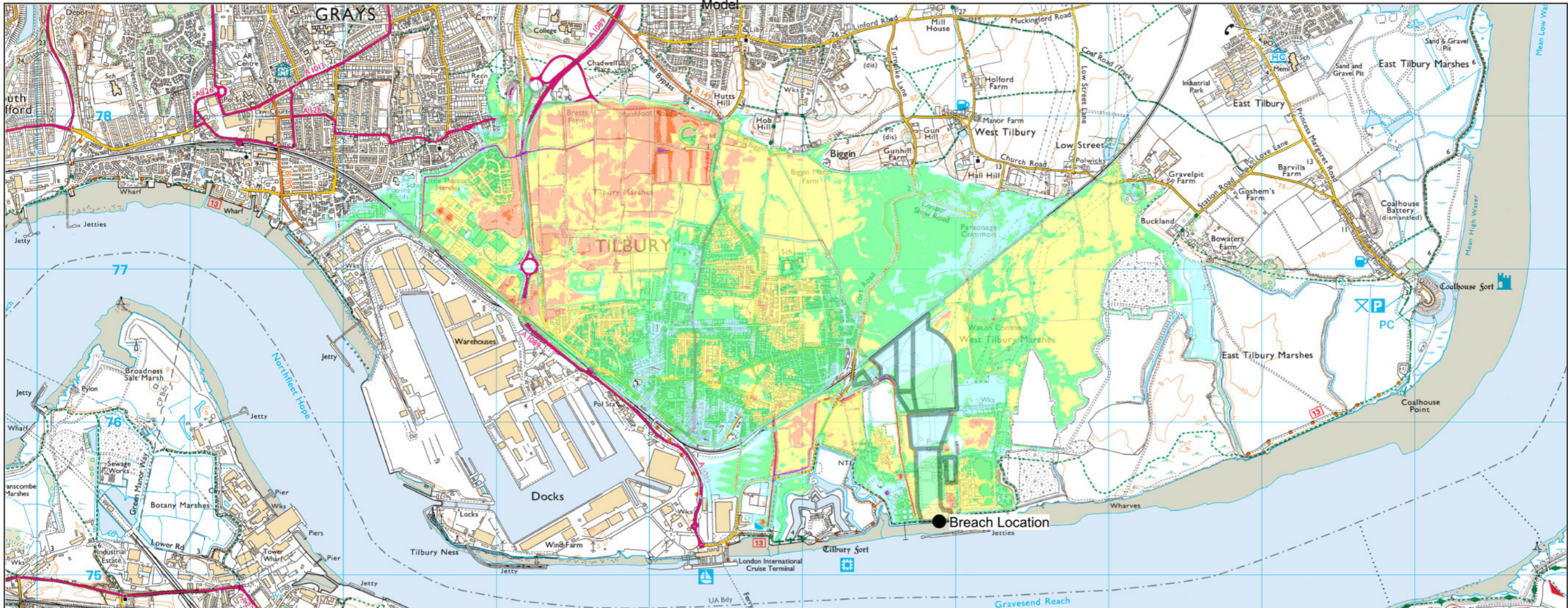
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Baseline Model



Proposed Development Model

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Max Modelled Depth (m)



Notes
See Figure 3 for depth difference map

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Project Title
Tilbury Port 2 Expansion

Drawing Title
FIGURE 3: 1000yr 2017
Max Modelled Depth

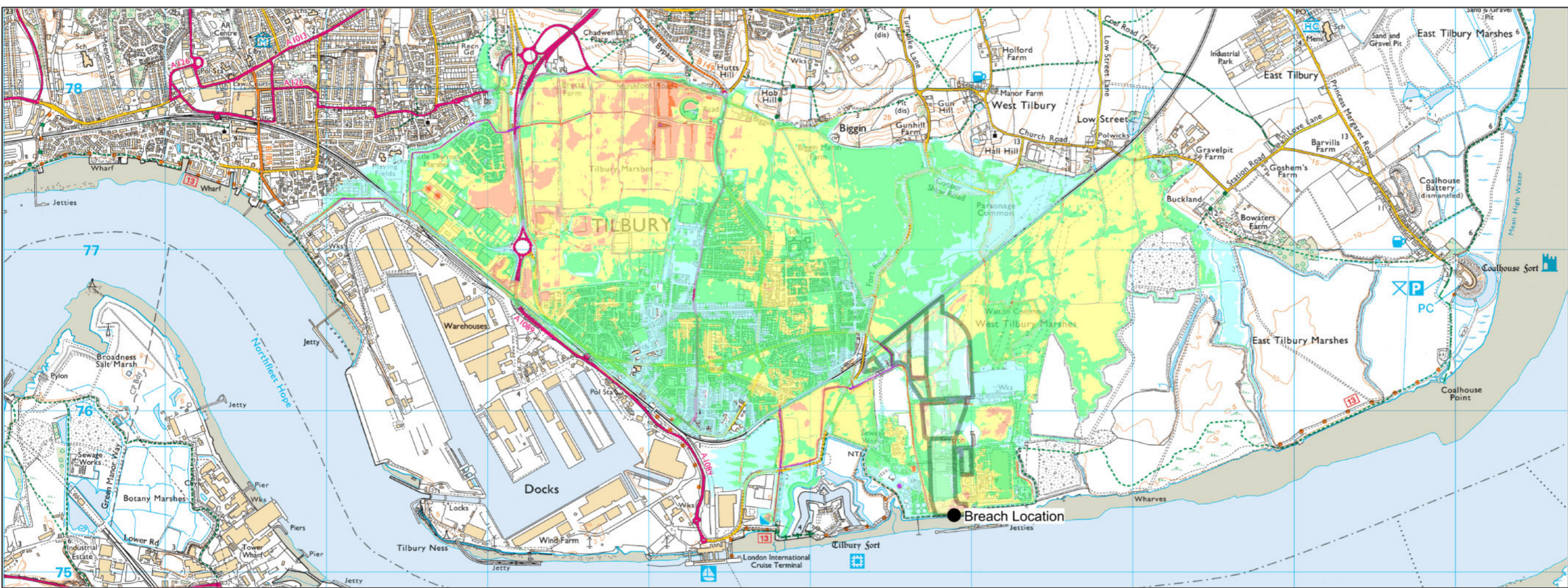
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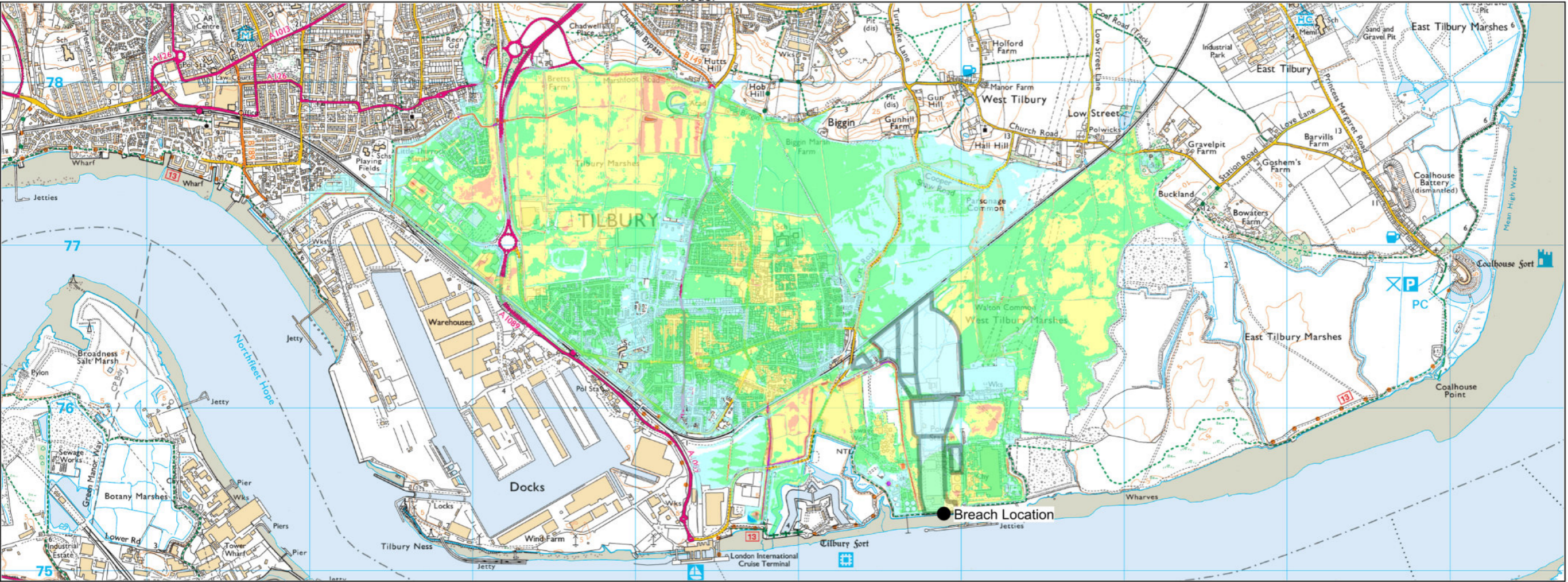
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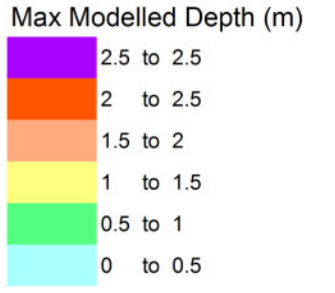


Baseline Model



Proposed Development Model

LEGEND



Notes
See Figure 4 for depth difference map

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Project Title
Tilbury Port 2 Expansion

Drawing Title
FIGURE 4: 1000yr 2117
Max Modelled Depth

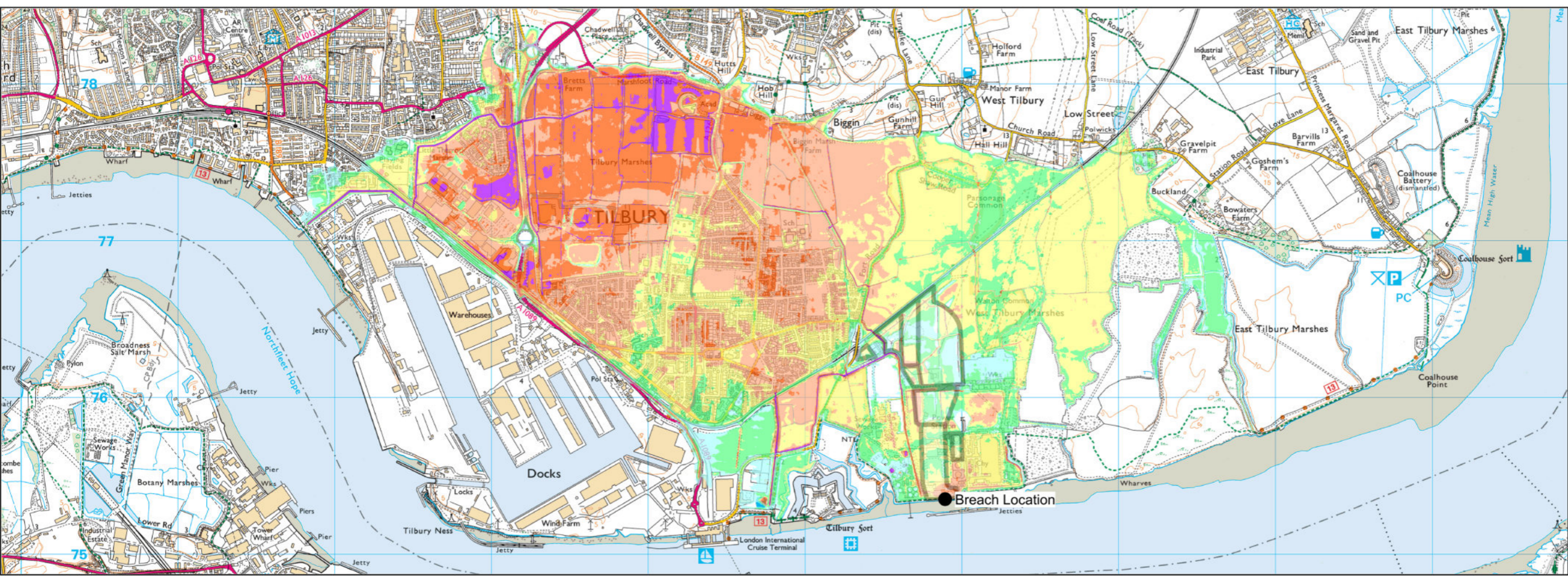
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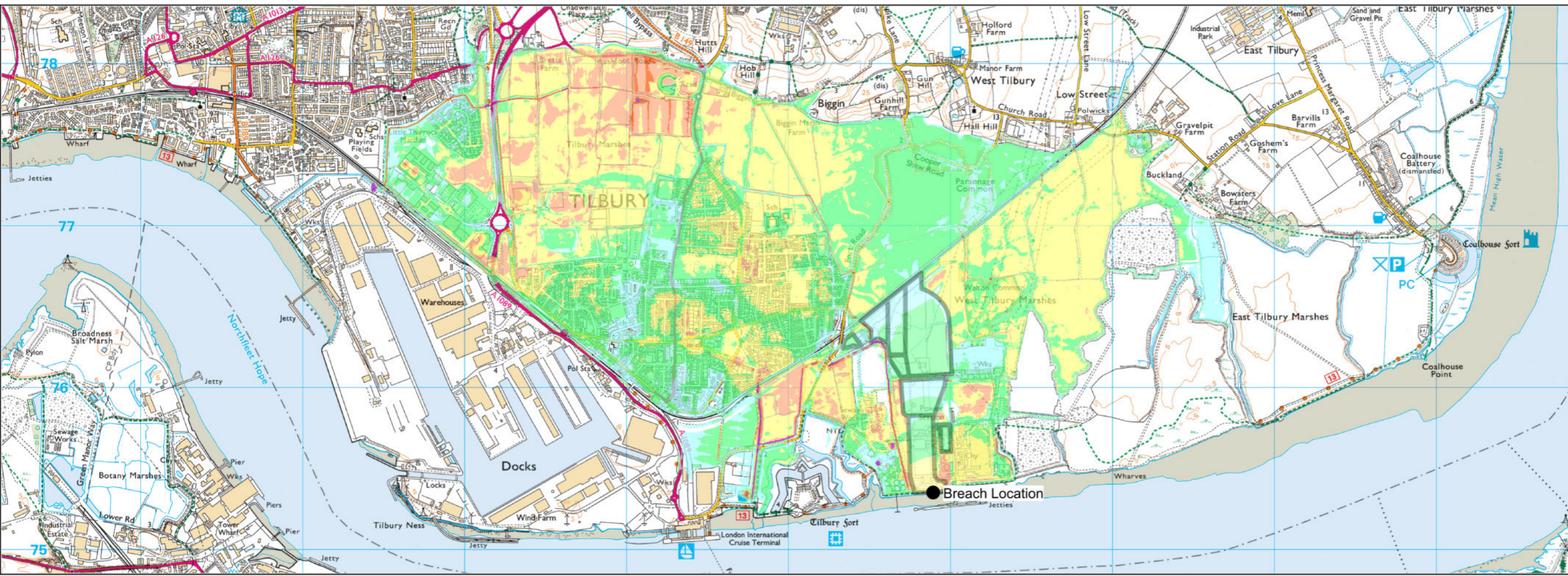
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Baseline Model



Proposed Development Model

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Depth Difference (m)
Proposed - Baseline



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Project Title
Tilbury Port 2 Expansion

Drawing Title
FIGURE 5: 200yr 2017
Depth Difference

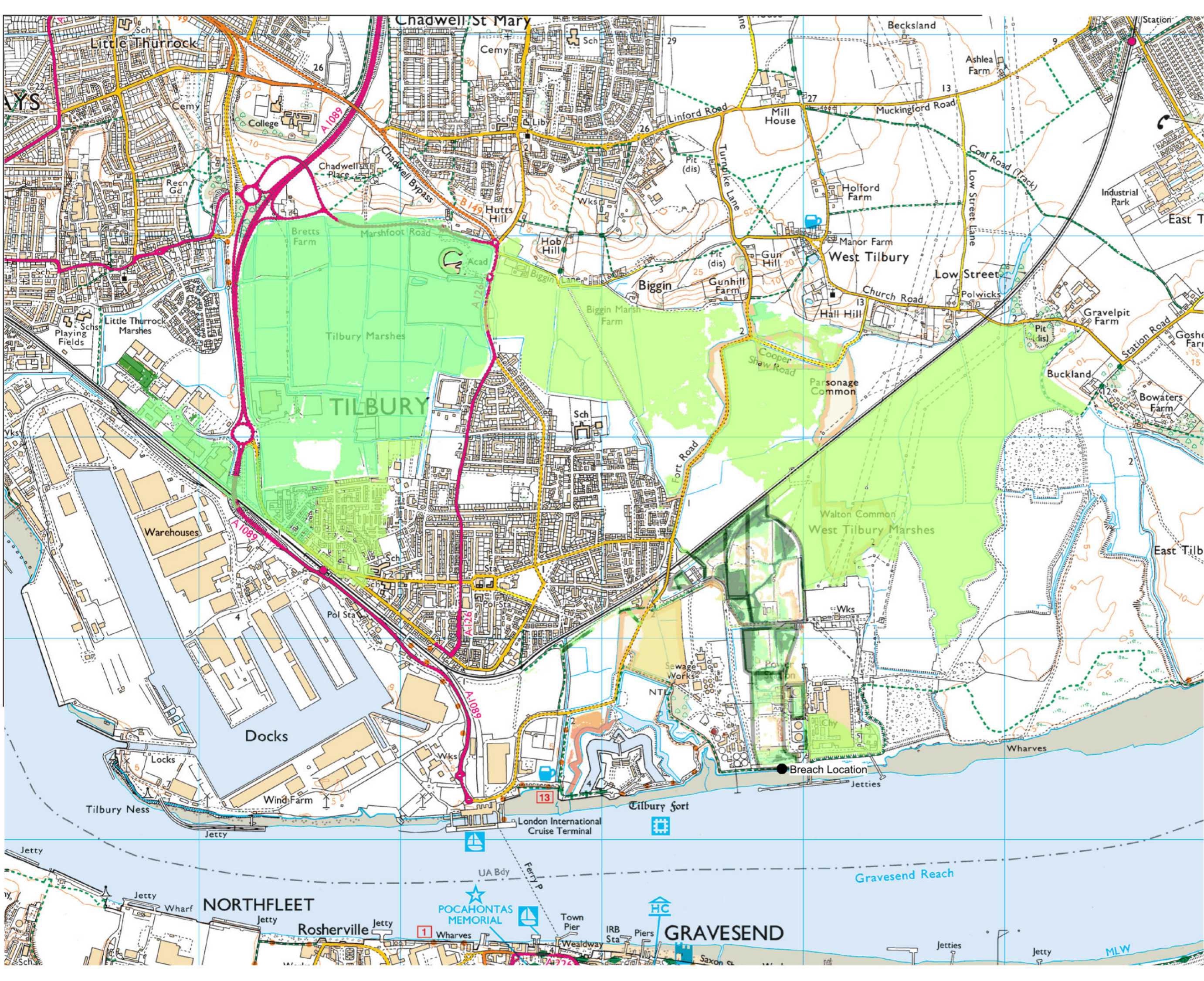
Drawn	Checked	Approved	Date
AI	BM	JR	15/09/2017

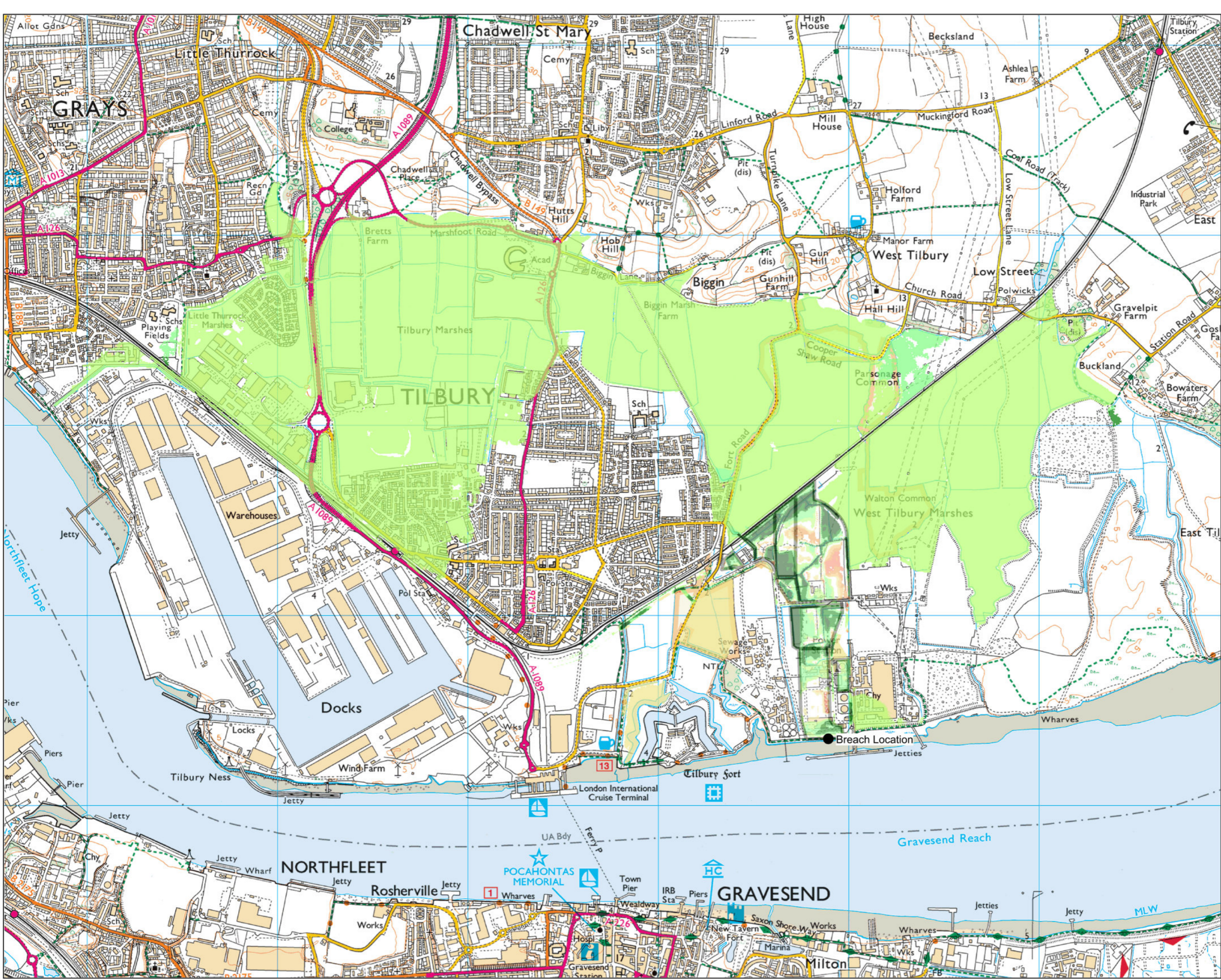
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Depth Difference (m)
Proposed - Baseline

0.7 to 0.88
0.6 to 0.7
0.5 to 0.6
0.4 to 0.5
0.3 to 0.4
0.2 to 0.3
0.1 to 0.2
-0.1 to 0.1
-0.25 to -0.1
-0.5 to -0.25
-0.75 to -0.5
-3.12 to -0.75

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Client			
Project Title		Tilbury Port 2 Expansion	
Drawing Title		FIGURE 7: 1000yr 2017 Depth Difference	
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Tilbury Port 2 Expansion

Project Title

Tilbury Port 2 Expansion

Drawing Title

FIGURE 9: 200yr 2017 Flood Hazard

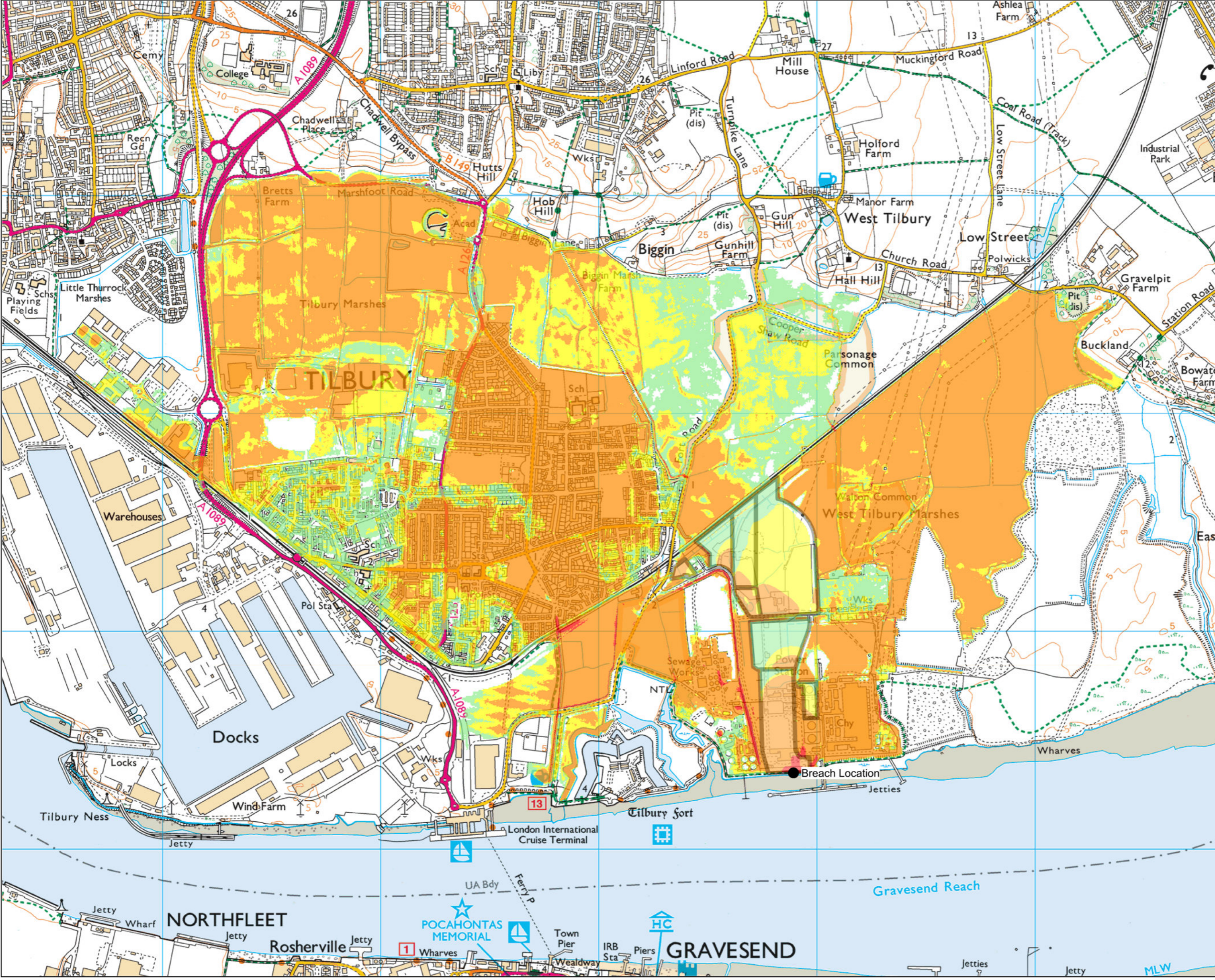
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Ai	xx	xx	14/09/2017

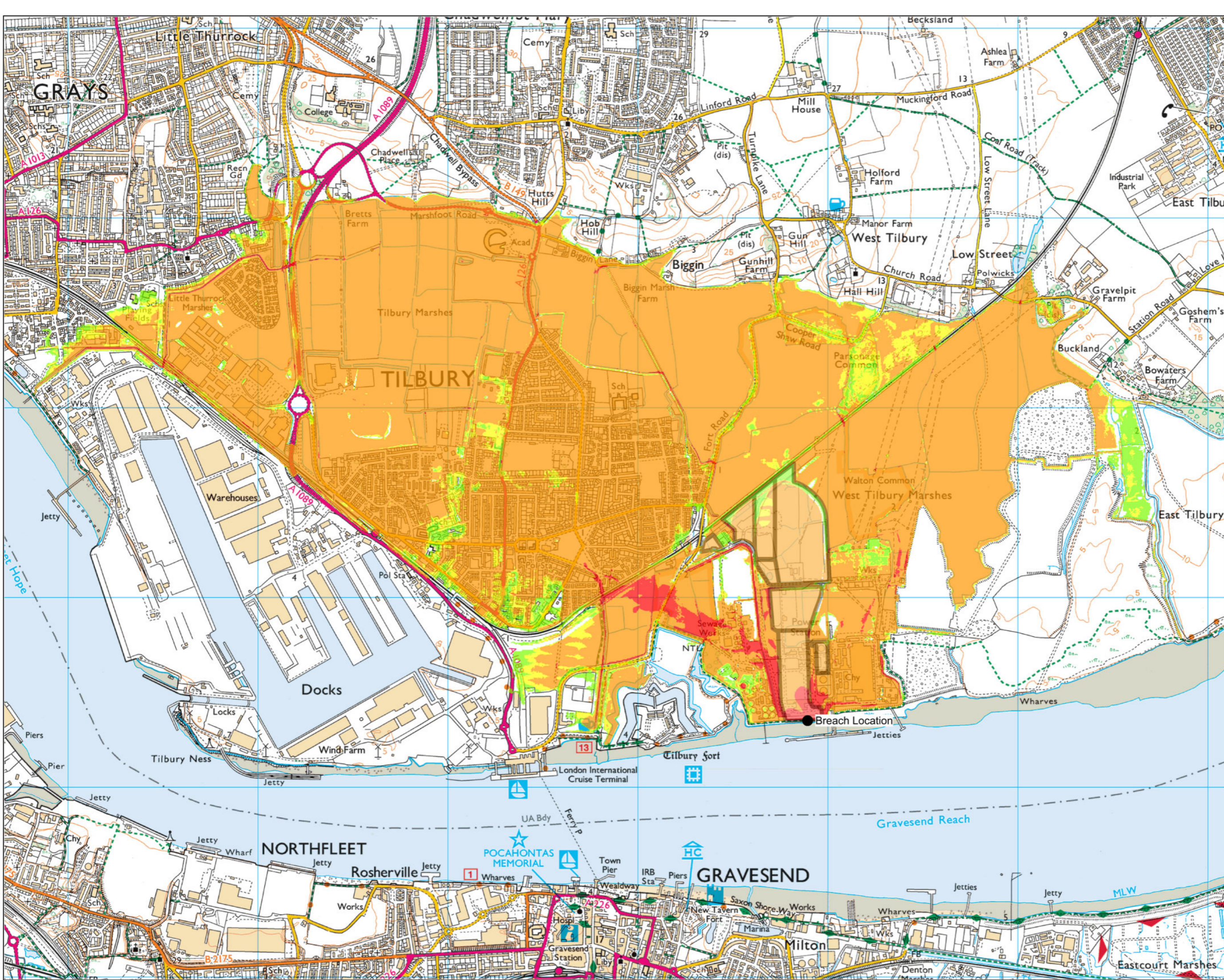
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Hazard Rating

- Extreme Hazard
- Significant Hazard
- Moderate Hazard
- Low Hazard

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Project Title

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Drawing Title

FIGURE 10: 200yr 2117 Flood Hazard

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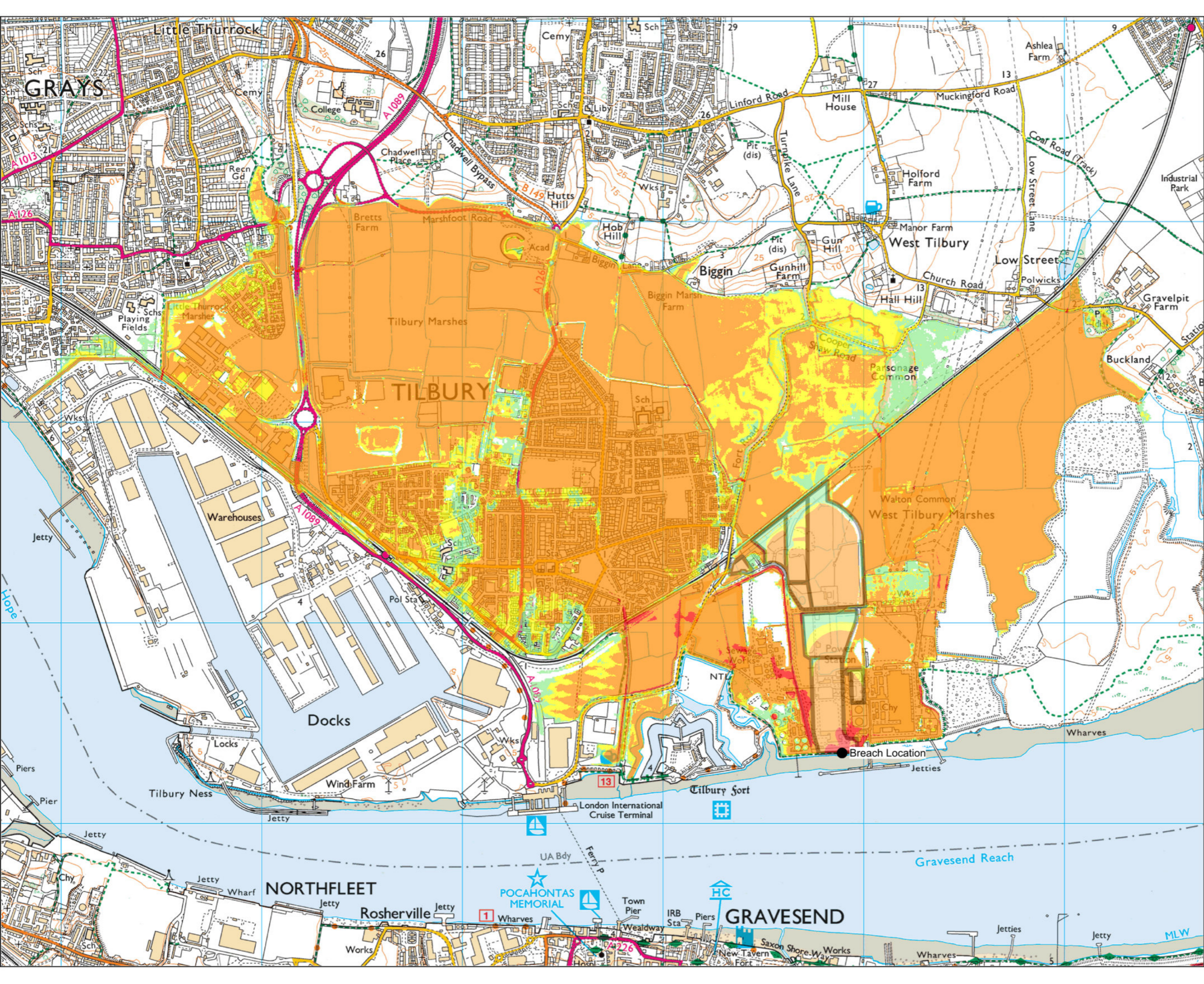
FIGURE 11: 1000yr 2017 Flood Hazard

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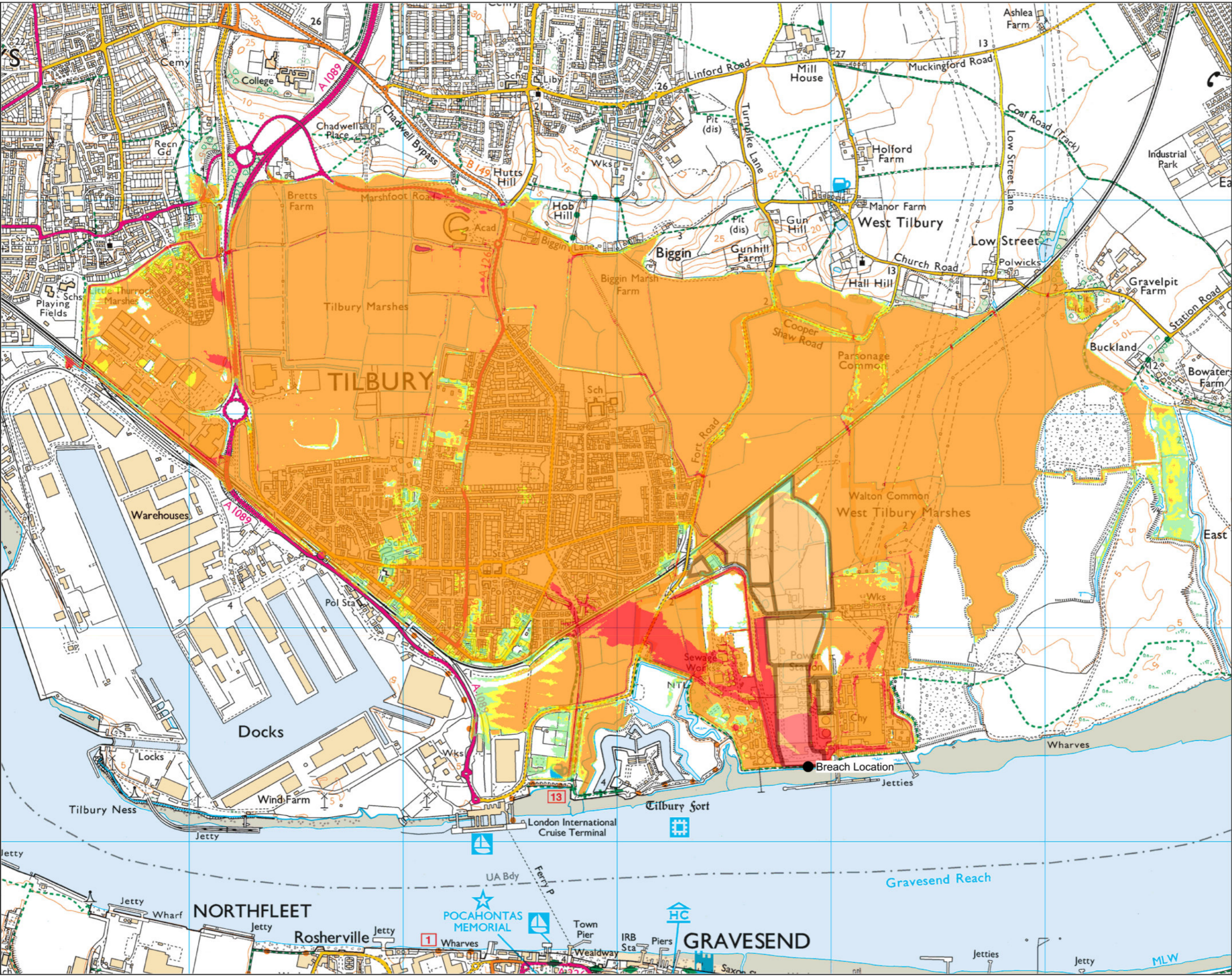
Drawing Title	FIGURE 12: 1000yr 2117 Flood Hazard			
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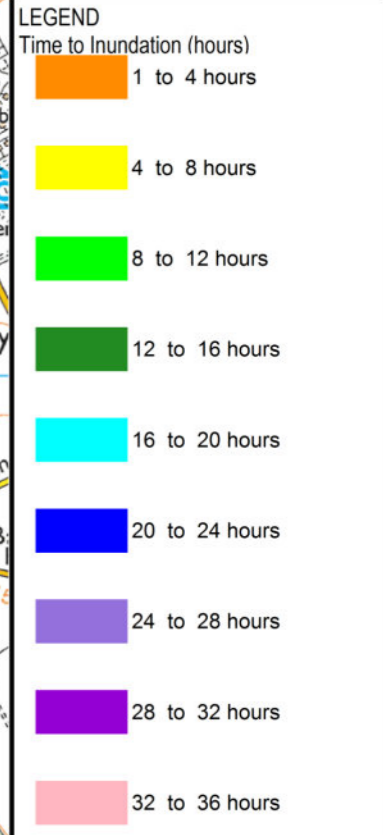
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Project Title
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Drawing Title
FIGURE 13: 200yr 2017 Time to Inundation

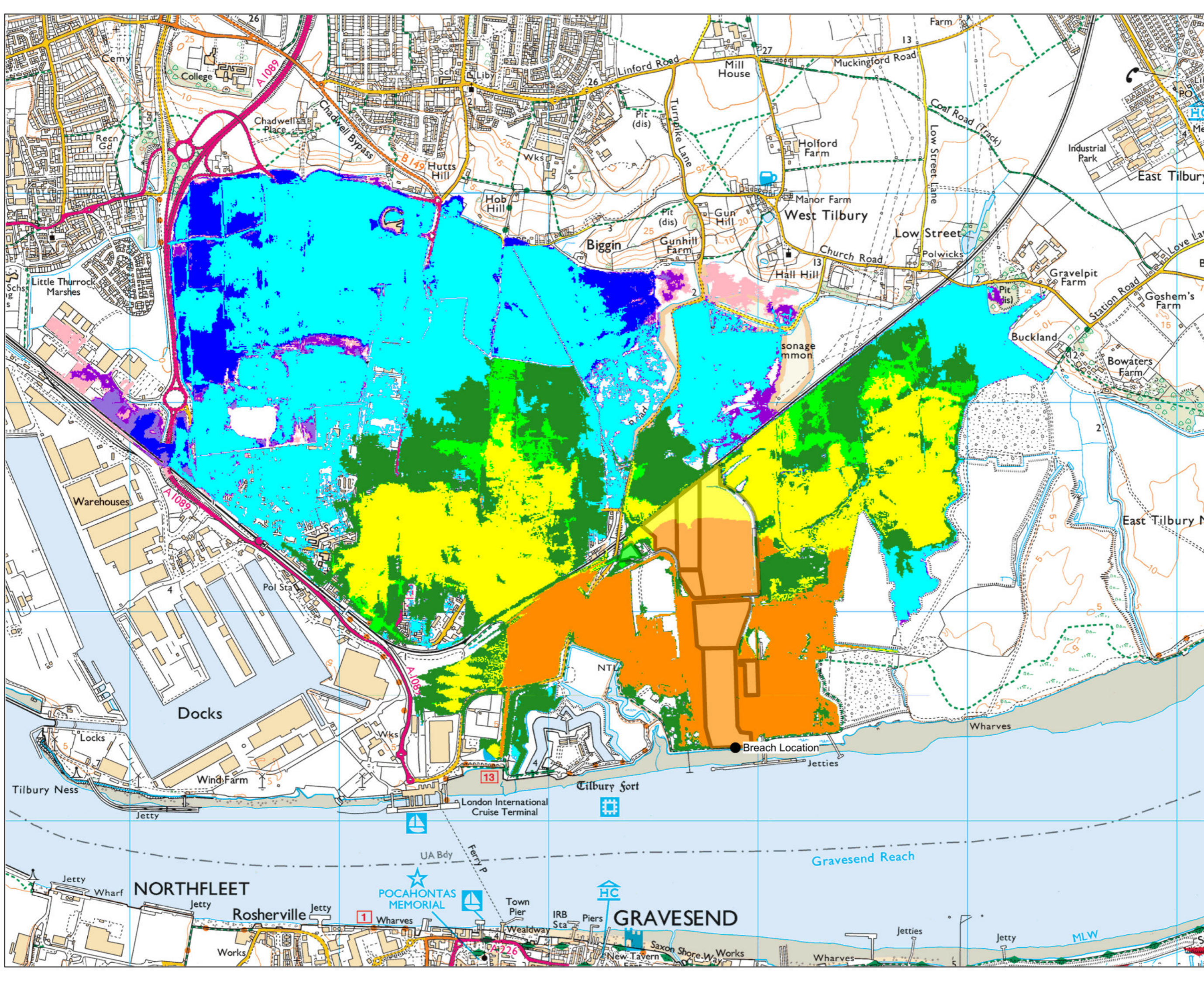
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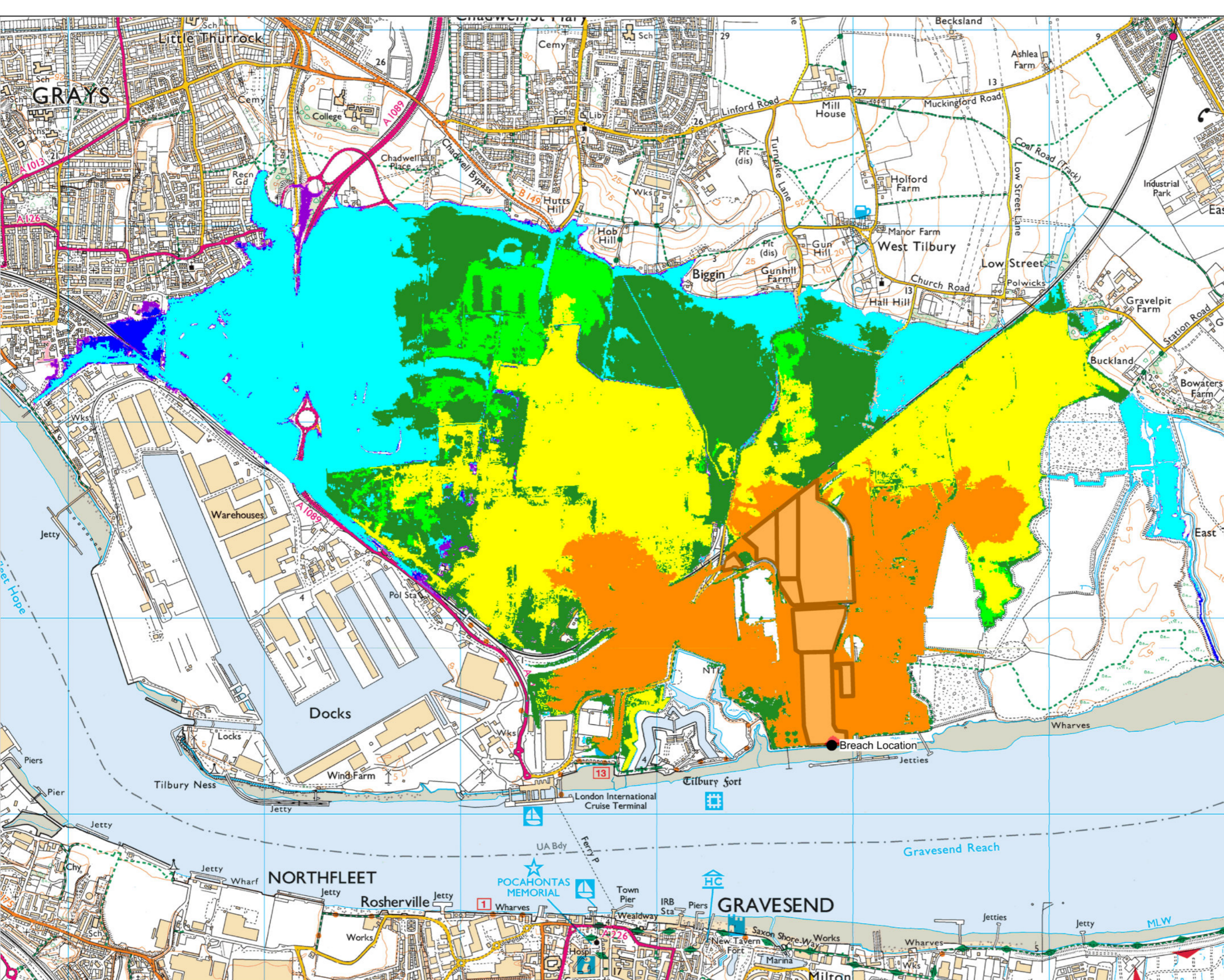
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Time to Inundation (hours)

- 0 to 1 hours
- 1 to 4 hours
- 4 to 8 hours
- 8 to 12 hours
- 12 to 16 hours
- 16 to 20 hours
- 20 to 24 hours
- 24 to 28 hours
- 28 to 32 hours
- 32 to 36 hours

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Drawing Title		FIGURE 14: 200yr 2117 Time to Inundation
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