Coastal modelling in Kent

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- Kent coastal model coverage and overview
- East Kent Coast modelling – case study
- North Kent Coast and Romney Marsh modelling updates overview

Flooding in Whitstable - 1953 tidal surge

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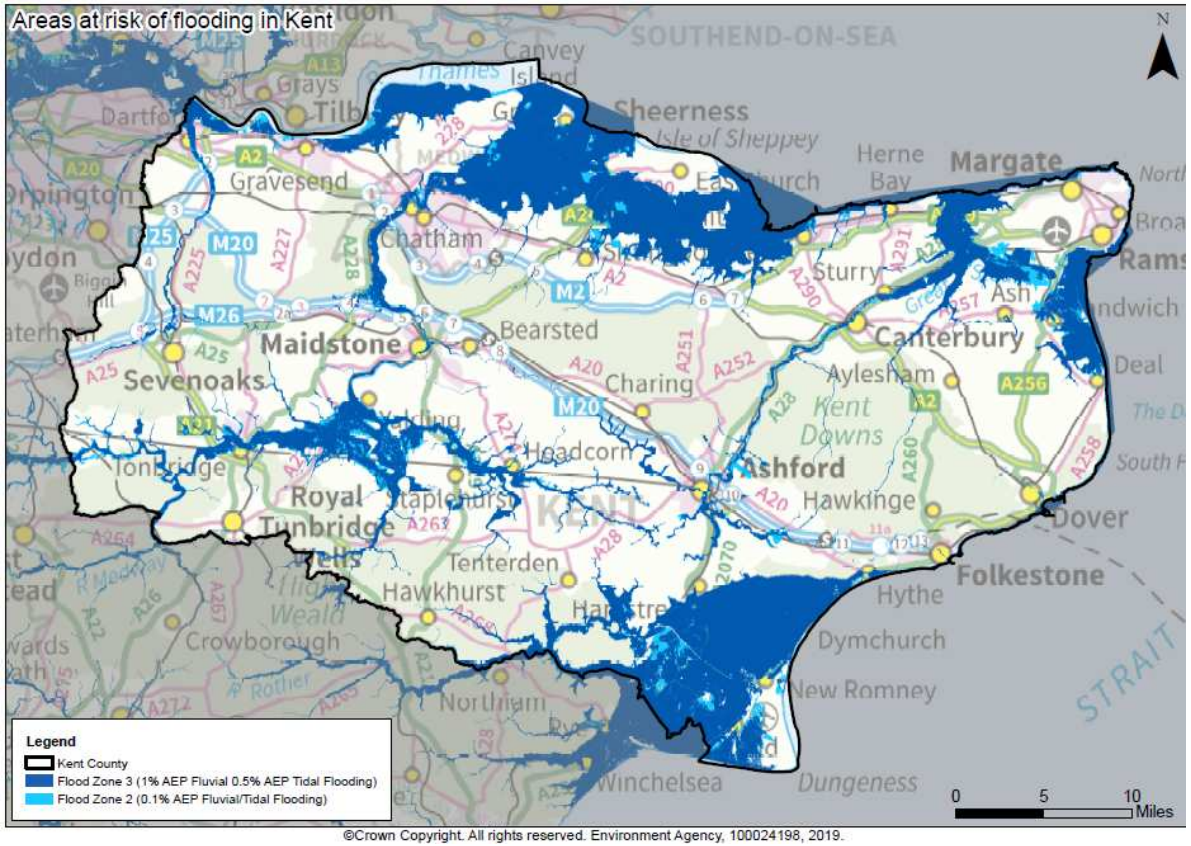
Flood risk in Kent overview



- 60,000 properties (residential and commercial) are at risk of flooding from rivers and the sea
- We use computer models help us to understand the areas at risk

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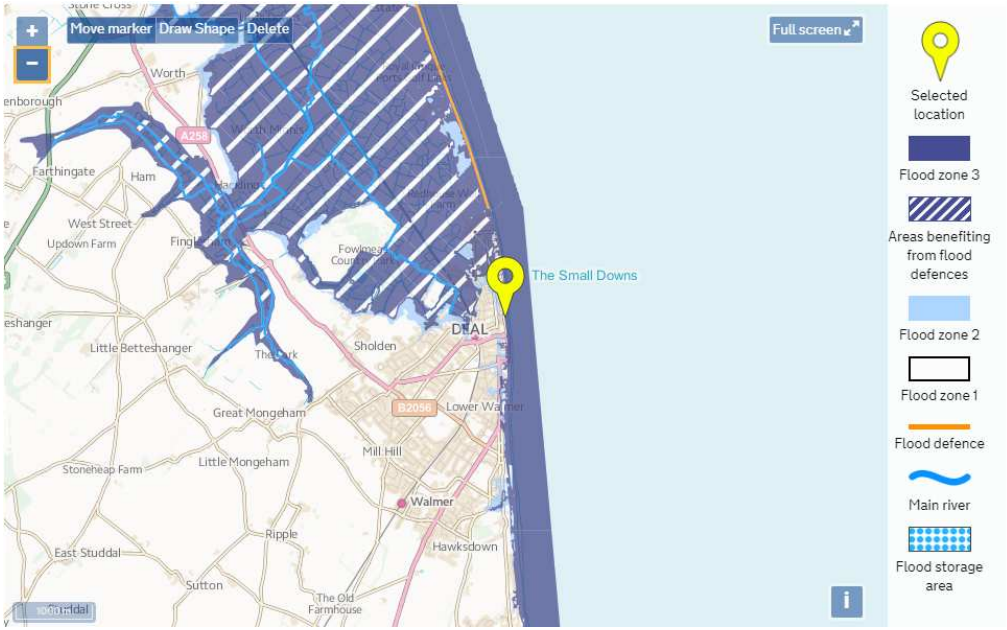
Flood map for planning

- Shows the **present day** risk of flooding to land from main rivers and/or the sea
- Two flood zones
  - Flood zone 3 – 1% chance of flooding from rivers or 0.5% chance of flooding from the sea in any given year
  - Flood zone 2 – 0.1% chance of flooding in any given year
- Does not take into account the presence of flood defences



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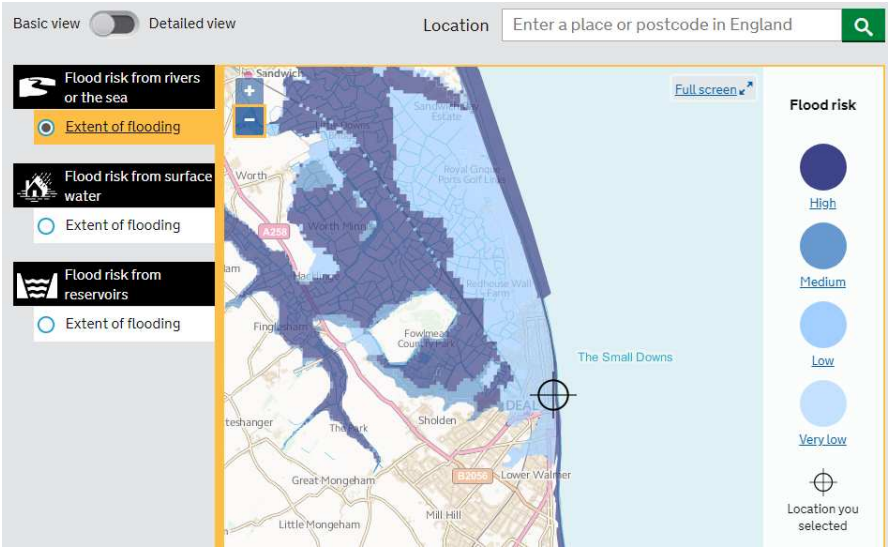
Risk of flooding from rivers and the sea

- Calculates the probability of flooding from main rivers or the sea
- Likelihood expressed as very low, low, medium or high risk
- Takes into the account the presence and condition of flood defences



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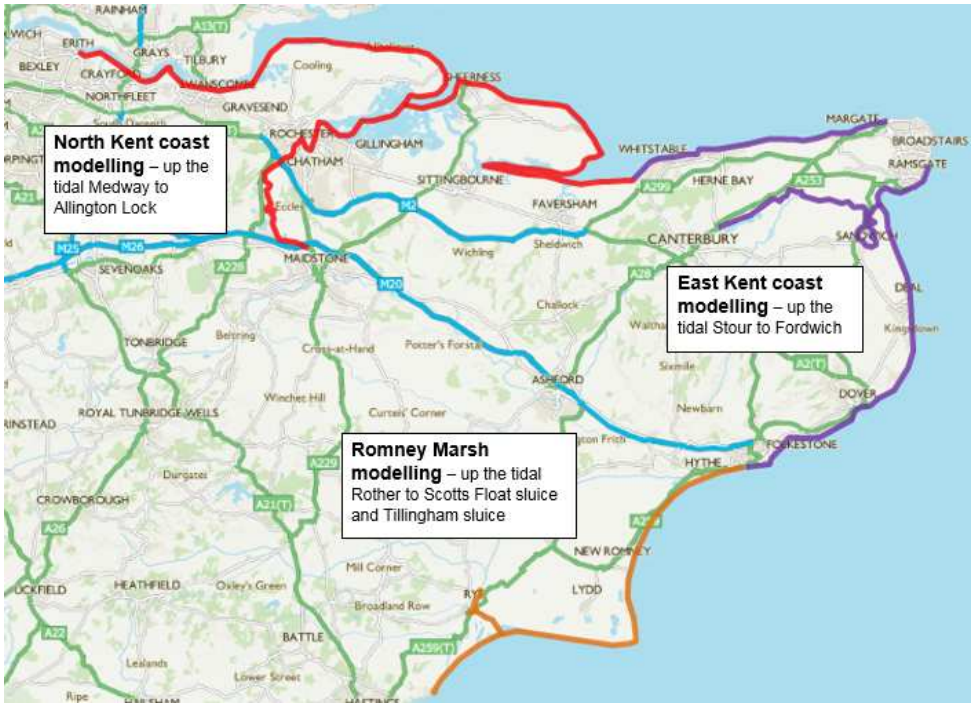
Kent coastal model coverage

- We have three flood risk models that cover the Kent coast

- Each model uses a similar approach and methodology and includes the following scenarios:
  - Defended and undefended
  - Present day
  - Climate change taken into account by:
    - Sea level rise
    - Increases in offshore wind speed
    - Offshore wave height



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Kent coastal model overview

- **East Kent Coast**
  - Detailed model completed in 2018
  - Previously had incomplete coverage and used broad scale approaches

- **North Kent Coast**
  - Completed in 2013, but is currently being updated to include:
    - Data collected during the December 2013 tidal surge
    - Most recent extreme sea level dataset (2015)

- **Romney Marsh**
  - Updated in 2017 but further work being undertaken to:
    - Undertake breach modelling at 14 locations
    - Represent the Broomhill Sands defences
    - Undertake further climate change runs

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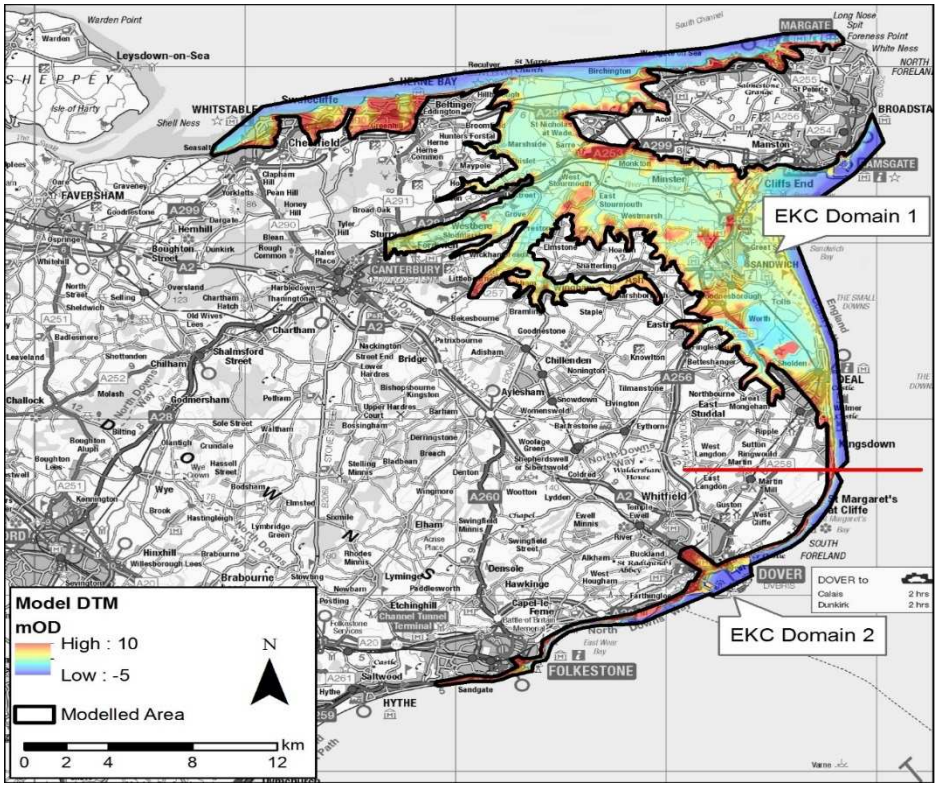
East Kent Coast Model – 2018 study area

- The East Kent coast had not previously been modelled in detail
- Large area split into two models:-
  - Domain 1 – Whitstable to Kingstown
  - Domain 2 – Kingsdown to Sandgate



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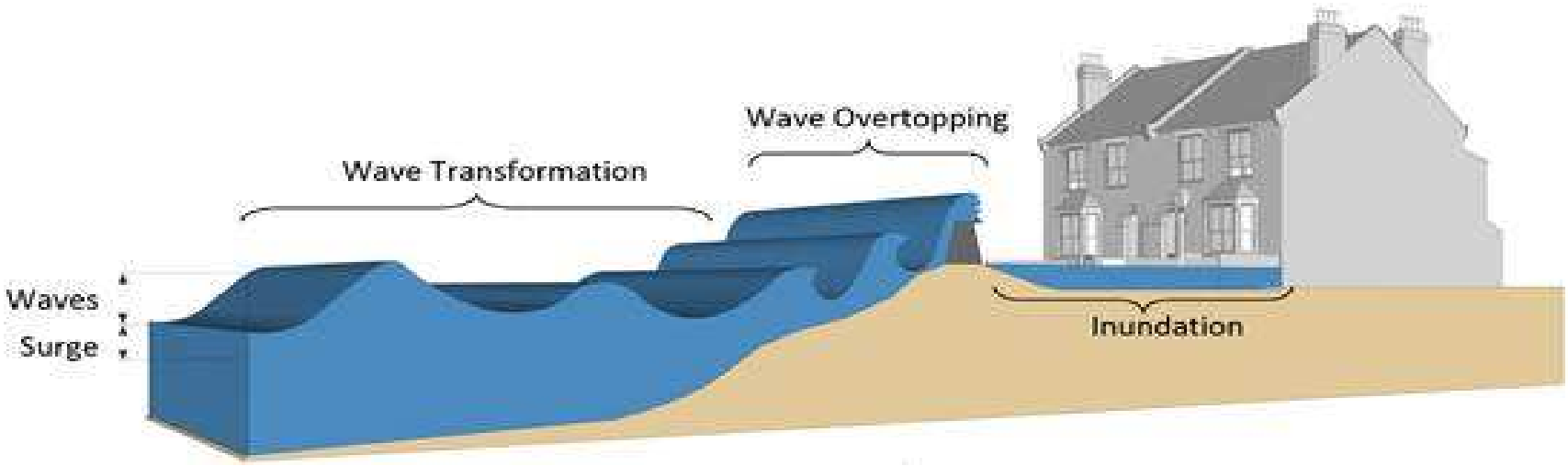
East Kent Coast Model – model build



- No single model is capable of simulating the wave transformation, wave overtopping and flood inundation
- Each process is modelled separately

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East Kent Coast Model – model scenarios

Event (% AEP)	Baseline Scenarios		Additional scenarios		
	Defended	Undefended*	Lower Stour embankment removed	Breach	Secondary breaches
20	✓	✓			
10	✓	✓			
5	✓	✓			✓
3.33	✓	✓			
2	✓	✓		✓	
1.33	✓	✓			
0.5	✓	✓	✓	✓	
0.1	✓	✓			
0.5 + climate change UKCP09 (2070)	✓	✓		✓	
0.5 + climate change UKCP09 (2115)	✓	✓		✓	
0.1 + climate change UKCP09 (2070)	✓	✓			
0.1 + climate change UKCP09 (2115)	✓	✓			
0.5 + climate change NPPF (2070)	✓	✓		✓	✓
0.5 + climate change NPPF (2115)	✓	✓		✓	✓

- **Defended** = extreme sea level and wave action
- **Undefended** = extreme sea level (still water) only NO WAVE ACTION
- In line with national guidance

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East Kent Coast Model – key outputs

- Flood depths and levels
- Velocities
- Flood extents
- Hazard grids
- Animations
- Flood Zones (combines undefended and defended flood extents)
- Areas Benefitting from Defences
- Evaluation of Standard of Protection (SoP) of local defences
- Review of the current Flood Warning Areas and criteria/procedures for flood incident management
- Forecasting tool

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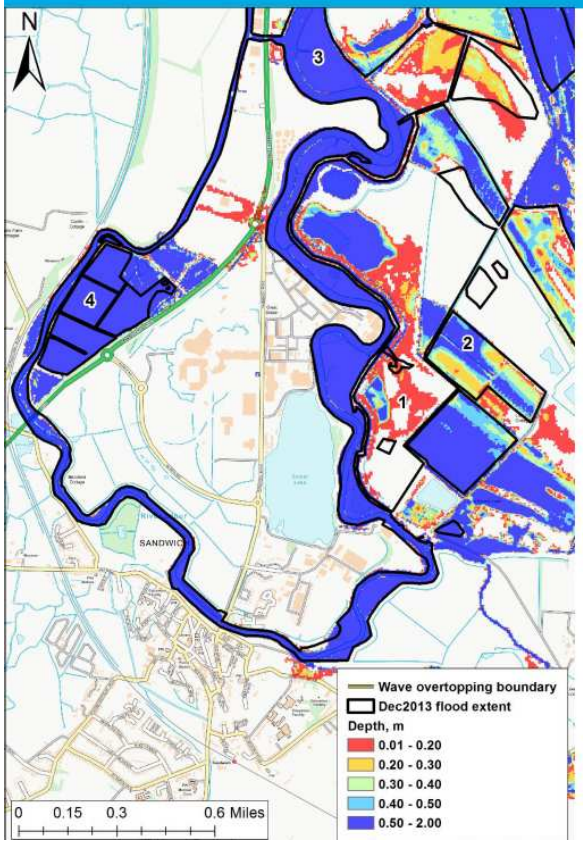
East Kent Coast Model – calibration at Sandwich

- Results calibrated using the December 2013 tidal surge data

Figure 5-3: Sandwich Calibration Modelled Flood Extent




Site Location 1


Site Location 2


Site Location 3


Site Location 4

Photographs supplied by the Environment Agency.

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East Kent Coast Model – calibration at Margate

Site Location 1

Site location 2

Site location 3

Site location 4

Photographs supplied by the Environment Agency.

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East Kent Coast Model - results overview

As a result of this new detailed modelling study:

- 5,768 residential and 714 commercial properties have been removed from flood zone 3.
- 432 residential and 126 commercial properties will now be included in flood zone 3
- 2,064 residential and 243 commercial properties will now be included in the Area Benefitting from Defence (ABD)

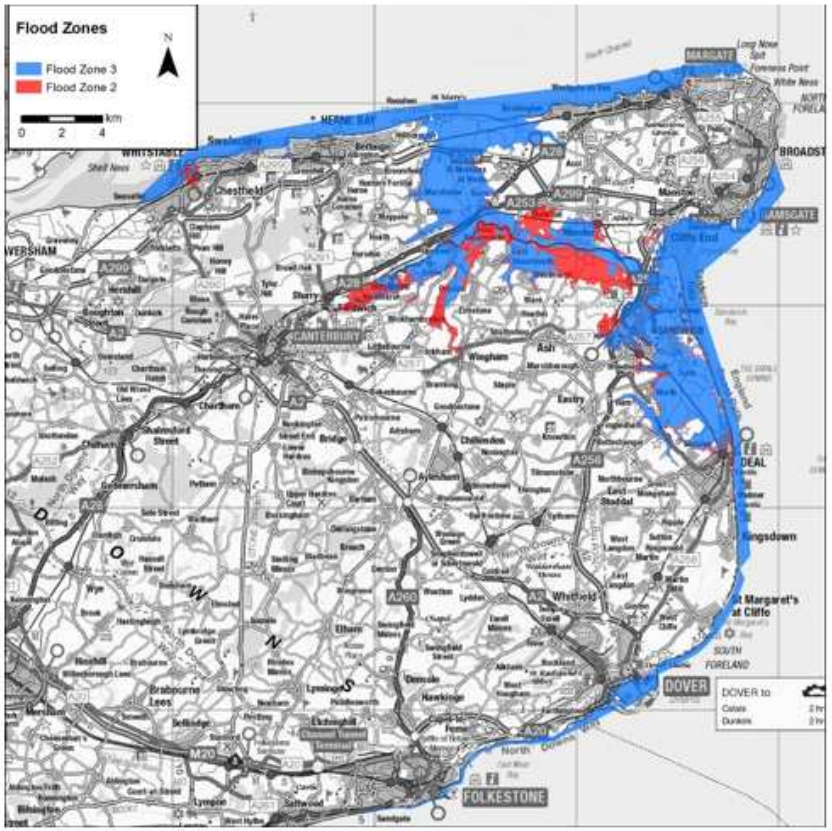

Figure 9-1: Proposed Flood Zone 2 (red) and Flood Zone 3 (blue)

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East Kent Coast Model – why the large change in property at risk numbers?

- Previous modelling had incomplete coverage and used broad scale methods
- This model has used the latest techniques and data including:
  - Latest topographic data
  - Updated defence data
  - Wave overtopping not taken into account previously
  - Roughness value implemented for the floodplain based on landuse/urban areas
  - Smaller grid size

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Model results – Sandwich town tidal defences scheme overview

Sandwich Town Tidal Defences scheme

Reach	Name	Crest level (m AOD)	Spillway level (m AOD)	Notes
		Right bank		
1a	Richborough Roman Amphitheatre	3.8	—	
1	Richborough Rd North	4.0	3.4 (1 in 50 yr)	
2	Richborough Rd South	4.1	—	
3	Gazen Salts	4.2	—	
4	Strand Street	4.15	—	
5	Sandwich Quay	4.2	—	
6	Sandwich Haven	4.4	—	
7	Black Sluice	4.4	—	
8-11	Broad Salts TFRA	4.8	3.8 (1 in 20 yr)	3,000,000 m^3 capacity
		Left bank		
12	Monks Wall Nature Reserve TFRA	4.1	—	
12a	Monks Wall TFRA Spillway		3.2 (1 in 20 yr)	250,000 m^3 capacity
13	Willowbank Development Site	4.2	—	Not part of formal scheme
14	Sandwich Industrial Estate	4.3	—	
15	Stonar Lake	4.4	—	
16	Discovery Park	4.8	—	

The two Tidal Flood Relief Areas (TFRAs) will fill up in 3 successive high tides of a 1 in 200 year event. They will then take a week to drain down.

Broad Salts TFRA (Reach 8-11)

Existing river embankments fronting defences were lowered in 50m intervals to allow better operation of new spillway

Spillway level set to 3.9m AOD, starts to spill in 1 in 20 yr event

Mid embankment within Broad Salts TFRA has a crest level of 3.2m AOD

Remaining embankments have a crest level of 4.8m AOD

Following an event, water drains out through culverts in the embankments

Monks Wall Nature Reserve TFRA (Reach 12 / 12a)

The spillway level varies; the lowest section is set at 3.2m AOD, starts to spill in 1 in 20 yr event

The rear embankment crest level is set to 4.1m AOD

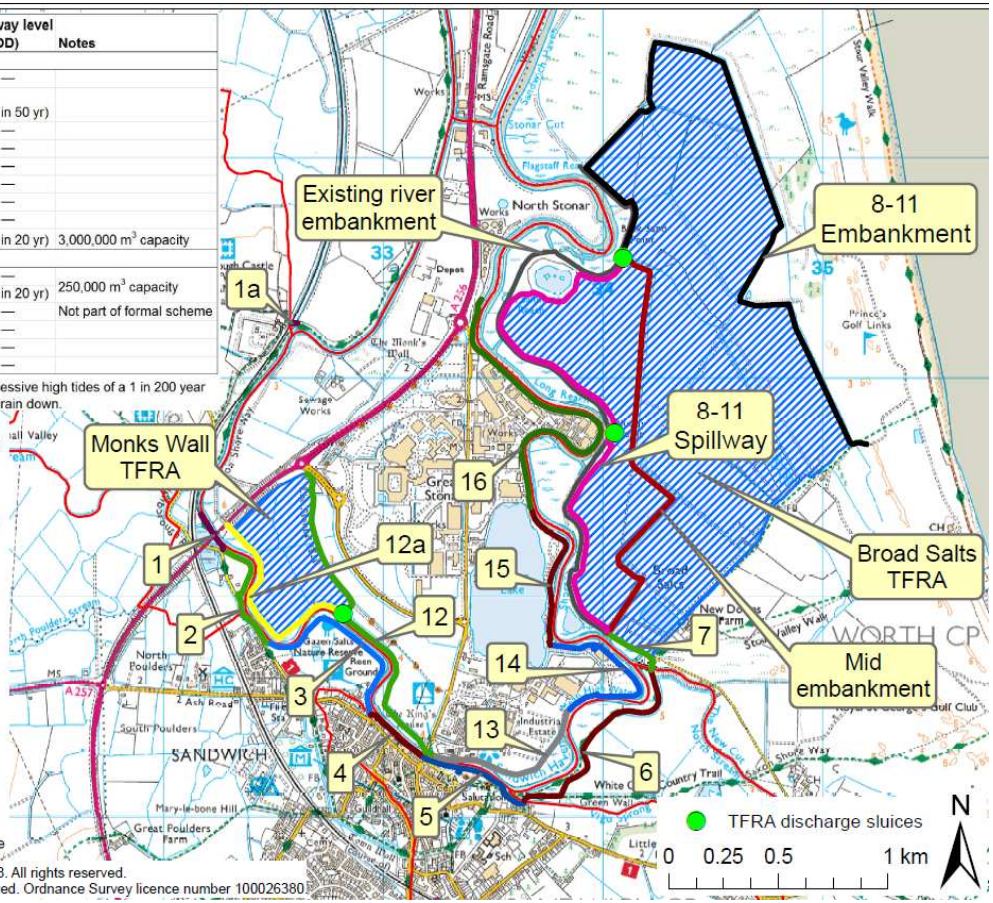
Following an event, water drains out through culverts in the spillway

Richborough Road North (Reach 1)

Although not technically a TFRA, water can flow into the Goshall Marshes via this spillway

Spillway level set to 3.4m AOD, starts to spill in 1 in 50 yr event

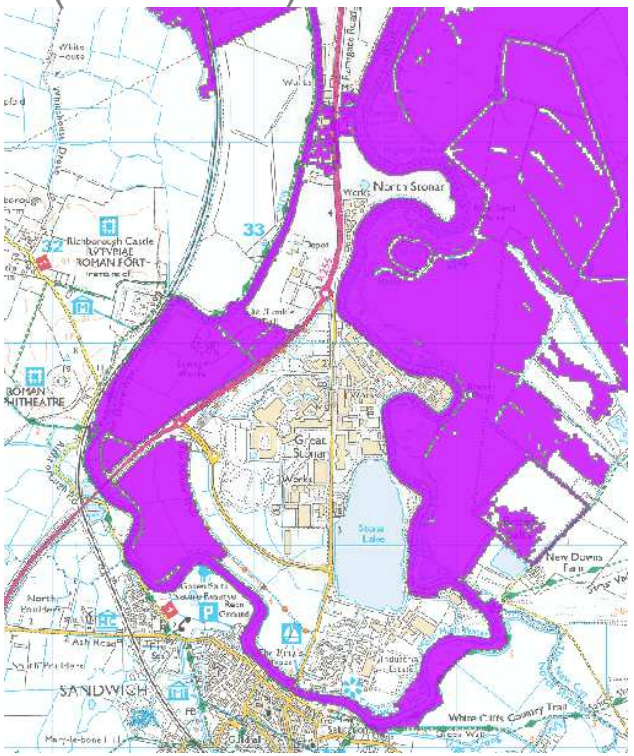
After the event, water then drains back out via Goshall Sluice



Model results – Sandwich undefended and defended scenario

Undefended 200 year (0.5% AEP)

Defended 200 year (0.5% AEP)



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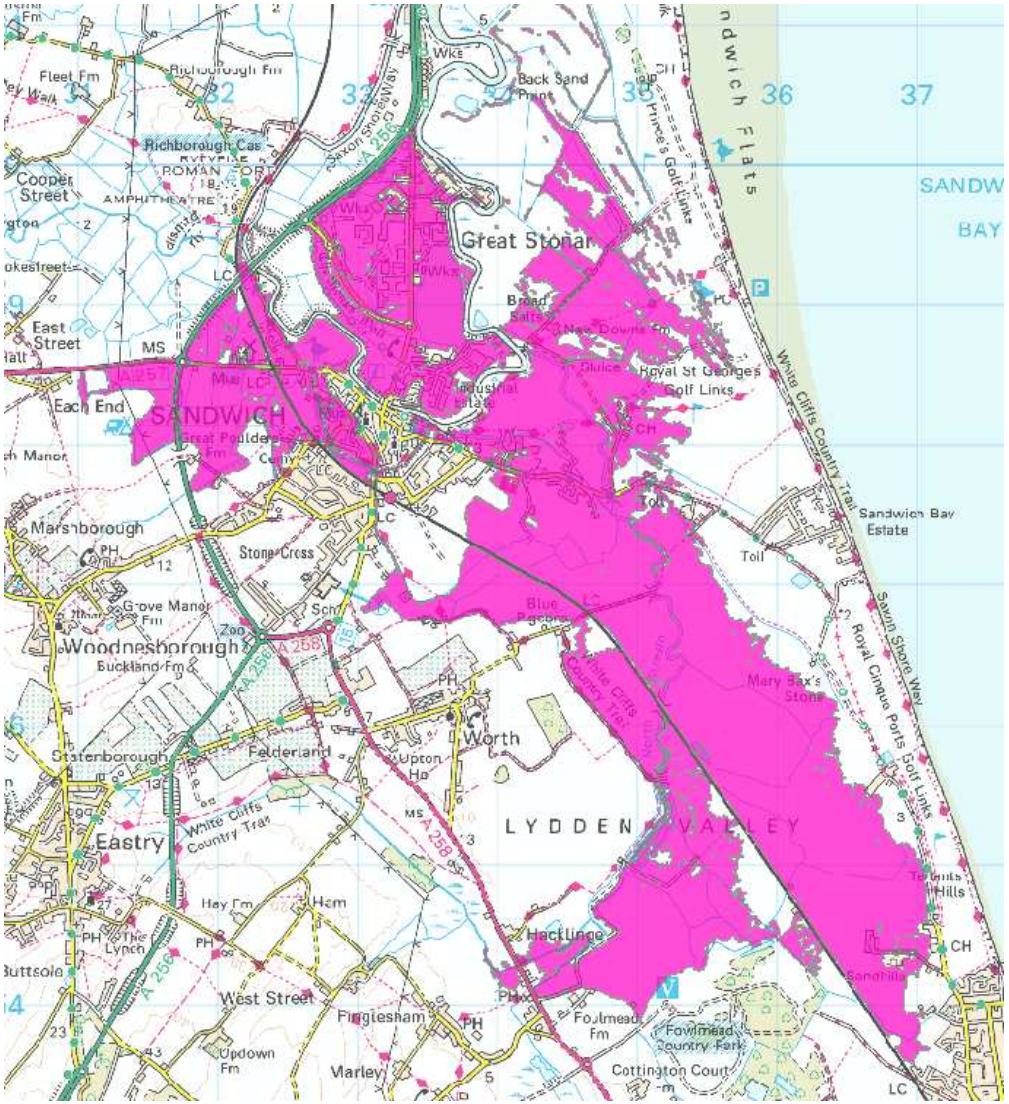
Model results – Sandwich 200 year Area Benefitting from Defences



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Model results – Sandwich animation

Animation for this area showing how the flood propagates for the 200 year (0.5% AEP) defended scenario over 3 tidal cycles

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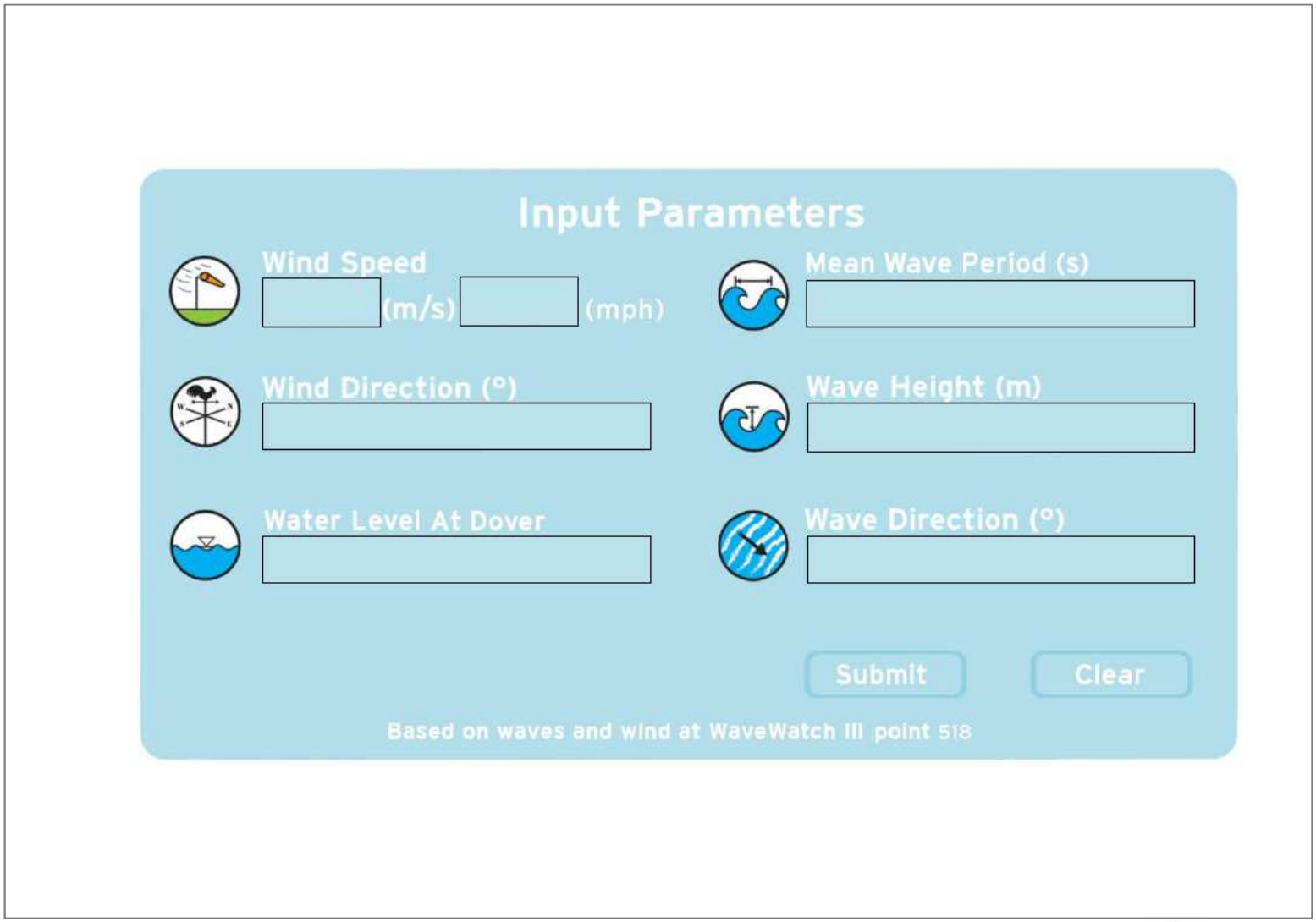
Model outputs - forecoast tool



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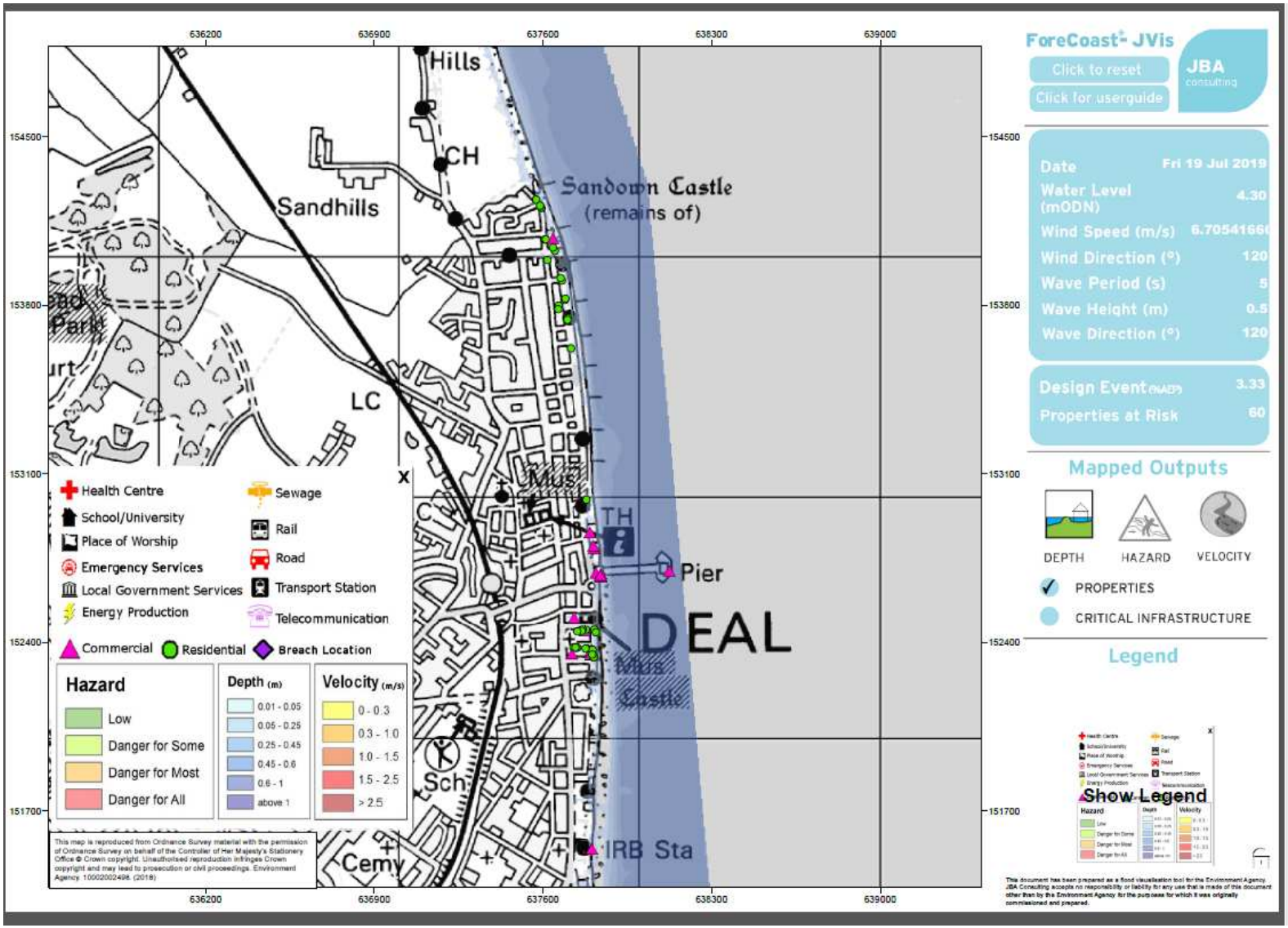
Model outputs - forecoast tool example



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East Kent Coast Model – key considerations

- No account has been taken of combined flood risk - only coastal flooding from tides and waves modelled.
- Wave action only applied to the defended scenarios
- A conservative approach of no infiltration has been taken.
- No surface water drainage or sewer network included
- Model assumes no infiltration into the shingle

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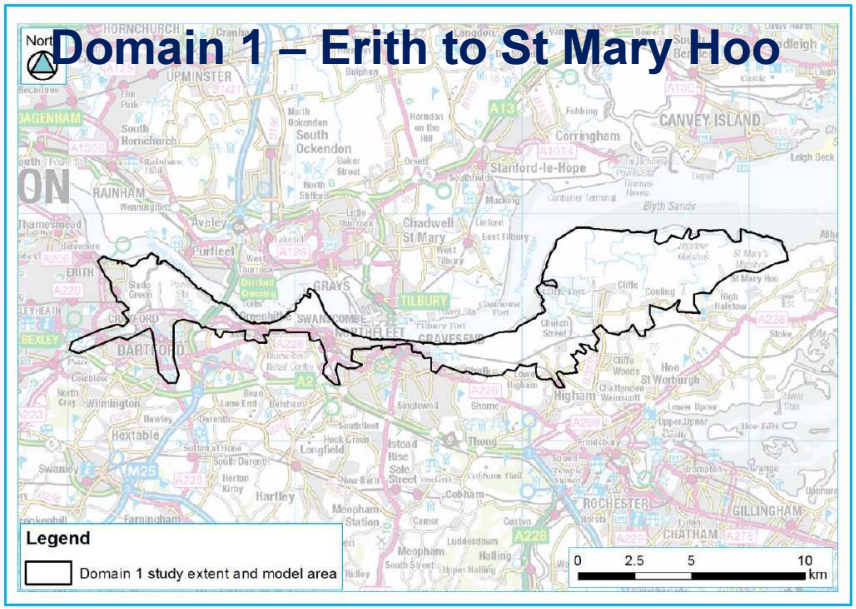
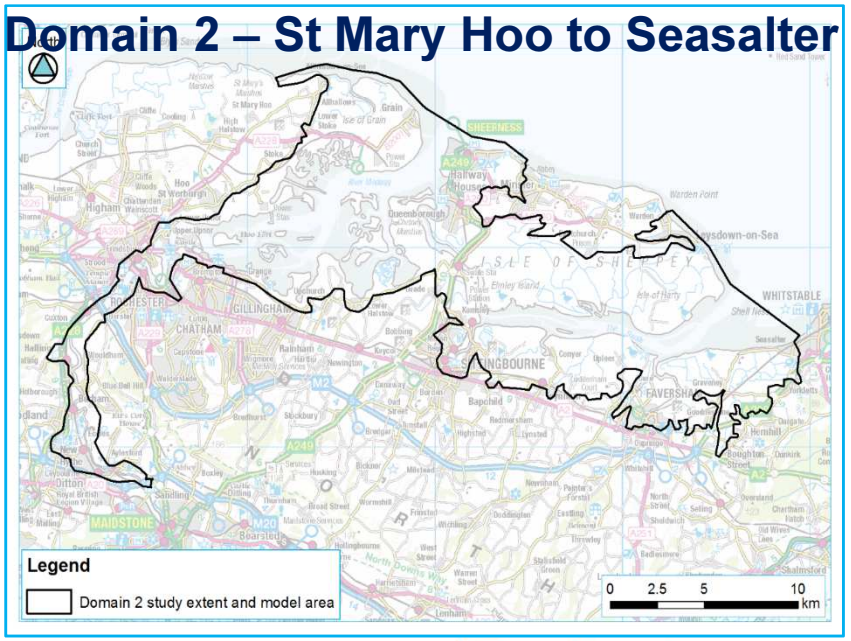
North Kent Coast Model

- Completed in 2013, currently being updated to include:
  - Data collected during the December 2013 tidal surge
  - Most recent extreme sea level dataset (2015)
- Flood map and flood warning areas to be updated by the end of 2019
- Forecasting tool commissioned to assist with incident response
- Model has been independently reviewed as part of a national project





Romney Marsh Model

- Updated in 2017 but further work underway to:
  - Model defence breaches at 14 locations, to inform strategic planning and incident response
  - Represent the Broomhill Sands defences
  - Undertake additional climate change runs
  - Develop a forecasting tool to assist with incident response

Figure 2.1: Romney Marsh study area

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Coastal Modelling – practical applications

- Understanding areas at risk of flooding to plan and prepare
  - Flood map and risk of flooding from rivers and the sea mapping
  - Flood warning areas
  - Incident response procedures

- Development and Planning
  - Strategic planning - SFRAs
  - Site scale - FRAs

- Asset management and scheme development

- Incident Response - data sharing across multi-agency partners

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Thank you for listening…..any questions?

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