

CLIMPING CREMATORIUM

Flood Risk Assessment

Prepared for: Southern Co-operative Group

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SLR



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- Appendix 01: Details of Proposed Layout
- Appendix 02: Site Topographic Survey
- Appendix 02: EA Data Request Response

1.0 Introduction

SLR Consulting Limited has been appointed on behalf of the Southern Co-operative Group Limited to prepare this Flood Risk Assessment (FRA) to support a planning application for a new crematorium on land near Climping ("the Site") in West Sussex.

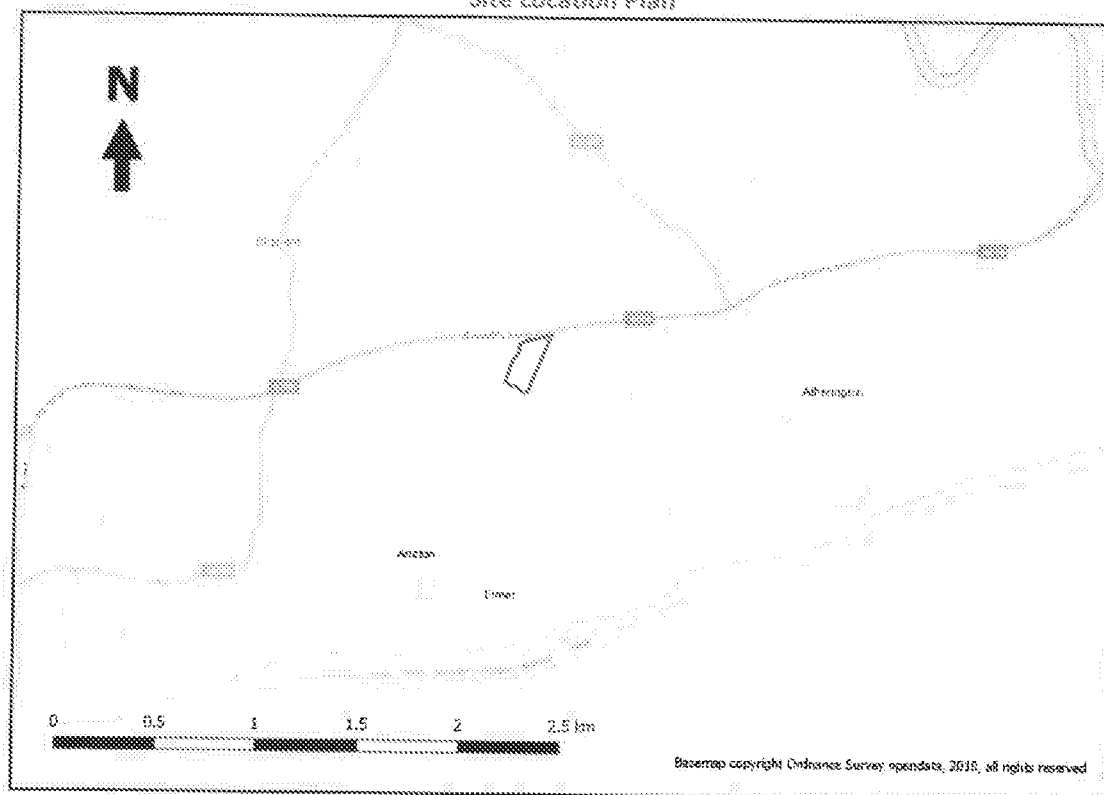
This FRA has been prepared under the direction of a Principal Hydrologist of SLR who specialises in flood risk and associated planning matters. This FRA report has been completed in accordance with guidance presented within the National Planning Policy Framework¹ (NPPF) and its associated Planning Practice Guidance² (PPG), taking due account of current best practice documents relating to assessment of flood risk published by the British Standards Institution BS8533³.

1.1 Site Location

The Site is situated to the south of Grevatt's Lane to the southwest of the village of Climping and to the northeast of Ancton and Elmer. The Site is centred at National Grid Reference 498735 101407.

A Site Location Plan is provided as Figure 1-1.

Figure 1-1
Site Location Plan



- 1 National Planning Policy Framework: Communities and Local Government (March 2012)
- 2 Planning Practice Guidance: Communities and Local Government (March 2014)
- 3 BS8533:2011, Assessing and managing flood risk in development: Code of Practice (1st Edition, October 2011)

The Site is located in an area which falls under the jurisdiction of Arun District Council and West Sussex County Council. The former is the local Planning Authority, and the latter is the Lead Local Flood Authority (LLFA).

1.2 Development Proposals

The proposal is for the development of land to create a crematorium with associated access, parking and landscaping at Grevatt's Lane, Climping, West Sussex, BN17 5RE. Details of the proposed development are enclosed at Appendix 01.

The development will comprise a detached, single storey crematorium building set back circa. 200m from Grevatt's Lane and will incorporate a vestibule and waiting areas, chapel, cremation equipment and ancillary office spaces. The development will be accessed via a new vehicular access from Grevatt's Lane sited in the northwest corner of the site. To the front of the building there will be two parking areas. The main car park will be hard-surfaced and provide for circa. 99 parking spaces. Around the outside of the car park, a driveway will be provided for the use of hearses etc. In addition to the main car park a second, smaller overflow car park, for circa. 60 cars, will be provided in the northeast corner of the site.

The proposals also include the landscaping of the remainder of the site.

2.0 Baseline Site Appraisal

2.1 Existing Site Features

The Site is an arable field which is bound to the north by Grevatt's Lane. A ditch flows in a southerly direction along the western Site boundary. This joins a larger watercourse called Ryebank Rife at the southwestern corner of the Site and this larger channel then forms the southern Site boundary.

Land use locally is all arable farmland and the closest buildings are associated with an area of light industry around 350m to the east

Access onto the Site is obtained from Grevatt's Lane at the northwest corner of the Site via a short track that crosses the ditch along the western Site boundary.

Figure 2-1
Aerial Plan of Site



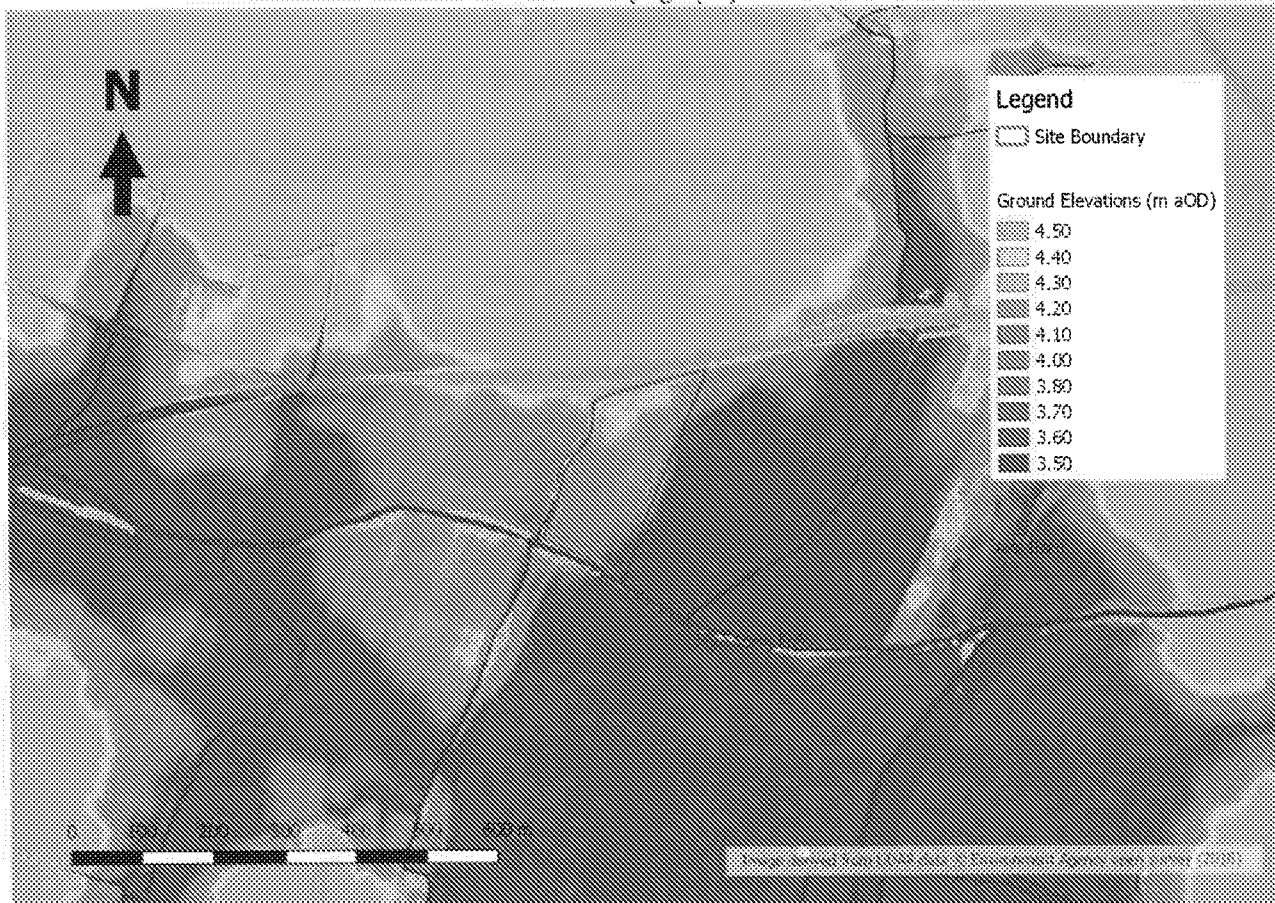
2.2 Topography

Topographic data for the Site and immediate locale, gathered using Light Detection and Ranging (LiDAR) aerial photogrammetric techniques, has been downloaded from the Environment Agency (EA) open data website⁴ (refer to Figure 2-2). A topographic survey of the Site has also been undertaken and a copy of this is contained in Appendix 02.

⁴ Environment Agency open data website, <http://environment.data.gov.uk>

Data indicates that the levels on the Site range between 3.5m above Ordnance Datum (aOD) and 4.5m aOD. The highest areas are to the north close to Grevatt's Lane with the lowest areas present to the southeast close to Ryebank Rife.

Figure 2-2
Local Topography



2.3 Hydrology and Drainage

A significant channel called Ryebank Rife forms the southern Site boundary. This channel, which flows from the west to the east, conveys runoff from the low-lying land between Yapton and Middleton-on-Sea into the tidal reaches of the River Arun. This channel is designated as Main River and the EA are therefore the statutory drainage authority with responsibility for approving any works to, or within 8m, of this channel.

A small ditch flows from the north to the south along the western Site boundary. The ditch drains land to the north of Grevatt's Lane, but, based on the topography, is only likely to receive flows from an area of around 10ha. The channel passes beneath Grevatt's Lane and the site access within a 300mm culvert and then discharges into Ryebank Rife at the southwestern corner of the Site. The channel is an Ordinary Watercourse.

Following the dissolution of the South West Sussex Internal Drainage Board, Arun District Council are now the statutory drainage authority with responsibility for approving any works for Ordinary Watercourses. Arun District Council work in partnership with West Sussex County Council (who are the LLFA) in respect of Consenting and Enforcement on Ordinary Watercourses.

At the time of the Site walkover there were no flows in either the ditch or Ryebank Rife, although standing water was observed in Ryebank Rife just downstream of the Site.

2.4 Geological and Hydrogeological Features

2.4.1 Geology

The National Soils Resources Institute, Soilsdscapes website⁵ describes the soils across the Site as '*Loamy soils with naturally high groundwater*'.

British Geological Survey (BGS) mapping⁶ indicates that the local area is underlain by a solid geology which is comprised of Chalk. This is overlain by drift deposits that are described as River Terrace Deposits consisting of sand, silt and clay.

The site is not located in a groundwater source protection zone. The River Terrace Deposits are however designated as a Secondary A aquifer while the Chalk is designated as a Principal Aquifer. The former designation suggest that this unit may be important for water resources at a local scale while the latter mean that the Chalk is important for water resources on a regional scale. On this basis it should be noted that a groundwater risk assessment will be required if burials are proposed at the site.

2.4.2 Site Investigation

An intrusive investigation of the Site was undertaken in August 2018⁷. This recorded that the drift deposits predominantly comprised silts and clays. The Chalk was encountered at depths of between 3m and 5m below ground level and was observed to be weathered.

Soakaway testing was undertaken at three locations. During the tests water levels in the excavated pits only dropped by between 2 to 14cm in around 5 hours. The tests, which were set up in line with the requirements of BRE365, were abandoned after this as soakage rate were clearly too slow to support infiltration drainage. Full results from this testing are included in the Phase 1 and 2 Geoenvironmental Assessment⁷.

5 Soilsdscapes online soil map, Cranfield Soil and Agrifood Institute, <http://www.landis.org.uk/soilsdscapes/>

6 BGS Geology of Britain Viewer, available at <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>.

7 Phase 1 & 2 Geoenvironmental Assessment, Grevatts Lane, Climping, Prepared for the Southern Co-operative Group, SLR, 2018

3.0 Planning Policy and Guidance

3.1 Proposal Summary

The proposal comprises the development of land to create a crematorium with associated access, parking and landscaping. Details of the proposed development are enclosed at Appendix 01.

With reference to PPG Table 2: *Flood Risk Vulnerability Classification* the proposed development relating to the provision of a crematorium is considered a 'Less Vulnerable' use in terms of flood risk vulnerability classification.

In line with PPG and best practice guidance (BS8533), a 100 year lifetime of development has been applied to this Crematorium development in line with other sites where elements of the proposed land use (including but not limited to, burial plots, etc.) are considered to remain in perpetuity.

3.2 Planning Context

3.2.1 Planning Policy

National Planning Policy

This FRA report has been completed in accordance with the guidance presented in the NPPF¹ and with reference to the PPG for flood risk and coastal change².

Local Planning Policy

This assessment has also been complete in line with local planning policy contained in the Arun Local Plan 2011 – 2031, which was adopted in July 2018. Of particular relevance is Policy W DM2 on flood risk. This states;

"Development in areas at risk from flooding, identified on the latest Environment Agency flood risk maps and the Council's Strategic Flood Risk Assessment (SFRA), will only be permitted where all of the following criteria have been satisfied:

- a. The sequential test in accordance with the National Planning Policy Guidance has been met.*
- b. A site specific Flood Risk Assessment demonstrates that the development will be safe, including access and egress, without increasing flood risk elsewhere and reduce flood risk overall.*
- c. The sustainability benefits to the wider community are clearly identified.*
- d. The scheme identifies adaptation and mitigation measures.*
- e. Appropriate flood warning and evacuation plans are in place; and*
- f. New site drainage systems are designed to take account of events which exceed the normal design standard i.e. consideration of flood flow routing and utilising temporary storage areas.*

The reports prepared as part of the criteria above must take into account contingency allowances, taking climate change into account as set out in Flood Risk Assessments: climate change allowances section of the NPPG.

In locations where strategic flood defence or resilient and resistant construction measures are necessary within the site itself, proposals will be required to demonstrate how measures have been incorporated as an intrinsic part of the scheme in a manner which is compatible with the latest Strategic Flood Risk Assessment.

All development proposals must take account of relevant Surface Water Management Plans, Catchment Flood Management Plans and related Flood Defence Plans and strategies such as the Lower Tidal River Arun Strategy. The council may require financial contributions from development on sites where measures to address flood risk or to improve the environmental quality of watercourses have been identified by these Plans and Strategies."

Where appropriate this assessment has also considered the requirements specified within other local plan policies including:

- Policy ECC SP1 (Adapting to climate change)
- Policy W SP1 (Water)
- Policy W DM1 (Water supply and quality)
- Policy W DM3 (Sustainable Urban Drainage Systems)

3.3 Flood Risk and Planning

3.3.1 Flood Zone Classification

The definition of EA Flood Zones is provided in PPG *Table 1: Flood Zones*:

- *Zone 1 - Low Probability* (Flood Zone 1) is defined as land which could be at risk of flooding from fluvial or tidal flood events with less than 1 in 1000 annual probability of occurrence i.e. considered to be at 'low probability' of flooding.
- *Zone 2 - Medium Probability* (Flood Zone 2) is defined as land which could be at risk of flooding with an annual probability of occurrence between 1 in 100 and 1 in 1000 from fluvial sources and between 1 in 200 and 1 in 1000 from tidal sources i.e. considered to be at 'medium probability' of flooding.
- *Zone 3a - High Probability* (Flood Zone 3a) is defined as land which could be at risk of flooding with an annual probability of occurrence greater than 1 in 100 from fluvial sources and greater than 1 in 200 from tidal sources i.e. considered to be at 'high probability' of flooding.
- *Zone 3b - the Functional Floodplain* (Flood Zone 3b) is defined as 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 in agreement with the EA. In the absence of definitive information, it is often defined as land that would flood with an annual probability of occurrence of 1 in 20 or greater.

In assessing the boundary between Flood Zones 1, 2 and 3, the protection afforded by flood defence structures, and other local circumstances, is not taken into account by the EA.

Based upon the EA Flood Map for Planning⁸ (Figure 3-1) the Site lies across Flood Zones 1, 2 and 3 with the high risk zones present in the lower areas to the south and east of the Site. This mapping is replicated within the SFRA⁹ but with delineation provided between Flood Zones 3a and 3b. This confirms that no areas of the Site are designated as Flood Zone 3b.

An overlay of the development proposal and the flood zones is provided in Figure 3-2. This shows the built elements of the development (crematorium and car parking) are all site outside of Flood Zone 3 and within Flood Zone 2.

⁸ Flood Map for Planning Service: Website: <https://flood-map-for-planning.service.gov.uk/>

⁹ Arun District Council, Level 1 and Level 2 Strategic Flood Risk Assessment, Final Report, November 2016

Figure 3-1
Extract from the EA Flood Map for Planning

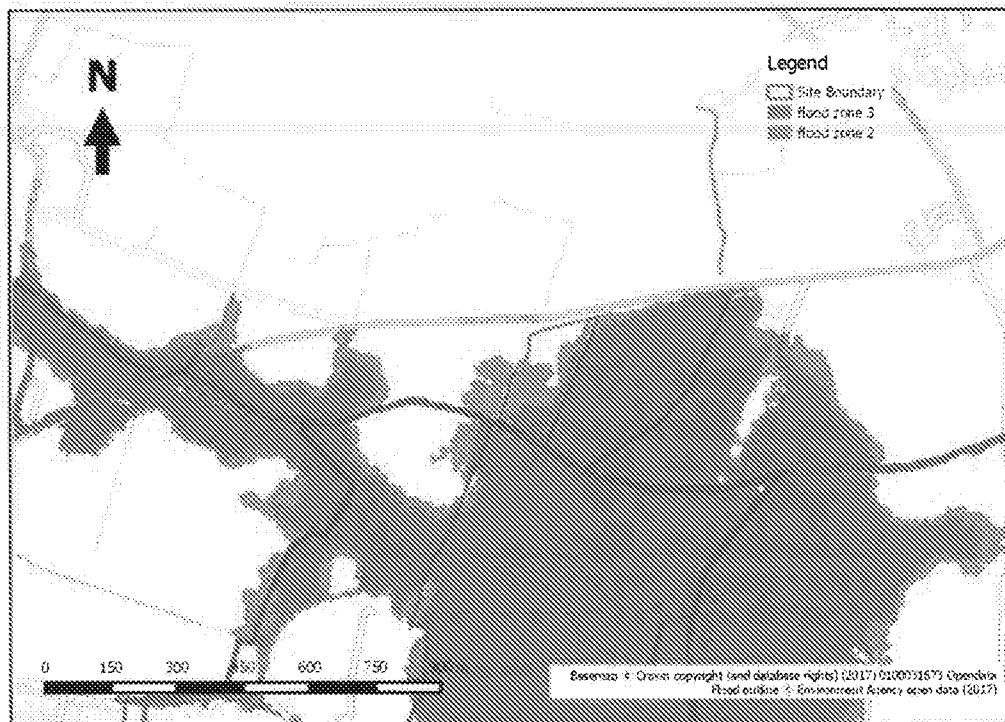
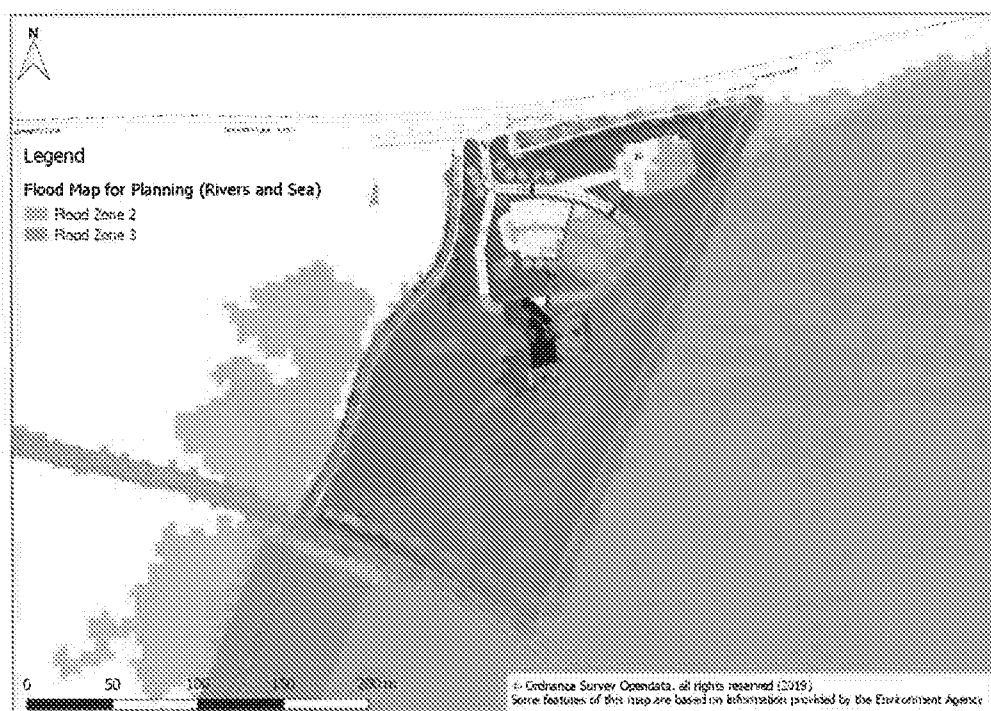


Figure 3-2
Extract from the EA Flood Map for Planning Overlaying Site Plan



3.3.2 Flood Risk Compatibility

As discussed in Section 3.3.1 the Site lies across Flood Zones 1 and 2 and 3 but the actual built parts of the development are sited in Flood Zone 2. As detailed in Section 3.1 the development proposals are considered a 'less vulnerable' development type.

PPG Table 3: Flood risk vulnerability and Flood Zone 'compatibility' (reproduced as Table 3-1) confirms that, with respect to flood risk, 'less vulnerable' development types are potentially appropriate in Flood Zones 2 that the Exception Test is does not need to be applied.

Table 3-1
 Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability Classification (PPG Table 2)		Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone (PPG Table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	Exception Test Required	✓	✓	✓
	Zone 3a	Exception Test Required	x	Exception Test Required	✓	✓
	Zone 3b (functional floodplain)	Exception Test Required	x	x	x	✓

Key: ✓ Development is appropriate x Development should not be permitted

3.3.3 Sequential Test

With reference to the NPPF the Sequential Test gives preference to locating new development in the available areas at lowest risk of flooding (i.e. Flood Zone 1). For sites that are allocated within the Local Plan it can be assumed that the Sequential Test has been passed; however, based on the Local Plan Policy Map¹⁰ the Site is not allocated.

The EA Flood Map for Planning (Figure 3-1) and SFRA are geared to providing the basis for applying the Sequential Test and indicate that the Site is located across Flood Zone 1, 2 and 3. As indicated in Figure 3-2 the part of the proposed development is located within Flood Zone 2 and therefore a sequential test is required. This has been completed in a separate document¹¹ demonstrating that there are no reasonably alternative sites that are subjects to lower levels of flood risk.

The crematorium was unable to be developed in Flood Zone 1 due to regulatory constraints relating to the 1902 Cremation Act. The 1902 Act states that new crematorium buildings should be sited not less than 200 yards of

¹⁰ <https://www.arun.gov.uk/download.cfm?doc=docm93jjm4n12500.pdf&ver=12518>

¹¹ Grevatts Lane Crematorium Alternative Sites Assessment, Chapman Lily Planning Limited

existing houses, unless the residents of existing houses within the 200 yard area have given consent. Nor should a crematorium building be located within 45 metres of a public right of way such as Grevatts Lane.

3.4 Climate Change

In February 2017 the EA issued updated guidance on the impacts of climate change on flood risk in the UK to support NPPF¹². This advice sets out that peak rainfall intensity, sea level, peak river flow; offshore wind speed and extreme wave heights are all expected to increase in the future as a result of climate change.

PPG recommends that considerations for future climate change are included in FRA's for proposed developments. Wave action and offshore windspeed are not considered of relevance at the Site due to the inland location. The recommended changes with respect to the other parameters are however detailed below.

3.4.1 Sea Levels

The guidance details the rate of apparent sea level rise will vary across the country reflecting both changes in sea level associated with climate change and isostatic rebound of the ground surface following the last ice age. Allowances are therefore provided on a regional basis.

Sea level rise is also projected to accelerate and therefore the estimated annual increments in sea level increase over time are provided for four different time horizons through to 2115.

These recommended allowances for sea level change are set out Table 3-2.

Table 3-2
 Sea Level Allowance for each Epoch in millimetres (mm) per year with cumulative sea level rise for each epoch in brackets (use 1990 baseline)

Area of England	1990 to 2025	2026 to 2055	2056 to 2085	2086 to 2115	Cumulative rise 1990 to 2115 / metres (m)
East, East Midlands, London, South East	4 (140 mm)	8.5 (225 mm)	12 (360 mm)	15 (450 mm)	1.21 m

Where horizons just beyond 2115 need consideration it is normal practice to further extrapolate the data based on sea levels continuing to rise by 15mm per year.

It should also be noted that the values quoted relate to the open coast and in other situations the precise changes may vary as a result of local bathymetric and topographic effects. As a result, in estuarine situations, or behind flood defences, best practice involves constructing a model and applying the change in sea level at the downstream model boundary. Where such a model exists the outputs from such modelling should be considered over and above a crude application of the uplifts detailed in Table 3-2.

3.4.2 Fluvial flows

For peak fluvial flow rates the EA guidance notes that the effect of climate change will increase over time and acknowledges that there is uncertainty with respect to the absolute level of change that is likely to occur. As such the document provides estimates of possible changes that reflect three different emission scenarios (*Upper*

¹² Environment Agency, Flood Risk Assessments: Climate change allowances. February 2017

End, Higher Central and Central) and three different horizons. These recommended allowances for peak fluvial flow are set out in Table 3-3.

Table 3-3
 Peak River Flow Allowances by River Basin District (2016)

River Basin District	Allowance Category	Total potential change anticipated for 2015 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
South East	Upper End	25%	50%	105%
	Higher Central	15%	30%	45%
	Central	10%	20%	35%

Guidance¹² advises that the allowance category applied should relate to both the Flood Zone in which a given Site is located and the sensitivity of the development. The proposals are for a 'less vulnerable' development type and, as such, the guidance states:

- Flood Zone 1 use the *central* allowance
- Flood Zone 2 use the *central* allowance
- Flood Zone 3 use the *central* and *higher central* allowances

As highlighted in Figure 3-2 the site is partly located in Flood Zone 3, however the built development is limited to areas designated as Flood Zone 2. Therefore, the *central* allowance has been considered in this assessment. In line with this, where required, this report assesses risks with reference to a 35% uplift in fluvial flows.

It should however be noted that the primary flood risk at the site is from tidal influences and fluvial flooding is not considered to pose a significant constraint even with uplifts associated with climate change.

3.4.3 Rainfall Intensity

The EA climate change guidance acknowledges that there is uncertainty with respect to the absolute level of change that is likely to occur with respect to rainfall and that both the absolute level of change the level uncertainty increase over time. As such the document provides estimates of possible changes that reflect three different time horizons and two different emission scenarios. These recommended allowances for rainfall depths are set out in Table 3-4.

Guidance states that flood risk assessments should assess both the '*central*' and '*upper end*' allowances to understand the range of impact. As detailed in Table 3-4, for a 100 year development lifetime (2060 – 2115), these equate to uplifts of 20% and 40% respectively.

Table 3-4
Peak Rainfall Intensity Allowance in Small and Urban Catchments
(Use 1961 to 1990 baseline)

River Basin District	Allowance Category	Total potential change anticipated for 2015 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Applies across all of England	Upper End	10%	20%	40%
	Central	5%	10%	20%

4.0 Potential Sources of Flooding

4.1 Methodology & Best Practice

This report has been prepared in accordance with the advice and requirements prescribed in current best practice documents relating to management of flood risk in development published by the Construction Industry Research and Information Association (CIRIA)¹³, and BS8533³.

A screening study has been completed to identify whether there are any potential sources of flooding at the Site which may warrant further consideration. If required, any potential significant flooding issues identified in the screening study would then be considered in subsequent sections of the assessment.

4.2 Screening Study

There are a number of potential sources of flooding and these include:

- » Flooding from the sea or tidal flooding;
- » Flooding from rivers or fluvial flooding;
- » Flooding from surface water and overland flow;
- » Flooding from groundwater;
- » Flooding from sewers;
- » Flooding from reservoirs, canals, and other artificial sources; and
- » Flood from infrastructure failure.

Flood risk from each of these potential sources is discussed below.

4.2.1 Flooding from the Sea or Tidal Flooding

While the Site is set more than 1km back from the coast, elevations on Site are all at or below 4.5m aOD and the land between the Site and the coast is low lying former marshland.

Direct inundation from the sea is currently prevented by a raised shingle bank along the beach with a crest height estimated (from LiDAR data) to be between 5m aOD and 6m aOD. Overtopping of this ridge by wave action is however possible and will become increasingly likely over time as sea levels rise associated with climate change.

The risk of flooding from the sea or tidal flooding is therefore potentially significant and is considered in greater detail in Section 5.0.

4.2.2 Flooding from Rivers or Fluvial Flooding

Fluvial flows within the ditch along the western Site boundary are unlikely to ever be significant. In the event that flows exceeded the channel capacity or there was a blockage (to either the channel or road culvert), flooding would preferentially occur to the west of the channel where land levels are slightly lower than the Site. This elevation differential can be seen in Figure 2-2.

Ryebank Rife does not follow the local topography indicating that it has been historically been straightened to run along field boundaries. Along the reach past the Site the channel is cutting through higher ground and, if

¹³ CIRIA Report C624, Development and flood risk: guidance for the construction industry

flooding were to ever occur along this channel, it would therefore not occur along this reach. Changes in flow associated with climate change are highly unlikely to alter the situation significantly.

Based on this, the risk of fluvial is assessed to be low and is not considered further.

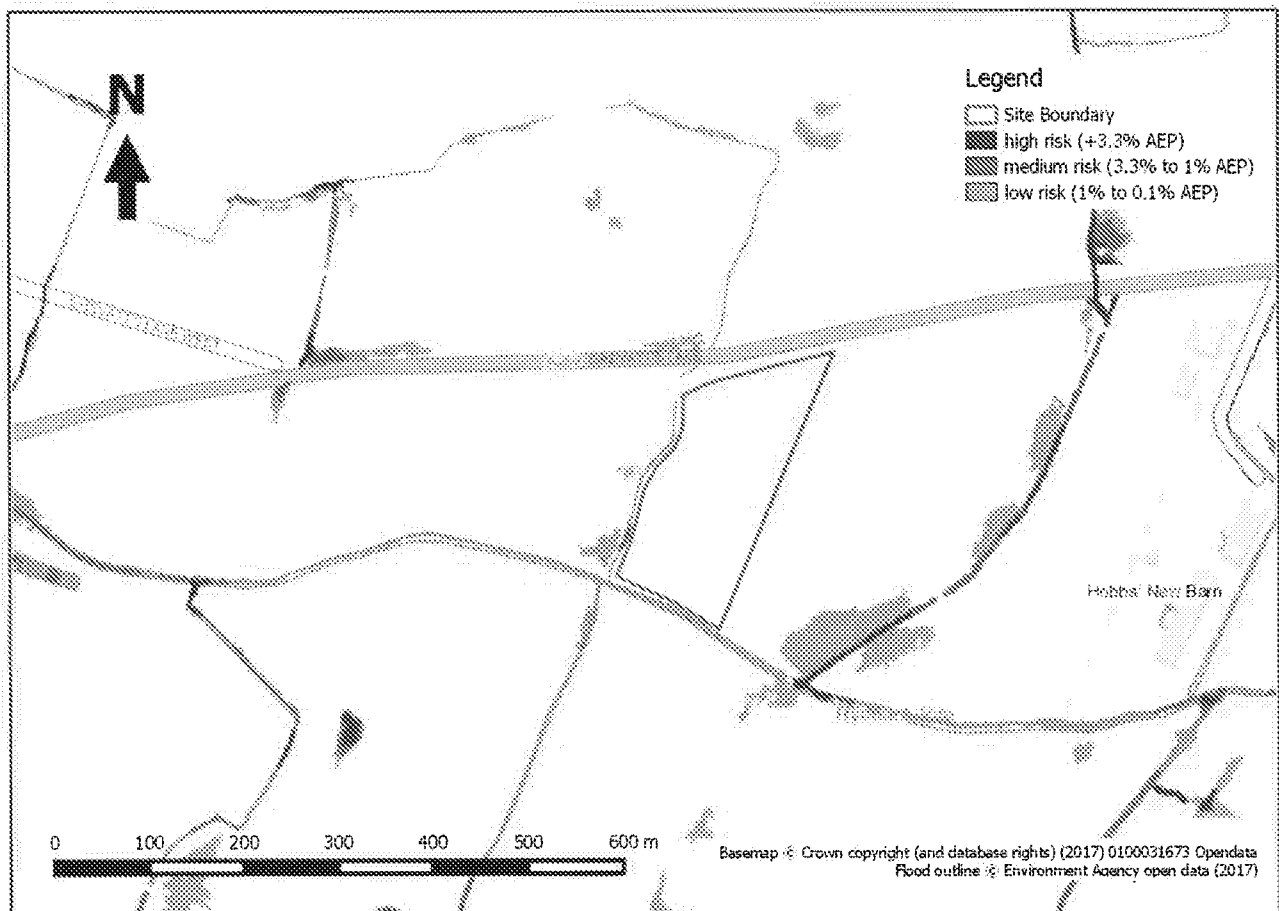
4.2.3 Flooding from Surface Water

The SFRA⁹ (Appendix H - Sheet No: 13 of 46) indicates that there are no reports of historical flooding from surface water runoff at or near the Site.

A review of local context indicates that surface runoff from the west and south would tend to be intercepted by watercourses. Runoff from land to the north would be intercept by Grevatt's Lane which is locally embanked above the Site and land levels fall to the east.

In line with this, EA mapping¹⁴, reproduced as Figure 4-1 (and also replicated in Appendix E of SFRA), indicates that the risk of surface water flooding at the Site is very low.

Figure 4-1
Extract of the EA Surface Water Flood Map



Based on this surface water flooding is not considered further.

¹⁴ Environment Agency's Long term flood risk assessment for location in England, <https://flood-warning-information.service.gov.uk/long-term-flood-risk/>

4.2.4 Flooding from Groundwater

The SFRA⁹ (Appendix H - Sheet No: 13 of 46) indicates that there are no reports of historical flooding from groundwater emergence at or near the Site. The SFRA (Appendix F - Sheet No: 13 of 46) does however suggest that the Site is within an area where over 75% of the land is underlain by a geological formation that could give rise to elevated levels of groundwater flood risk.

A review of the Site context indicates that the Site is gently sloping and that there are no steep faces or geological boundaries that would promote groundwater emergence. In addition, the presence of channels to the west and south of the Site provides a natural control on groundwater elevations.

Intrusive investigation at the Site did not encounter any groundwater in boreholes excavated to 5m below ground level. The site development plans do not propose any subterranean development.

Based on this, the risk of groundwater emergence and groundwater flooding is assessed to be low and is not considered further.

4.2.5 Flooding from Sewers and Water Mains

The SFRA⁹ (Appendix H - Sheet No: 13 of 46) indicates that does not highlight any historic sewer flooding events on, or in the vicinity of, the Site.

Based on Southern Water asset plans there are no public sewers on or adjacent to the Site, but potable water mains are present beneath Gravett's Lane. A significant surcharge or failure (or burst main) immediately adjacent to the Site could result in flood water flowing onto the Site; however, provided that a differential is maintained between the building floor levels and adjacent ground levels (i.e. in line with Building Regulations), this would bypass the buildings and not present a major flood risk.

4.2.6 Flooding from Reservoirs, Canals and other Artificial Sources

EA mapping¹⁴ shows that the Site does not lie within the flood extent of a breach from any raised reservoirs.

No other artificial sources of flooding have been identified in the vicinity of the Site and therefore flooding from reservoirs, canals and other artificial sources is considered low. Flooding from this source is not considered further.

4.2.7 Flooding from Infrastructure Failure

Raised shingle beaches are present along the coast between the elevated areas of Littlehampton and Bognor Regis. These act as a flood defence and prevent regular tidal inundation of the low lying former marshland between the Site and the coast. In the event that this shingle beach was breached / eroded away significant flooding could extend inland towards the Site.

This potential flood mechanism is considered in greater detail within Section Error! Reference source not found.

A review of the local context has not identified any other infrastructure, the failure of which could result in flooding at the Site.

4.3 Flood Summary

A summary of the potential sources of flooding and the flood risk arising from them is presented in Table 4-1.

Table 4-1
Potential Risk Posed by Flooding Sources

Potential Source	Potential Flood Risk at Site?
Sea or Tidal Flooding	Yes
Rivers or Fluvial Flooding	No
Surface Water and Overland Flow	No
Groundwater	No
Sewers and Water Mains	No
Reservoirs, Canals and other Artificial Sources	No
Infrastructure Failure	Yes

5.0 Tidal Flood Risk

As noted in Section 4.2.1 the Site is located on the edge of an area of low-lying former coastal marshland and is currently protected by raised shingle ridges. A risk exists of these defences being over topped or failing as a result of erosion.

5.1 Local Flood Defences

A failure / breach of the shingle ridge would allow water to flow through the defences onto the low-lying land on and around the Site. The Site would be at greatest risk from a failure between Elmer and Poole Place (the section of raised defence closest to the Site). Erosion of the shingle ridge in this area is however controlled by offshore breakwaters. The defences in this area are classified by the EA as being in a '*moderate (3)*' state of repair.

The Site would also be vulnerable to a failure further to the east along the stretch of coast from Climping Beach eastwards. Flooding in this area would be routed along Ryebank Rife towards the Site. Within this stretch the defences were observed to be in a poor state of repair with recent erosion of the shingle bank behind wooden barriers. The defences in this area are classified by the EA as being in a '*poor (4)*' state of repair.

Observations of the poor state of repair of the local defences are provided in Figure 5-1 below. These demonstrate that the shingle ridge is being actively eroded and does not indicate any active management or repairs. On this basis a major failure in the short to medium term is considered to be highly likely.

Figure 5-1
Damaged flood defences near Climping Beach (August 2018)



5.2 Shoreline Management

The Local Shoreline Management plan¹⁵ states that the local policy is to

"begin to realign the coastline landwards in a proactive manner. This may be achieved by either reconfiguring the primary defences to create a number of larger, swash-aligned bays, or allowing the existing primary defences to roll back/fail and the shoreline to erode whilst maintaining flood defence to the hinterland by constructing secondary defences."

On this basis, and in advance of detailed plans to 'protect the hinterland', a full failure of the shingle ridge and inundation of the low-lying land between the sea and the Site should be considered as likely in the short to medium term.

On this basis when considering long term risk the Site should be considered to be undefended. In the light of this no separate consideration of over topping or breach scenarios as these will result in less water propagating inland and lower floodwater levels at and around the site.

5.3 Undefended Flood Model Outputs

The Environment Agency has provided (Appendix 03) estimated flood levels for modelled scenarios that assume the existing flood defences fail and the area remains undefended (i.e. the shingle ridge has been fully eroded). These suggest a current day flood level of 3.86maOD which is predicted to increase to 4.37m aOD by 2070 and 4.94m by 2115. These flood levels are for events with a 1 in 200 annual probability of re-occurrence. This is the normal design standard applied for tidal flooding.

Assessing for a projected 100 year development lifetime (see Section 3.1) this would mean a design flood level for the site of 4.94m aOD¹⁶.

If the existing defences were retained (and repaired /upgraded) or a new flood defence scheme were constructed further inland this could have a significant effect on flood risk at the site. The EA have not however provided any 'defended' model data or information concerning proposals for an inland flood defence scheme. Such scenarios are therefore not considered in this assessment.

5.4 Flood Mitigation

The Southern Co-op have designed the proposed crematorium building to have a floor level of 4.64m aOD. The design flood is therefore only predicted to breach the site from 2070 to 2115 with a maximum predicted depth of internal flooding of 0.3m. This will significantly reduce the probability of internal flooding and ensure that if flooding does occur (in the longer term due to changes associated with climate change) the severity of flooding would be relatively modest.

Additional measures will also be incorporated into the design of the crematorium to improve the resilience of the development to flooding, reduce damage in the event of a flood and reduce the cost and time required for clean-up following a major tidal storm.

The building on the Site will be designed to be flood resilient to at least an elevation of 5.24m aOD (i.e. 300mm above design flood level). This will require;

- Routing electrics down from the ceiling and elevating electric sockets,

¹⁵ Beachy Head to Selsey Bill Shoreline Management Plan Final Document - 2006

¹⁶ For a time horizon of 2118 an additional 45mm should need to be added to the projected flood level for 2115 (see Section 3.4.1); however, as this results in an uplift of less than 0.005m this has been ignored.

- ✦ Locating document storage and sensitive plant at above a height of 5.24m aOD (i.e. raise 0.6m above floor levels,
- ✦ Avoiding suspended floor and the use of permeable materials (plaster board, carpets etc) below an elevation of 5.24m aOD, and
- ✦ Incorporating one-way valves on foul drainage.

5.5 Access and Egress

Routes into and out of the site along Grevatt's Lane are located within Flood Zone 1 and as such would not be inundated in the event of a major flood. Access into and egress from the site should therefore still be possible even the event of a flood event.

5.6 Flood Planning

Clearly a major flood event would impact operations on the site and could have implications for aspects of the development such as the welfare facilities. Post planning approval the Southern Co-op Group will therefore prepare an emergency flood response plan to consider what the impact of flooding might be on site operations and how these are best managed for the safety of both staff and the public. Key elements of the plan will include

- ✦ Detail of the local EA flood warning service and a commitment to subscribe to this;
- ✦ Consideration of situations that may require a shut-down of the site and practical steps for implementing this;
- ✦ Consideration of ancillary aspects of the site (drainage / landscaping) that could get damaged by flood water and steps that could safely be undertaken in advance of flooding to limit this; and
- ✦ Planning for any post flood remedial measures that might reasonably be expected (dehumidifiers etc).

6.0 Conclusions

SLR Consulting Limited has been appointed on behalf of the Southern Co-operative Group Limited to prepare this Flood Risk Assessment (FRA) to support planning application for a new crematorium on land near Climping ("the Site"). Based on this assessment the following conclusions are made;

1. The Site is situated across Flood Zone 1, 2 and 3 and, as development extends into Flood Zone 2 a sequential test has been completed in a separate document. This demonstrates that there are no reasonably alternative sites that are subjects to lower levels of flood risk.
2. The primary flood risk arises from the sea and the fact that current flood defences along the coast are unlikely to be retained. As a result of this, and projected changes in sea level associated with climate change, tidal flood could extend inland up to, and across, all of the Site with a design flood level of 4.94m aOD.
3. Finished floor levels for the crematorium will be set at 4.64m aOD. This will limit the depth of potential flooding within the building (under design flood conditions) to at or less than 300mm for a 1 in 200 year tidal flood event.
4. The building on the Site will be designed to be flood resilient to at least an elevation of 5.24m aOD (i.e. 300mm above design flood level). This will require;
 - ✦ Routing electrics down from the ceiling and elevating electric sockets,
 - ✦ Locating document storage and sensitive plant at above a height of 5.24m aOD (i.e. raise 0.6m above floor levels),
 - ✦ Avoiding suspended floor and the use of permeable materials (plaster board, carpets etc) below an elevation of 5.24maOD, and
 - ✦ Incorporating one-way valves on foul drainage.
5. An emergency flood response plan will be prepared for the Site post planning approval setting out how operations on the Site will be managed (or ceased) during periods of heightened risk.

APPENDIX 01

Details of Proposed Layout



APPENDIX 02

Site Topographic Survey

APPENDIX 03

EA Data Request Response

Daniel Watson
SLR Consulting Ltd
Warnford Court
29 Throgmorton Street
London
EC2N 2AT

Our ref: SSD91970

Date: 19/07/2018

Dear Daniel,

Enquiry Regarding Product 4 for Flood Risk Assessment for Land To The South Of Grevatt's Lane, Climping, BN17 5RE.

Thank you for your enquiry which was received on 06 July 2018.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004. The information is attached.

The information on Flood Zones in the area relating to this address is as follows:

The site is in an area located within Flood Zone 3 (tidal) as shown on our Flood Map for Planning (Rivers and Sea).

Note - This information relates to the area that the above named property is in and is not specific to the property itself as it is influenced by factors such as the height of door steps, air bricks or the height of surrounding walls. We do not have access to this information and is not currently used in our flood modelling.

Flood Zone definitions can be found at www.gov.uk/guidance/flood-risk-and-coastal-change#Table-1-Flood-Zones

Flood Defences

There are no formal raised flood defences in the vicinity of the site.

Model Information

The model used was the Ems to Littlehampton Modelling (Arun to East Head Model) which was completed by JBA in 2016.

Flood History

We hold no record of previous flooding events affecting this site.

Please note our records are not comprehensive and may not include all events. I recommend contacting the Lead Local Flood Authority, **West Sussex County Council** or the Local Authority, **Arun District Council** for a more comprehensive flood history check.

FRA advisory text

Name	Product 4
Description	Detailed Flood Risk Assessment Map for Land To The South Of Grevatt's Lane, Climping, BN17 5RE.
Licence	Open Government Licence
Information Warnings	None
Information Warning - OS background mapping	<i>The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply to this background mapping. You are granted a non-exclusive, royalty free, revocable licence solely to view the Licensed Data for non-commercial purposes for the period during which the Environment Agency makes it available. You are not permitted to copy, sub-license, distribute, sell or otherwise make available the Licensed Data to third parties in any form. Third party rights to enforce the terms of this licence shall be reserved to OS.</i>
Attribution	Contains Environment Agency information © Environment Agency and/or database rights. Contains Ordnance Survey data © Crown copyright 2018 Ordnance Survey 100024198.

Data Available Online

Many of our flood datasets are available online:

- [Flood Map For Planning \(Flood Zone 2, Flood Zone 3 ,Flood Storage Areas, Flood Defences, Areas Benefiting from Defences\)](#)
- [Risk of Flooding from Rivers and Sea](#)
- [Historic Flood Map](#)
- [Current Flood Warnings](#)

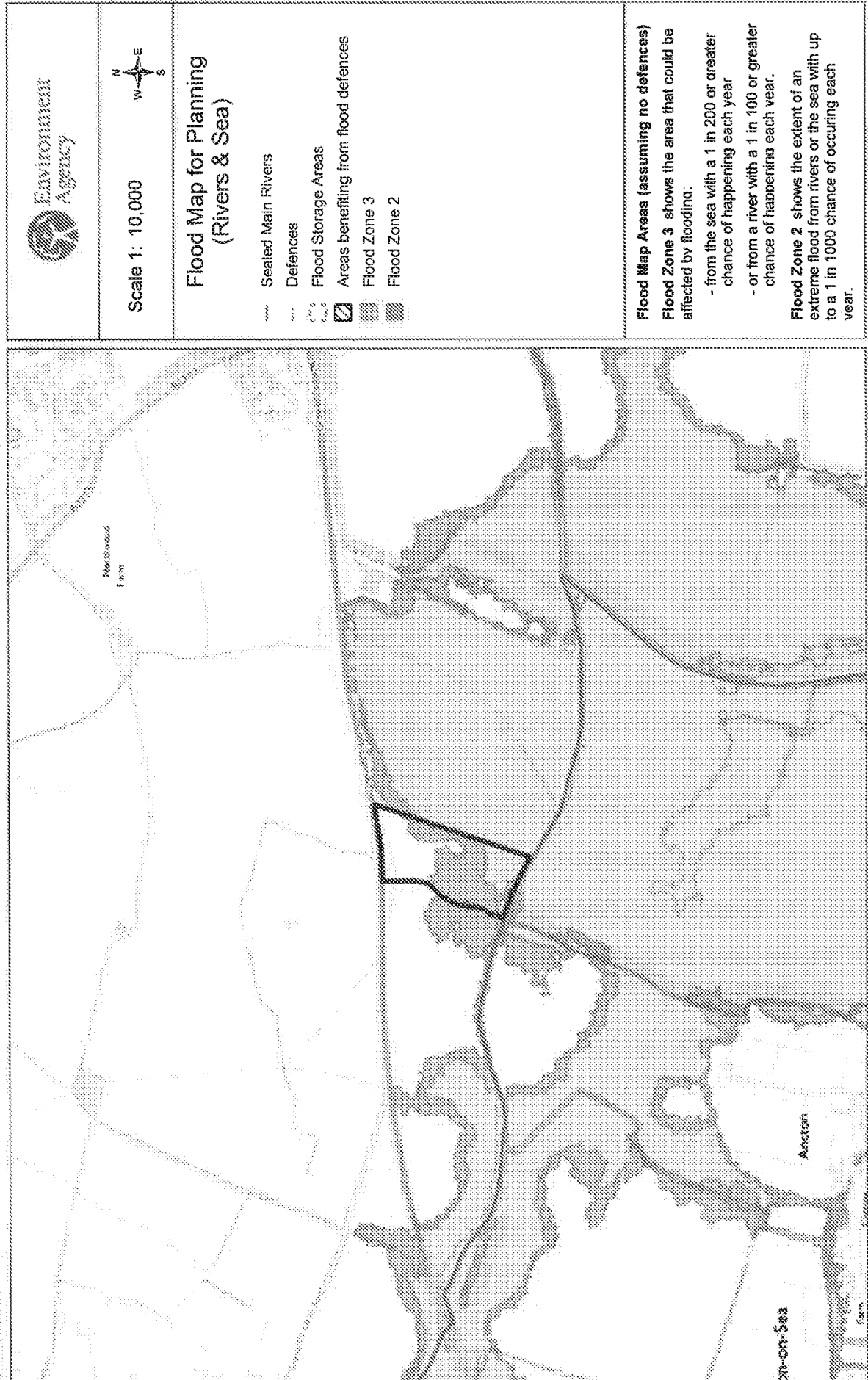
Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Yours sincerely,

Leanne Prentice

FCRM Officer - PSO West Sussex

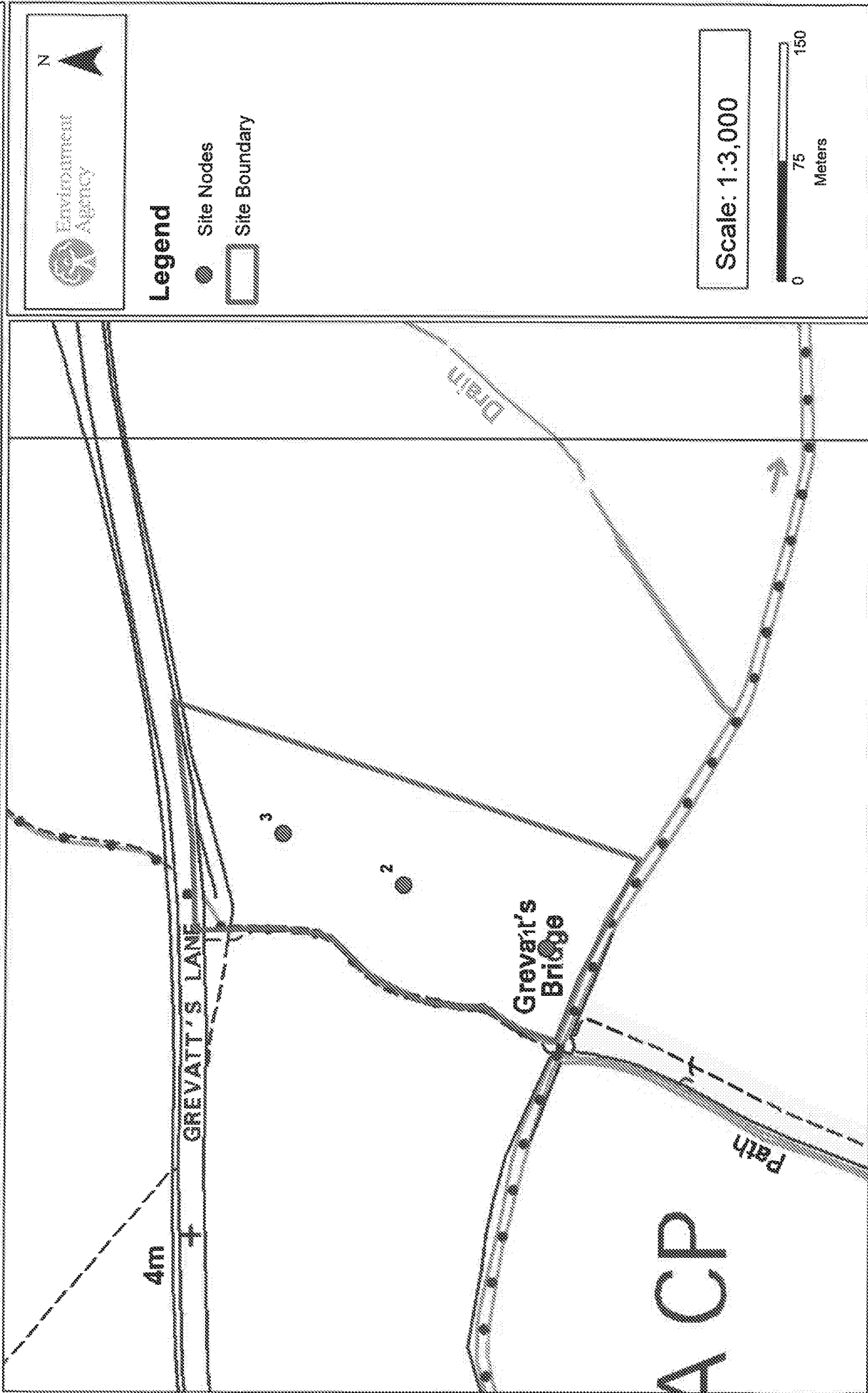
Flood Map for Planning (Rivers and Sea). Centred on BN17 5RE. Created 16/7/18.



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Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03705 508 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Site Boundary & Node Point Map. Centred BN17 5RE. Created 19/7/18.



Product 4 Flood Risk Data Requested by: SLR Consulting

Site: Land to the South of Grevatt's Lane, Climping, BN17 5RE

Table 1: Water Levels: Tidal Undefended

Node Ref	NGR		Modelled Flood Levels in Metres			
	Eastings	Northings	Undefended Annual Exceedance Probability			
			0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	498677	101302	3.86	4.37	4.94	4.07
2	498717	101393	N/A	4.37	4.94	4.05
3	498750	101469	N/A	4.38	4.95	N/A

Table 2: Water Depth: Tidal Undefended

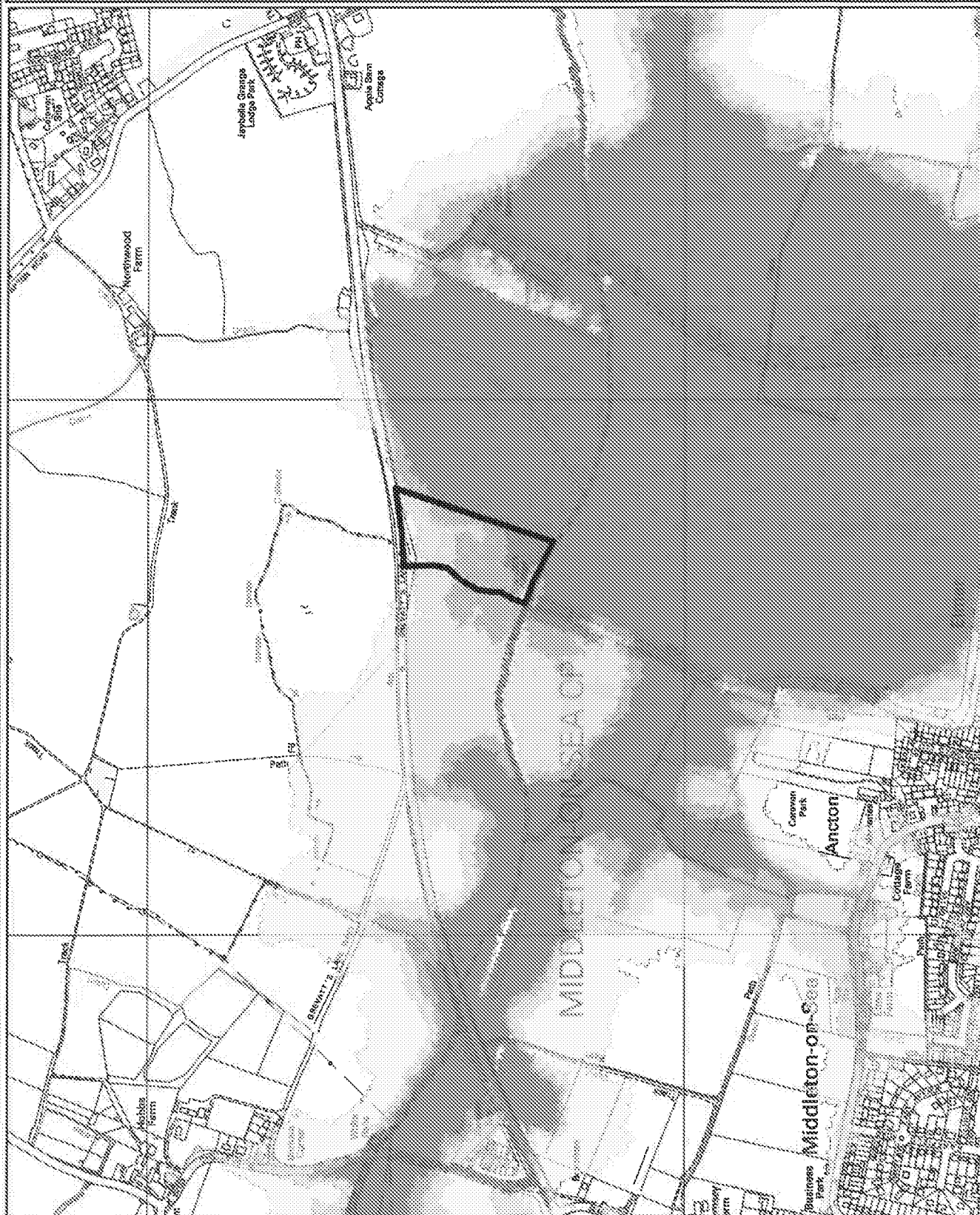
Node Ref	NGR		Modelled Flood Depths in Metres			
	Eastings	Northings	Undefended Annual Exceedance Probability			
			0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	498677	101302	0.05	0.56	1.13	0.26
2	498717	101393	N/A	0.42	1.00	0.11
3	498750	101469	N/A	0.10	0.67	N/A

All levels taken from: Arun to East Head Model

Produced on: 19/07/2018

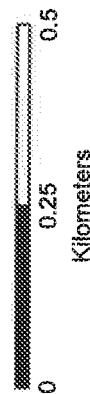
There is no additional information or health warnings for these levels/depths or the model from which they have been produced.

Modelled Flood Outlines (Un defended Tidal) Map. Centred BN17 5RE. Created 19/7/18.



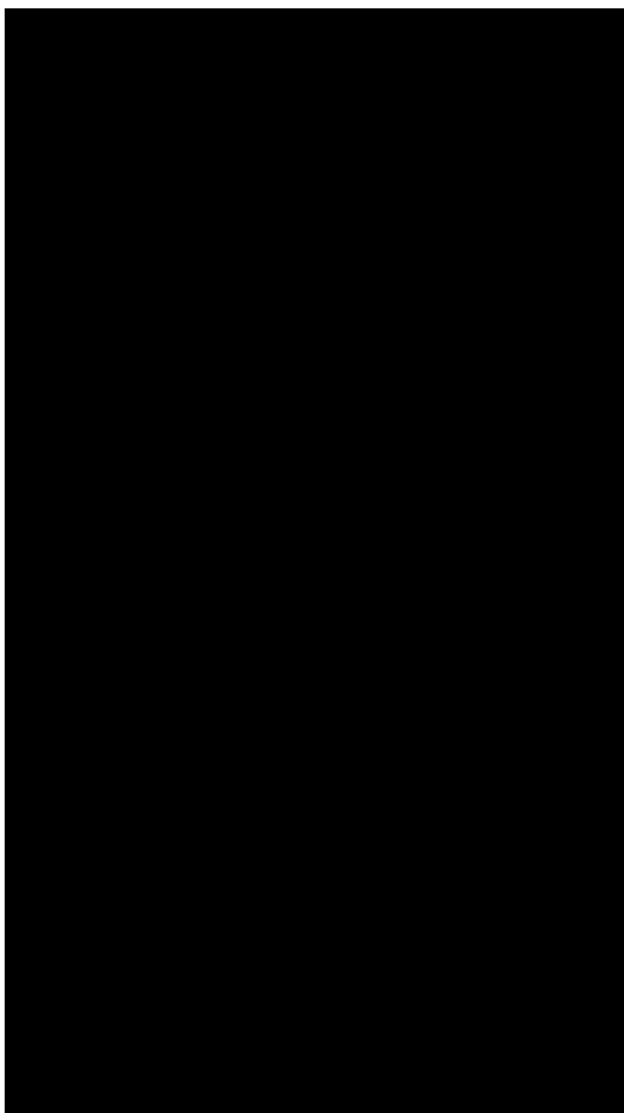
Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:10,000



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