URS

Essex County Council

Replacement Minerals Local Plan: Pre – Submission Draft Level 1 Strategic Flood Risk Assessment

Final Report

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UNITED KINGDOM & IRELAND

Prepared for:

Essex County Council

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EXECUTIVE SUMMARY

URS Infrastructure and Environment UK Ltd ("URS", formerly Scott Wilson Ltd) has been commissioned to prepare a Level 1 Strategic Flood Risk Assessment (SFRA) on behalf of Essex County Council (ECC) to assess the flood risk to potential mineral site allocations. This information will be used by ECC to inform the preparation of their Replacement Minerals Local Plan[1] (MLP) which is required to meet their obligations as a Minerals Planning Authority (MPA).

The original Level 1 Minerals and Waste SFRA[2] was prepared on behalf of ECC in September 2010 and provided an assessment of both mineral and waste sites. The SFRA was subsequently updated in July 2011[3] to take account of amended and additional potential waste sites, as well as up to date flood risk information published by the Environment Agency (EA). References to new legislation, policies and strategies emerging during this period and relevant to the study area such as the Flood and Water Management Act[4] (FWMA) were also incorporated into the SFRA where appropriate. In September 2012, ECC commissioned another revision to the SFRA to support the submission of the MLP. This version of the SFRA provides an assessment solely of the mineral sites that have been considered during the development of the MLP. This version of the SFRA also takes account of the publication of the National Planning Policy Framework[5] (NPPF).

The Level 1 SFRA builds upon existing district and borough SFRAs that are available as well as the Essex Mineral Development Issues and Options high level Flood Risk Assessment of Minerals Options[6] which was completed in January 2009.

The study area covers the following 12 districts; Uttlesford, Braintree, Colchester, Tendring, Maldon, Chelmsford, Harlow, Epping Forest, Brentwood, Basildon, Rochford, and Castle Point.

Essex is prone to coastal flooding from the River Thames and North Sea through a number of large estuaries which transmit this risk to the extensive coastline areas. The county also includes a number of large main rivers and associated tributaries such as the rivers Chelmer, Blackwater, Colne and Stour in the north, the River Crouch and River Roach in the south and the River Lea in the east.

The northern half of Essex is predominantly rural with over 60% of the land used for arable crop production[7], while the south of Essex is more heavily urbanised.

The main mineral resources in Essex are sand and gravel for aggregate use and brickearth, chalk, brick clay and silica sand which are all non-aggregate. Sand and gravel is worked predominantly to supply local markets.

This report forms a Level 1 SFRA providing an overview of flood risk issues across all twelve districts within the study area.

The primary objective of the study is to enable ECC to undertake sequential testing in line with the Government's principles of flood risk and planning set out in the NPPF. This will inform development of ECC's emerging Minerals Local Plan.

The NPPF requires that all development is steered to areas of lowest flood risk where possible. Development is only permissible in areas at risk of flooding in exceptional circumstances where it can be demonstrated that there are no reasonable available sites in areas of lower risk and that the benefits of that development outweigh the risks from flooding. Such development is required to include mitigation and management measures to minimise risk to life and property should flooding occur.

The SFRA forms an essential reference tool providing the building blocks for future strategic planning.

[1] Essex County Council (November 2012) Essex Replacement Minerals Local Plan: Pre Submission Draft
[2] Scott Wilson Ltd (September 2010) Essex County Council Minerals and Waste Level 1 Strategic Flood Risk Assessment
[3] URS Scott Wilson Ltd (July 2011) Essex County Council Minerals and Waste Level 1 Strategic Flood Risk Assessment Update
[4] HMSO (April 2010) Flood and Water Management Act
[5] CLG (March 2012) National Planning Policy Framework
[6] Essex County Council (January 2009) Issues and Options – High Level Flood Risk Assessment of Minerals Options
[7] Environment Agency (December 2009) North Essex Catchment Flood Management Plan

The core output of this study is a series of maps (included in Appendices B and C) which include a narrative of flood risk issues and a presentation of key facts for minerals sites lying within Flood Zones and therefore at risk of flooding from fluvial or tidal sources.

In addition to flood risk, planning issues and policies that are pertinent to the County and may affect the potential minerals sites have also been examined and reported. Much of the mineral development taking place in Essex will comprise sand and gravel workings. In accordance with the NPPF, these are categorised as 'Water Compatible' development. However, ECC will still need to ensure the Sequential Test is followed before sites at flood risk are identified as suitable for extraction.

As long as this SFRA is used to inform planning and policy decisions into the future, it is imperative that it is adopted as a 'living document' to be reviewed regularly in light of emerging policy directives and an improved understanding of flood risk within the Districts. The period between reviews should be no more than 6 years but would ideally be every 3 years.

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ABBREVIATIONS

Abbreviation	Description
AONB	Area of Outstanding Natural Beauty
BGS	British Geological Society
CFMP	Catchment Flood Management Plan
CLG	Communities and Local Government
Defra	Department for Environment, Food and Rural Affairs
DPD	Development Plan Document
DTM	Digital Terrain Model
EA	Environment Agency
ECC	Essex County Council
FRA	Flood Risk Assessment
FRR2009	Flood Risk Regulations 2009
FWMA	Flood and Water Management Act 2010
GIS	Geographical Information System
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
MLP	Minerals Local Plan
MPA	Minerals Planning Authority
NPPF	National Planning Policy Framework
PFRA	Preliminary Flood Risk Assessment
RBMP	River Basin Management Plan
RFRA	Regional Flood Risk Appraisal
RPG	Regional Planning Guidance
SA	Sustainability Appraisal
SAC	Special Area for Conservation
SFRA	Strategic Flood Risk Assessment
SMP	Shoreline Management Plan
SPA	Special Protection Area
SPZ	Source Protection Zone
SUDS	Sustainable Drainage Systems
WAG	Welsh Assembly Government
WCS	Water Cycle Study
WFD	Water Framework Directive

GLOSSARY

Term	Definition
Aquifer	A source of groundwater comprising water-bearing rock, sand or gravel capable of yielding significant quantities of water.
Attenuation	In the context of this report - the storing of water to reduce peak discharge of water.
Catchment Flood Management Plan	A high-level planning strategy through which the EA works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
Culvert	A channel or pipe that carries water below the level of the ground.
Drift Geology	Sediments deposited by the action of ice and glacial processes
Flood Defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Floodplain	Area adjacent to river, coast or estuary that is naturally susceptible to flooding.
Flood Resilience	Measures that minimise water ingress and promotes fast drying and easy cleaning, to prevent any permanent damage.
Flood Resistant	Measures to prevent flood water entering a building or damaging its fabric. This has the same meaning as flood proof.
Flood Risk	The level of flood risk is the product of the frequency or likelihood of the flood events and their consequences (such as loss, damage, harm, distress and disruption)
Flood Risk Assessment	A FRA is required for any planning application at a potential risk of flooding to ensure the proposed development is not at an unacceptable risk of flooding and does not increase the risk of flooding elsewhere.
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.
Flood and Water Management Act	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.
Flood storage	A temporary area that stores excess runoff or river flow often ponds or reservoirs.
Flood Zone	Flood Zones are defined in the NPPF Technical Guidance based on the probability of river and sea flooding, ignoring the presence of existing defences.
Flood Zone 1	Low probability of fluvial flooding. Probability of fluvial flooding is < 0.1%
Flood Zone 2	Medium probability of fluvial flooding. Probability of fluvial flooding is 0.1 – 1%. Probability of tidal flooding is 0.1 – 0.5 %
Flood Zone 3a	High probability of fluvial flooding. Probability of fluvial flooding is 1% (1 in 100 years) or greater. Probability of tidal flooding is 0.5%(1 in 200 years)
Flood Zone 3b	Functional floodplain. High probability of fluvial flooding. Probability of fluvial flooding is >5%
Fluvial	Relating to the actions, processes and behaviour of a water course (river or stream)
Fluvial flooding	Flooding by a river or a watercourse.
Freeboard	Height of flood defence crest level (or building level) above designed water level
Functional Floodplain	Land where water has to flow or be stored in times of flood.
Groundwater	Water that is in the ground, this is usually referring to water in the saturated zone below the water table.

Inundation	Flooding.
Lead Local Flood Authority	As defined by the FWMA, in relation to an area in England, this means the unitary authority or where there is no unitary authority, the county council for the area, in this case Essex County Council.
Main River	Watercourse defined on a 'Main River Map' designated by DEFRA. The EA has permissive powers to carry out flood defence works, maintenance and operational activities for Main Rivers only.
Mitigation measure	An element of development design which may be used to manage flood risk or avoid an increase in flood risk elsewhere.
Overland Flow	Flooding caused when intense rainfall exceeds the capacity of the drainage systems or when, during prolonged periods of wet weather, the soil is so saturated such that it cannot accept any more water.
Residual Flood Risk	The remaining flood risk after risk reduction measures have been taken into account.
Return Period	The average time period between rainfall or flood events with the same intensity and effect.
River Catchment	The areas drained by a river.
Sequential Test	Aims to steer vulnerable development to areas of lowest flood risk.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
Solid Geology	Solid rock that underlies loose material and superficial deposits on the earth's surface.
Source Protection Zone	Defined areas in which certain types of development are restricted to ensure that groundwater sources remain free from contaminants.
Sustainability	To preserve /maintain a state or process for future generations
Sustainable drainage system	Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques.
Sustainable development	Development that meets the needs of the present without compromising the ability of future generations meeting their own needs.
Sustainable Flood Risk Management	Sustainable Flood Risk Management promotes a catchment wide approach to flooding that uses natural processes and systems (such as floodplains and wetlands) to slow down and store water.
Topographic survey	A survey of ground levels.
Tributary	A body of water, flowing into a larger body of water, such as a smaller stream joining a larger stream.
Watercourse	All rivers, streams, drainage ditches (i.e. ditches with outfalls and capacity to convey flow), drains, cuts, culverts and dykes that carry water.
1 in 100 year event	Event that on average will occur once every 100 years. Also expressed as an event, which has a 1% probability of occurring in any one year.
1 in 100 year design standard	Flood defence that is designed for an event, which has an annual probability of 1%. In events more severe than this the defence would be expected to fail or to allow flooding.

STRATEGIC FLOOD RISK ASSESSMENT PRO FORMA

The following table has been reproduced from the Level 1 SFRA outputs outlined in the Practice Guide to Planning Policy Statement (PPS) 25. It is presented here to demonstrate that the objectives of the Level 1 Minerals SFRA in accordance with the NPPF have been met and to provide those who review this SFRA a ready reference to where responses to the questions raised below can be found within this document.

Topic Area and Question	Location in Document
Plans showing the study area, main rivers, ordinary watercourses and flood zones, including functional floodplain (if appropriate), across the County, as well as all minerals sites undergoing assessment.	Appendix B, C
An assessment of the implications of climate change for flood risk at allocated sites over an appropriate time period	Appendix B, C
Plans to show areas at risk from other sources of flooding such as surface water and groundwater flooding	Appendix B, C
Flood risk management measures, including location and standard of infrastructure and the location of flood warning systems	Appendix B, C
Locations where additional development may significantly increase flood risk elsewhere through the impact on existing sources of flooding, or by the generation of increased surface water runoff (a surface water management plan may be needed)	Appendix B, C
Guidance on the preparation of FRAs for allocated sites	Section 9

1 INTRODUCTION

1.1 Background

1.1.1 Essex County Council (ECC) is in the process of producing a Replacement Minerals Local Plan[8] (MLP) in order to meet its obligations as a Minerals Planning Authority (MPA). Once adopted, the Replacement MLP will replace the current Minerals Local Plan[9].

1.1.2 The MLP forms part of the statutory Development Plan for Essex which delivers the spatial planning strategy for the area. Each Plan, including the MLP, has to undergo a Sustainability Appraisal (SA) which assists ECC in ensuring their policies fulfil the principles of sustainability. Strategic Flood Risk Assessments (SFRAs) are one of the documents to be used as the evidence base for planning decisions and form a component of the SA process.

1.1.3 URS Infrastructure and Environment UK Ltd ("URS", previously Scott Wilson Ltd) has been commissioned to prepare a Level 1 SFRA on behalf of ECC to assess the flood risk to the minerals sites that have been considered throughout the preparation of the MLP.

1.1.4 The National Planning Policy Framework[10] (NPPF) and accompanying Technical Guidance[11] were published in March 2012 and replace Planning Policy Statement 25 (PPS25) Development and Flood Risk[12]. To date the PPS25 Practice Guide[13] has not been revoked. As a result, this Level 1 Minerals SFRA has been prepared in full accordance with the principles of the NPPF, the NPPF Technical Guidance and the PPS25 Practice Guide.

1.1.5 In September 2010, URS were commissioned to prepare a Level 1 SFRA[14] for both mineral and waste sites. The SFRA was subsequently updated in July 2011[15] to take account of amended and additional potential waste sites, as well as up to date flood risk information published by the Environment Agency (EA). References to new legislation, policies and strategies emerging during this period and relevant to the study area such as the Flood and Water Management Act[16] (FWMA) were also incorporated into the SFRA where appropriate.

1.1.6 In September 2012, ECC commissioned a revision to the SFRA solely to support the publication of the MLP. This version of the SFRA therefore provides an assessment of the mineral sites that have been considered during the development of the MLP. This version of the SFRA also takes account of the publication of the NPPF.

1.2 Previous Studies

1.2.1 The majority of local authorities within Essex have either individually, or in partnership with adjacent authorities, produced SFRAs to support their proposed development allocations as part of their LDF process. Existing Level 1 SFRAs in Essex concentrate on mapping flood risk against proposed development, excluding minerals sites. However, they are a good base upon which to build this county-wide Level 1 Minerals SFRA. Within the ECC boundary, the following SFRAs have been produced:

[8] Essex County Council (November 2012) Essex Replacement Minerals Local Plan: Pre Submission Draft
[9] Essex County Council (November 1996) Minerals Local Plan
[10] CLG (March 2012) National Planning Policy Framework
[11] CLG (March 2012) National Planning Policy Framework Technical Guidance
[12] CLG (March 2010) Planning Policy Statement 25: Development and Flood Risk
[13] CLG (December 2009) Planning Policy Statement 25: Development and Flood Risk Practice Guide
[14] Scott Wilson Ltd (September 2010) Essex County Council Minerals and Waste Level 1 Strategic Flood Risk Assessment
[15] URS Scott Wilson Ltd (July 2011) Essex County Council Minerals and Waste Level 1 Strategic Flood Risk Assessment Update
[16] HMSO (April 2010) Flood and Water Management Act

- The Mid Essex SFRA[17] - covering the local authorities of Colchester, Braintree, Maldon and Chelmsford, completed in April 2008.
- Rochford Combined Level 1 and 2 SFRA, completed in February 2011, as part of the South Essex Partnership[18].
- Castle Point Borough Council Combined Level 1 and 2 SFRA[19], completed in November 2010, as part of the South Essex Partnership.
- Basildon Borough Council Level 1[20] and Level 2[21] SFRAs, completed in June and September 2011 respectively, as part of the South Essex Partnership.
- Uttlesford District Council SFRA[22], completed in March 2008.
- Tendring District Council SFRA[23], completed in April 2004.
- Brentwood Borough Council Level 1 SFRA[24], completed in January 2011.
- Epping Forest District Council and Harlow Council Level 1 SFRA[25], completed in April 2011.

1.2.2 In addition, this revised Level 1 SFRA builds upon the Essex Mineral Development Issues and Options high level Flood Risk Assessment of Minerals Options[26] which was completed in January 2009.

1.3 Aims & Objectives

1.3.1 The aim of this study is to assess and map the different levels and sources of flood risk within the ECC study area to be used in the strategic planning process for minerals sites. The aim of the SFRA will be met through the following objectives:

- To provide an assessment of the impact of all potential sources of flooding in accordance with NPPF using available information, including an assessment of any future impacts associated with climate change;
- Enable planning policies to be identified to minimise and manage local flooding issues;
- Provide information required to apply the Sequential Test for identification of land suitable for development in line with the principles of the NPPF;
- To provide baseline data to inform the SA of the MLP with regard to catchment-wide flooding issues which affect the study area;
- To provide sufficient information to allow ECC to assess flood risk for minerals development proposal sites, thereby setting out the requirements for site specific Flood Risk Assessments (FRAs) where they may be necessary;

[17] URS Scott Wilson Ltd, April 2008, Mid Essex (Colchester, Braintree, Maldon and Chelmsford) Level 1 SFRA
[18] URS Scott Wilson Ltd, January 2011, Rochford District Council Level 1 and 2 Strategic Flood Risk Assessment.
[19] URS Scott Wilson Ltd, January 2011, Castle Point Borough Council Level 1 and 2 Strategic Flood Risk Assessment
[20] URS Scott Wilson Ltd, June 2011, Basildon Borough Council Level 1 Strategic Flood Risk Assessment
[21] URS Scott Wilson Ltd, September 2011, Basildon Borough Council Level 2 Strategic Flood Risk Assessment
[22] JBA Consulting, March 2008, Uttlesford District Council Strategic Flood Risk Assessment.
[23] Applied Environmental Research Centre Ltd, April 2004, Tendring District Council Strategic Flood Risk Assessment
[24] Entec UK Ltd, January 2011, Brentwood Borough Council Level 1 Strategic Flood Risk Assessment
[25] Epping Forest District Council and Harlow District Council, April 2011, Strategic Flood Risk Assessment
[26] Essex County Council (January 2009) Issues and Options – High Level Flood Risk Assessment of Minerals Options

- Enable relevant authorities to use the SFRA as a basis for decision-making at the planning application stage;
- Provide information on flood risk associated with other forms of development taking place at minerals sites and initial identification of potential methods of restoration/after use of mineral extraction workings including habitat creation and flood alleviation capacity.
- Ensure consistency with the Essex Catchment Flood Management Plans (CFMP) and its policy units, incorporating their recommendations into the study.

2 STUDY AREA

2.1 Overview

2.1.1 Essex has a population of approximately 1.4 million people[27] covering an area of approximately 3,465 square kilometres. It has a rich and varied environment including an extensive coastline, conservation areas of international importance and high densities of ancient trees[28]. The settlements with the largest population are Chelmsford and Colchester with populations of approximately 100,000. ECC comprises the following twelve local authority areas which are presented in Appendix B, Figure 1.

- Brentwood Borough Council
- Castle Point Borough Council
- Chelmsford City Council
- Colchester Borough Council
- Basildon Borough Council
- Braintree District Council
- Epping Forest District Council
- Harlow District Council
- Maldon District Council
- Rochford District Council
- Tendring District Council
- Uttlesford District Council

Uttlesford District Council

2.1.2 Uttlesford is situated in the west of Essex with close proximity to Stansted Airport and the M11 corridor. It covers an area of approximately 640km^2 and its main towns are Great Dunmow, Saffron Walden and Stansted Mountfitchet.

2.1.3 The district includes the main rivers of River Bourne, River Can, River Pant, River Stort, River Roding, River Chelmer, River Cam, River Granta, Ugley Brook, Bourne Brook, Princey Brook, Stansted Brook, Stebbing Brook and The Slade. This district is not affected by tidal flood risk.

Braintree District Council

2.1.4 Braintree is located in the central, northern section of Essex, bordered by Uttlesford, Chelmsford, Maldon and Colchester. The district covers an area of approximately 610km^2 and has three main centres of population; Braintree, Witham and Halstead.

2.1.5 The main rivers present within the district are the Rivers Colne, Stour, Blackwater, Brain, Pant and Ter which pose a risk of flooding to the surrounding area. In addition to these, there are over 480km of ordinary watercourses within the district.

Colchester Borough Council

2.1.6 Colchester is located in the north-east of Essex and covers an area of 333km^2. It is bounded to the west by Braintree, to the east by Tendring and to the south by Maldon. The southern boundary of the borough follows the northern bank of the Blackwater/Colne Estuary.

2.1.7 The eastern boundary of the borough is defined by the River Colne until the river reaches Wivenhoe. The Stour forms the northern border of the borough with the western boundary being located inland, running south, across the Colne Valley, until it reaches Tiptree in the south. There are many hydrological features within the borough of Colchester, including the

[27] Office of National Statistics (September 2012) Population Estimates for England and Wales Mid-2011 (2011 Census-based) Accessed October 2012 http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-262039
[28] Essex County Council Website, Access July 2011 www.essexcc.gov.uk

estuarine systems of the Rivers Colne and Blackwater. Landscape features of this area include Mersea Island and various creeks and channels, including Pyefleet Channel, Strood Channel, Geedon Marshes and Creek and Fingringhoe Creek.

Tendring District Council

2.1.8 Tendring forms the north east peninsular of Essex, extending from the River Stour in the north to the north-sea coast and the River Colne in the south. Urban areas include Clacton on Sea, Brightlingsea and Harwich. The district covers an area of approximately 337km^2 and has a population of approximately 147,000. Given the location, this district is at risk from tidal flooding, as well as fluvial flood sources including the River Ramsey, River Stour, Holland Brook, and tributaries of the River Colne.

Harlow District Council

2.1.9 Harlow is located on the western border of Essex with Hertfordshire. The area is heavily urbanised with an area of approximately 30km^2 and population of approximately 79,000. Harlow is located on the River Stort which flows south west to join the Lee Valley systems. The town has historically suffered from flooding associated with this watercourse.

Epping Forest District Council

2.1.10 Epping Forest is located in the south western corner of Essex, bounded to the north by Harlow and Uttlesford and to the east by Chelmsford and Brentwood. It has an area of 338km^2 and a population of approximately 124,000. The largest town in the district is Loughton. Epping Forest includes an area of ancient woodland and lies between the River Lee to the west and the River Roding in the east. The district has suffered from flooding in the past, especially in areas adjacent to the River Roding, including Loughton, Chigwell, Aldridge and Ongar.

Chelmsford City Council

2.1.11 Chelmsford is located in the centre of Essex. It has an area of 340km^2 and a population of approximately 167,000. The southern boundary of the borough adjoins the district of Basildon and the northern bank of the River Crouch, which forms the only tidal boundary. The remaining landward boundaries of the borough extend to Maldon in the east, Epping Forest and Brentwood in the west and Braintree and Uttlesford in the north. The main watercourses that influence flooding in the Chelmsford are the River Can, River Wid and River Chelmer, which flow through the main town of Chelmsford. The other major settlements in the Borough are Writtle, Danbury and South Woodham Ferrers.

Maldon District Council

2.1.12 Maldon covers an area of approximately 360km^2. It has a population of approximately 60,000 people, the majority of which live in the town of Maldon and small rural villages. The district is located on the north-sea coast to the east of Chelmsford and includes the Dengie peninsula as well as the Blackwater Estuary which divides the district in two. The district of Maldon includes a number of large main rivers including the River Can, River Chelmer, the River Blackwater and the River Crouch which forms the southern boundary of the district.

Brentwood Borough Council

2.1.13 Brentwood is located in the south west of Essex and borders Greater London. The borough is only 18 miles north east of London but still contains large areas of woodland, farmland and country parks. The borough has a total area of approximately 153km^2 and a population of approximately 70,000. The River Roding is located in the north west of the borough and the River Wid flows from the north east of the borough towards Chelmsford.

Basildon Borough Council

2.1.14 Basildon is located in the south of Essex and borders Thurrock to the east, Castle Point to the west and Chelmsford to the north. The district has an area of 110km^2 and an approximate population of 170,000. The district is relatively heavily urbanised and has three main centres; Billericay, Wickford and Basildon. The headwaters of the River Crouch are located in the district and this watercourse flows in a north easterly direction towards Maldon and Rochford.

Rochford District Council

2.1.15 Rochford is located in the south eastern corner of Essex. It has an area of approximately 170km^2 and an approximate population of 80,000 with the major centres of population being Rochford and Rayleigh. The River Roach flows through Rochford and joins the River Crouch at Wallasea Island. Rochford has a significant extent of estuary and coastline along its borders and is therefore at risk of tidal flooding.

Castle Point Borough Council

2.1.16 Castle Point is located in South Essex and includes the towns of Canvey on Canvey Island, Hadleigh, Thundersley and South Benfleet. The borough covers an area of approximately 45km^2 and has an approximate population of 87,000. The Thames estuary is located to the south of the borough and tidal flood risk is the largest flood risk to the area as demonstrated during the tidal flooding experienced in 1953.

2.2 Mineral Resources in Essex

2.2.1 The MLP provides a snapshot of the geology and minerals infrastructure in the study area:

- *"Essex has extensive deposits of sand and gravel Kesgrave formation.*
- *There are more localised deposits of silica sand, chalk, brick earth and brick clay.*
- *Marine dredging takes place in the extraction regions of the Thames Estuary and the East Coast, whilst aggregate is landed at marine wharves located in east London, north Kent, Thurrock, and Suffolk. Essex has no landing wharves of its own.*
- *There are no hard rock deposits in the County so this material must be imported into Essex currently by rail to the existing rail depots at Harlow and Chelmsford.*
- *Essex is the largest producer and consumer of sand & gravel in the East of England.*
- *There are 18 active sand & gravel sites (including 1 silica sand site, 2 for brick clay, and 1 chalk site.*
- *There are 2 marine wharves and 4 rail depots capable of handling aggregate.*
- *Construction, demolition and excavation waste is also recycled at 25 dedicated and active aggregate recycling sites (2010).*
- *Aggregate is both imported into Essex (hard rock) and exported (sand and gravel primarily to London)".*

2.2.2 The purpose of the MLP is to set out how ECC will provide for future mineral needs. In particular, it covers the following minerals which can be extracted economically in Essex:

- **Aggregates** - This term encompasses Sand, gravel, crushed rock, and other bulk materials used by the construction industry. Only land won sand and gravel production is relevant to Essex. The County is one of the largest producers in the UK,

- **Silica Sand** – This is higher value sand which contains a high proportion of silica in the form of quartz and has a narrow grain size. Silica sand is used for a variety of industrial uses and is currently extracted from one site in the Plan Area, located in north-east Essex,

- **Brick Clay** – This is sedimentary material used in the industrial manufacture of bricks, roof tiles, and clay. There are two brick making sites in Essex, both of which extract brick clay,

- **Brickearth** – Historically, brickearth was used in Essex for the manufacture of bricks and tiles. Although not currently worked, most of the deposit is found in Rochford District,

- **Chalk** – A form of sedimentary limestone rock produced mostly for agriculture, but also used in small amounts in the pharmaceutical industry. Chalk outcrops only occur in the north-west of the County, where currently only one extraction site produces white chalk.

3 POLICY CONTEXT

3.1 Introduction

3.1.1 The following sections provide a summary of European, national, regional and local policies concerning flood and water management that are of relevance and importance to the provision of minerals sites across the ECC administrative area.

3.2 European Policy

Floods Directive (November 2007)

3.2.1 The aim of the European Union (EU) Floods Directive is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. The Directive required member states to carry out a preliminary assessment by 2011 to identify the river basins and associated coastal areas at risk of flooding. For such zones, they would then need to draw up flood risk maps by 2013 and establish flood risk management plans focused on prevention, protection and preparedness by 2015. The Directive applies to inland waters as well as coastal waters across the whole territory of the EU.

3.2.2 It is intended that the Directive shall be carried out in coordination with the Water Framework Directive, in particular by flood risk management plans and river basin management plans being coordinated, and through coordination of public participation procedures in the preparation of these plans. It is intended that all assessments, maps and plans prepared shall be made available to the public.

3.2.3 The Flood Risk Regulations 2009 transpose the Floods Directive into legislation for England and Wales and are described further in Section 3.3.

Water Framework Directive (December 2000)

3.2.4 The Water Framework Directive (WFD) is a substantial piece of EU legislation which came into force on 22nd December 2000, and establishes a new integrated approach to the protection, improvement and sustainable use of Europe's rivers, lakes, estuaries, coastal waters and groundwater. The directive requires that all member states manage their inland and coastal water bodies so that a 'good status' is achieved by 2015. This aims to provide substantial long term benefits for sustainable management of water. The EA is responsible for implementing the WFD in England and Wales.

3.2.5 The Directive introduces two key changes to the way the water environment must be managed across the European Community:

- Environmental and Ecological Objectives
- River Basin Management Plans

3.2.6 **Environmental & Ecological Objectives**: The WFD provides for Protected Areas and Priority Substances to safeguard uses of the water environment from the effects of pollution and dangerous chemicals. In addition, important ecological goals are set out to protect, enhance and restore aquatic ecosystems.

3.2.7 **River Basin Management Plans**: RBMPs (produced by the EA) are the key mechanism to ensure that the integrated management of rivers, canals, lakes, reservoirs and groundwater is successful and sustainable. RBMPs aim to provide a framework in which costs and benefits can be properly taken into account when setting environmental and water management objectives.

3.2.8 Each RBMP must apply to a 'River Basin District' (RBD) (a geographical area which is defined based on hydrology – see Annex 1, Defra & WAG (Welsh Assembly Government) River Basin Planning Guidance[29]) . Essex falls into two RBDs; the 'Anglian RBD' covers over two thirds of the northern county, and the 'Thames RBD' includes the south western corner of the county including Castle Point, Basildon, Brentwood, Epping Forest and Harlow.

3.2.9 The river basin planning process involves setting environmental objectives for all groundwater and surface water within the RBD, and designing steps and timetables to meet these objectives. According to the Defra and WAG River Basin Planning Guidance, a RBMP should be a strategic plan that gives all stakeholders within a RBD some confidence about future water management in their District. It should also set the policy framework within which future regulatory decisions affecting the water environment will be made.

3.2.10 Although RBMPs specifically address sustainable water management issues, the WFD also requires that other environmental considerations and socio-economic issues are taken into account. This ensures that the policy priorities between different stakeholders are balanced to ensure that sustainable development within RBDs is achieved.

RBMPs Influencing Spatial Plans

3.2.11 The following sections are extracted from the Defra and WAG River Basin Planning Guidance.

3.2.12 As well as being informed by various spatial and catchment wide plans and strategies, RBMPs provide strategic, regional policy information that is necessary to feed into the spatial planning process. For example, where RBMPs have a direct affect on the use and development of land they will have to be material considerations in the preparation of statutory development plans for the areas they cover. It will also be necessary for planning authorities to consider WFD objectives at the detailed development control stage (not least to consider the requirements of Article 4(7) of the WFD in relation to new physical modifications).

3.2.13 To allow planning authorities to incorporate WFD objectives into their various statutory development plans, the EA provide local authorities with information such as CFMPs, CAMS and other catchment-wide guidance and strategies, to enable effective integration of the water management framework within statutory development plans. In order to address the fact that these plans have different planning cycles, and are at different stages in their development, RBMP policies that affect the development and use of land must be considered in the monitoring and review of statutory spatial plans.

3.2.14 In addition, some of the measures necessary to achieve WFD objectives will be delivered through land use planning mechanisms. For example spatial planners can make major contributions to WFD objectives by including appropriate planning conditions and planning obligations in relevant planning permissions for new developments, or by restricting some forms of development. Delivery of these measures is more likely to take place if they are included in plans developed by strategic land use planners.

3.2.15 Mineral Plans being prepared by individual authorities should include policies and recommendations relating to flood risk management and development within catchments.

3.3 National Policy

Flood and Water Management Act (April 2010)

3.3.1 During July 2007, heavy rainfall resulted in extensive surface water flooding throughout parts of the UK including Gloucestershire, Sheffield and Hull causing considerable damage and

[29] Defra, WAG (August 2006) River basin Planning Guidance

disruption. The Pitt Review[30] examined the flooding and published a range of recommendations for future flood management, most of which have been enacted through the Flood and Water Management Act[31] (FWMA) which came into force in April 2010.

3.3.2 The FWMA reinforces the need to manage flooding holistically and in a sustainable manner and places a number of duties on Councils such as ECC, which are designated Lead Local Flood Authority (LLFA). As LLFA, ECC has a number of responsibilities and duties which are summarised below:

- A leadership role in the creation of local partnerships for local flood management.
- A duty to investigate and record details of significant flood events within their area, notifying relevant flood risk management authorities where necessary and publishing the results of any investigations carried out.
- A duty to maintain an asset register of structures or features which are considered to have a significant effect on flood risk, including details on ownership and condition.
- LLFAs are designated the SuDS Approval Body (SAB) for any new drainage system and therefore must approve, adopt and maintain any new SuDS within their area. This responsibility is anticipated to commence from April 2012.
- LLFAs are required to develop, maintain and monitor a Local Flood Risk Management Strategy for their area. The LFRM Strategy will build upon information such as national risk assessments and will use consistent risk based approaches across different local authority areas and catchments.
- LLFAs have powers to undertake works to manage flood risk from surface runoff and groundwater, consistent with the LFRM Strategy for the area.
- LLFAs as well as lower tier authorities and the EA, have powers to designate structures and features that affect flooding in order to safeguard assets that are relied upon for flood risk management. Once a feature is designated, the owner must seek consent from the authority to alter, remove or replace it.

National Flood and Coastal Erosion Risk Management (FCERM) Strategy

3.3.3 In accordance with the FWMA the EA have developed a National Strategy for Flood and Coastal Erosion Risk Management (FCERM) in England[32]. This strategy, which is to be approved by the Secretary of State and Parliament, provides a framework for the work of all flood and coastal erosion risk management authorities.

3.3.4 The National FCERM Strategy sets out the long-term objectives for managing flood and coastal erosion risks and the measures proposed to achieve them. It sets the context for, and informs the production of, local flood risk management strategies by LLFAs, which will in turn provide the framework to deliver local improvements needed to help communities manage local flood risk. It also aims to encourage more effective risk management by enabling people, communities, business and the public sector to work together to:

- establish aims and principles for others to be consistent with;

[30] Cabinet Office (2008) The Pitt Review – Learning Lessons from the 2007 Floods
[31] HMSO (April 2010) Flood and Water Management Act
[32] Defra, Environment Agency (2011) The National Flood and Coastal Erosion Risk Management Strategy for England.

- ensure a clear understanding of the risks of flooding and coastal erosion, nationally and locally, so that investment in risk management can be prioritised more effectively;
- set out clear and consistent plans for risk management so that communities and businesses can make informed decisions about the management of the remaining risks;
- encourage innovative management of risks taking account of the needs of communities and the environment;
- ensure that emergency responses to flood incidents are effective and that communities are able to respond properly to flood warnings; and,
- ensure informed decisions are made on land use planning.

Flood Risk Regulations 2009 (December 2009)

3.3.5 The Flood Risk Regulations 2009[33] (FRR2009) came into force in December 2009 and transpose the EU Floods Directive into law for England and Wales. The FRR2009 require three main types of assessment or plan:

1) Preliminary Flood Risk Assessment (PFRA) – This involves ECC collecting information on past and future floods from surface water, groundwater and small watercourses; assembling the information into a PFRA report; and identifying Flood Risk Areas. PFRA reports and spreadsheets must be completed by 22nd December 2011 and ECC has completed this part of the requirement as described in Section 3.5.

2) Flood Hazard and Flood Risk Maps – Following the identification of Flood Risk Areas, the EA and ECC are required to produce hazard and risk maps by 22nd December 2013.

3) Flood Risk Management Plans – The EA and ECC are required to produce a Flood Risk Management Plan by 22nd December 2015. It is likely that SWMPs undertaken for lower tier authorities, as well as the Flood Risk Management Strategy required under the FWMA will contribute significantly to the preparation of a Flood Risk Management Plan for ECC.

National Planning Policy Framework (NPPF)

3.3.6 The National Planning Policy Framework (NPPF) and its supporting Technical Guidance (CLG March 2012) were published in March 2012. The majority of Minerals Planning Guidance Notes and Minerals Policy Statements were cancelled with the publication of the NPPF. In addition the NPPF indicated that detailed waste policies will form part of the National Waste Management Plan. However at the time of writing the following documents remain in force until such a time as they are cancelled or replaced:

- PPS10 Planning for Sustainable Waste Management
- MPG4 Revocation, modification, discontinuance, prohibition and suspension orders
- MPG8 Planning and Compensation Act 1991 – Interim Development Order Permissions: Statutory Provisions and Procedures
- Minerals Planning Guidance 9: Planning and Compensation Act 1991 - Interim development order permissions (IDOS): conditions

[33] HMSO (November 2009) Flood Risk Regulations 2009

- Minerals Planning Guidance 14: Environment Act 1995 - Review of Mineral Planning Permissions
- National and regional guidelines for aggregates provision in England 2005-2020
- Letter to Chief Planning Officers: National and regional guidelines for aggregates provision in England - 2005-2020

3.3.7 The NPPF also sets out the Government's approach to planning policy with respect to flood risk, and emphasises the active role planning authorities should have in ensuring flood risk is considered during all stages of strategic land use planning.

3.3.8 To assist MPAs in their strategic land use planning, SFRAs should present sufficient information to enable them to apply the sequential approach where possible to the allocation of sites mineral extraction and processing. It is acknowledged within the NPPF that minerals have to be extracted and processed where the minerals are located but that the operational workings 'should not increase flood risk elsewhere and need to be designed, worked and restored accordingly'.

3.4 Regional Policy

Regional Spatial Strategy (2010)

3.4.1 The East of England Plan[34] was published by the Secretary of State for Communities and Local Government in May 2008. It covers the county and unitary authorities of Bedford, Cambridgeshire, Central Bedfordshire, Essex, Hertfordshire, Luton, Norfolk, Peterborough, Southend-on-Sea, Suffolk and Thurrock. The Plan sets out the vision and strategic framework for growth to 2021.

3.4.2 In March 2010, a draft revision to the EEP[35] was prepared which takes the region forward to 2031, deepens key policy areas including climate change, the coast, energy and waste and refreshes other policy areas including transport and economic development.

3.4.3 Following the election of a coalition government in May 2010, a Devolution and Localism Bill has been confirmed which intends to 'shift power from the central state back to the hands of individuals, communities and councils'. This Bill includes legislation to abolish the RSS. While the Secretary for State for Communities and Local Government has confirmed that RSS will be revoked, at the time of writing there is no replacement for the RSS, therefore the RSS will be referred to as the current planning policy document for the purposes of this report.

3.4.4 The EEP contains policies directly relating to flood risk and climate change as well as policies relating directly to minerals, which are summarised below.

POLICY WAT3: Flood Risk Management

3.4.5 Local Development Documents and development proposals should take a stringent approach to limiting and mitigating the risk from all forms of flooding, reflecting the principles in the NPPF, and taking into account the likely impacts of climate change on flood risk and the standard of defences.

3.4.6 Where it is necessary, following application of the sequential approach as set out in the NPPF, to locate development in Flood Zones 2 or 3 (such as in areas undergoing planned regeneration), policies and proposals should:

[34] Government Office for the East of England (May 2008) East of England Plan Regional Spatial Strategy
[35] Government Office for the East of England (March 2010) Draft revision to the Regional Spatial Strategy for the East of England

- *ensure that the land use proposed is compatible with the standard of defences and the strategy for their future maintenance; and*

- *be contingent upon effective flood warning and response procedures being in place, so as to minimise the risk of any increased need for rescue from land and property by the emergency services.*

3.4.7 Areas of functional floodplain needed for strategic flood storage in the Thames Estuary should be identified and safeguarded by local authorities in their Local Development Documents.

3.4.8 Surface runoff should be excluded from foul and combined sewers wherever possible to reduce risk of sewer flooding. Development proposals should incorporate sustainable drainage measures unless there is evidence that it is impractical to do so.

POLICY M1: Land Won Aggregates and Rock

3.4.9 Policy M1 states that "mineral development documents should identify and safeguard mineral resources to ensure that there are sufficient environmentally acceptable sources, avoiding harm to sites of European and international importance for wildlife in particular, to maintain the following annual average level of supply during the Plan period".

3.4.10 Essex, Thurrock and Southend have been allocated a target of 4.45million tonnes pa of land won sand and gravel and a target of 71.20 million tonnes of sand and gravel in total.

North and South Essex Catchment Flood Management Plan (CFMP)

3.4.11 A CFMP is a high-level strategic planning document that provides an overview of the main sources of flood risk and how these can be managed in a sustainable framework for the next 50 to 100 years. The EA engages stakeholders within the catchment to produce policies in terms of sustainable flood management solutions whilst also considering local land use changes and effects of climate change.

3.4.12 The CFMPs also inform and support planning policies, statutory land use plans and implementation of the Water Framework Directive, so that future development in the catchment is sustainable in terms of flood risk. Awareness of the role of CFMPs among land-use planners is in its infancy as these plans, along with SFRAs, are a relatively new requirement.

3.4.13 The approach that the EA would like to see taken to flood risk management in Essex is outlined in two separate Catchment Flood Management Plans (CFMPs) for North and South Essex respectively.

North Essex Catchment Flood Management Plan (December 2009)

3.4.14 The North Essex CFMP[36] includes the catchment of four major rivers: the River Chelmer, Blackwater, Colne and Stour as well as the Holland Brook and other small watercourses. The downstream boundary of the CFMP area is located at the Essex and South Suffolk Shoreline Management Plan (SMP) boundary.

3.4.15 The north Essex catchment is further divided into eight sub-areas which have similar physical characteristics, sources of flooding and level of risk as illustrated in Figure 3-1.

[36] Environment Agency (December 2009) North Essex Catchment Flood Management Plan

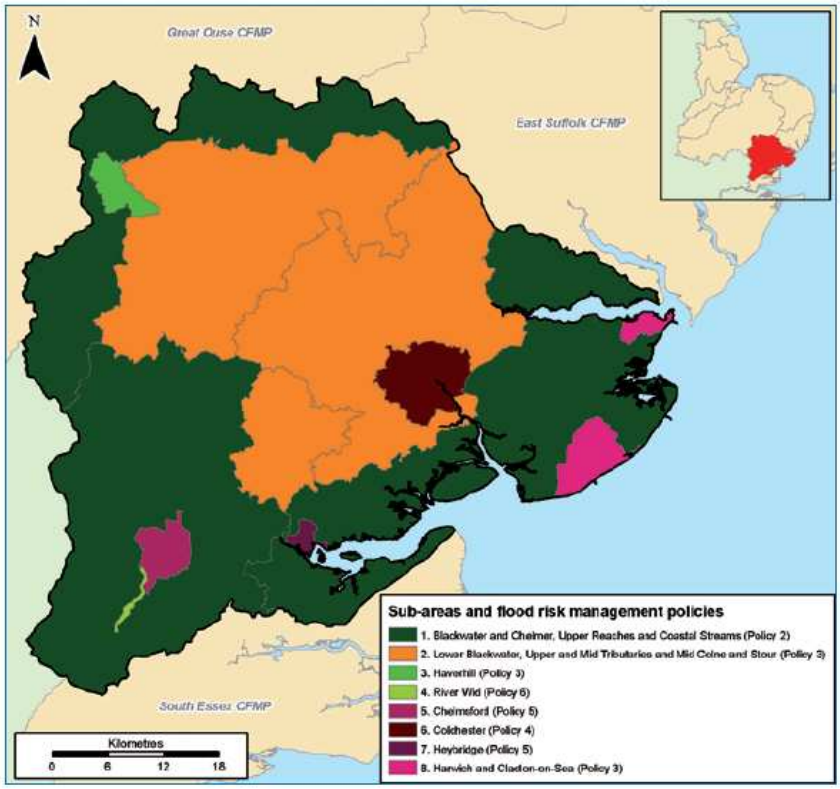

Figure 3.1 Sub-areas and flood risk management policies in North Essex

(Source: Environment Agency (December 2009) North Essex CFMP Map 3, P12)

3.4.16 An overview of the proposed approach to flood management within this area is outlined below:

- **Policy 1 – Areas of little or no flood risk where the EA will continue to monitor and advise.**
- **Policy 2 – Areas of low to moderate flood risk where the EA can generally reduce existing flood risk management actions.** Applied to Blackwater and Chelmer, Upper Reaches and Coastal Streams.
- **Policy 3 – Areas of low to moderate flood risk where the EA are generally managing the flood risk effectively.** Applied to the Lower Blackwater, Upper and Mid Tributaries and Mid Colne and Stour, Harwich and Cladden-on-Sea, Haverhill.
- **Policy 4 – Areas of low, moderate or high flood risk where the EA are already managing the flood risk effectively but where they may need to take further action to keep pace with climate change.** Applied to Colchester.
- **Policy 5 – Areas of moderate to high flood risk where the EA can generally take further action to reduce flood risk.** Applied to Chelmsford and Heybridge.
- **Policy 6 – Areas of low to moderate flood risk where the EA will take action with others to store water or manage run-off in locations which provide overall flood risk reduction or environmental benefits.** Applied to River Wid catchment.

South Essex Catchment Flood Management Plan (December 2009)

3.4.17 The South Essex CFMP[37] area includes catchments of three major rivers; the River Crouch, River Roach and the River Mardyke. The downstream limit of the CFMP area is located at the Essex and South Suffolk Shoreline Management Plan (SMP) boundary. The South Essex CFMP is further sub-divided into nine sub-areas which have similar characteristics. Figure 3.2 highlights the sub-areas within South Essex:

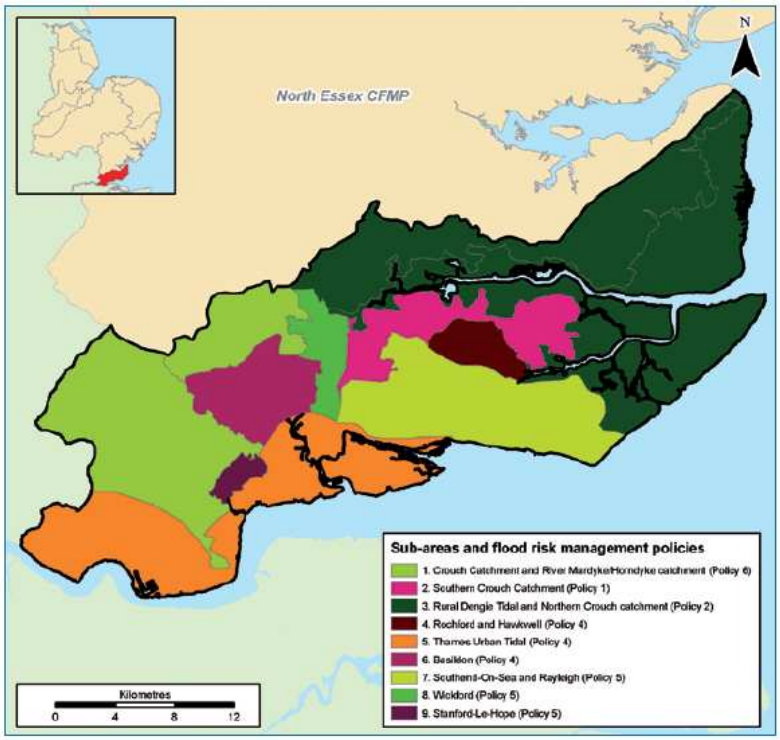

Figure 3.2 Sub-areas and flood risk management policies in South Essex

(Source: Environment Agency (December 2009) South Essex CFMP, p12)

3.4.18 The proposed approach to flood risk management in these areas is the same as those outlined in the North Essex CFMP, included in section 3.4.17 above.

- **Policy 1 – Areas of little or no flood risk where the EA will continue to monitor and advise.** Applied to Southern Crouch Catchment.
- **Policy 2 – Areas of low to moderate flood risk where the EA can generally reduce existing flood risk management actions.** Applied to Rural Dengie Tidal and North Crouch catchment.
- **Policy 3 – Areas of low to moderate flood risk where the EA are generally managing the flood risk effectively.**
- **Policy 4 – Areas of low, moderate or high flood risk where the EA are already managing the flood risk effectively but where they may need to take further action to keep pace with climate change.** Applied to Rochford and Hawkwell and Thames Urban Tidal.

[37] Environment Agency (December 2009) South Essex Catchment Flood Management Plan

- **Policy 5 – Areas of moderate to high flood risk where the EA can generally take further action to reduce flood risk.** Applied to Southend-on-Sea and Rayleigh, Wickford and Stanford-le-Hope.
- **Policy 6 – Areas of low to moderate flood risk where the EA will take action with others to store water or manage run-off in locations which provide overall flood risk reduction or environmental benefits.** Applied to Crouch Catchment and River Mardyke /Horndon Catchment.

Essex and South Suffolk Shoreline Management Plan

3.4.19 The Essex and South Suffolk Shoreline Management Plan (SMP)[38] is a high-level policy document in which the organisations that manage the shoreline set their long-term plan. The SMP aims to identify the best ways to manage flood and erosion risk to people and to the developed, historic and natural environment. It also identifies opportunities where shoreline management can work with others to make improvements.

3.4.20 Some of the minerals sites that have been assessed as part of this Level 1 SFRA fall within the SMP Management Units for the Colne Estuary (Unit D) and the Blackwater Estuary (Unit F). The overall intent for the management of both of these shorelines is to sustain and support the viability of communities, tourism and commercial activities while creating new intertidal habitats and focusing flood risk management on frontages where it is most needed. In order to achieve this intent, it is proposed to maintain the flood and erosion defence to the majority of the defended land in these Management Units, whilst also allowing coastal and estuarine processes to act in a less constrained manner by realigning defences that are under pressure and/or where the value of protected features is likely to justify continued maintenance. The specific implications for those areas in these Management Units in which minerals sites are located are highlighted on the site-specific plans included in Appendix C.

3.5 Local Policy

Minerals Local Plan

3.5.1 The MLP provides the strategy and policies for minerals planning in Essex until at least 2029, as well as allocations of sites for development, and a Policies (previously Proposals) Map. Since April 2012 this document has been referred to as the Replacement Minerals Local Plan: Pre Submission Draft, and when adopted will replace the current MLP (approved 1996). The Replacement Minerals Local Plan: Pre Submission Draft is a combined document which comprises:

- The Minerals Core Strategy, setting out the long-term direction for minerals development and the plan to deliver this strategy
- Development Management Policies for minerals planning
- Strategic Site Allocations and safeguarding for mineral extraction, transhipment facilities and other related activities
- The Pre Submission Draft Policies Map Policies (previously Proposals) Map.

3.5.2 The MLP has already passed through a number of consultation stages on its journey to adoption, including:

- Evidence gathering
- Public consultation on various Issues & Options papers including site options

[38] Environment Agency (October 2010) Essex and South Suffolk Shoreline Management Plan 2 (Version 2.4)

- The Preferred Approach, setting out ECC's preferences including sites

3.5.3 Each stage of preparation of the document includes public consultation, and the consultation responses inform the next stage of preparation.

3.5.4 ECC are currently preparing the Publication and Pre-Submission stage of the document, which will include the Regulation 20 'Test of Soundness Engagement' exercise, followed by Submission to the Planning Inspectorate and an Examination in Public. The Planning Inspectorate will subsequently issue the Inspector's Report, followed by review and adoption of the document and Annual Monitoring Review thereafter.

3.5.5 A schedule of minerals sites has been assessed as part of this SFRA which includes non-selected as well as preferred sites (refer to Section 6 and Appendix C for details of the assessments).

Essex County Council Preliminary Flood Risk Assessment

3.5.6 The PFRA is a high level screening exercise to locate flood risk areas in which the risk of surface water and groundwater flooding is significant and warrants further examination through the production of maps and management plans. The PFRA prepared for ECC was published in January 2011[39].

3.5.7 Within the PFRA, the majority of Basildon Borough Council administrative area, as well as parts of Rochford District Council and Castle Point Borough Council have been designated as an Indicative Flood Risk Area, with almost 40,000 people estimated to be at risk from flooding.

Essex County Council Local Flood and Coastal Erosion Risk Management (FCERM) Strategy

3.5.8 The National FCERM Strategy, prepared by the EA to meet the requirements of the FWMA, will set out guiding principles for flood and coastal erosion risk management across England. It is then the role of ECC to consider how the principles apply in their authority, and to prepare a Local FCERM Strategy. The Local Strategy should:

- demonstrate understanding of the current and future flood risk from all sources, a baseline assessment of which will be available through the PFRA, as well as SFRAs and SWMPs for lower tier authorities.
- use the principles of the National Strategy to consider what the main objectives and measures are to manage flood risk, for example development control, emergency planning, and what measures should be used over different timescales.
- involve communities and work in collaboration with other risk management authorities to achieve objectives.
- put in place mechanisms for reviewing the development and implementation of the Local Strategy as well as reporting back to Government.

3.5.9 ECC has commenced work on their Local FCERM Strategy and a draft Strategy[40] document has been released which begins to address these objectives.

[39] URS Scott Wilson Ltd (January 2011) Essex County Council Preliminary Flood Risk Assessment Report
[40] Essex County Council (April 2012) Essex Flood Risk Management Strategy (Draft Report)

4 THE SEQUENTIAL TEST

4.1 The Sequential Approach

4.1.1 The sequential approach is a simple decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to areas at higher risk in accordance with the requirements of the NPPF. It can be applied at all levels and scales of the planning process, both between and within Flood Zones. All opportunities to locate new developments in reasonably available areas of little or no flood risk should be explored, prior to any decision to locate them in areas of higher risk.

4.1.2 The Sequential Test refers to the application of the sequential approach by planning authorities. This allows the determination of site allocations based on flood risk and development vulnerability. Development should be directed to Flood Zone 1 wherever possible, and then sequentially to Flood Zones 2 and 3. Additionally, within each Flood Zone development should be directed to the areas of least flood risk first.

4.1.3 The NPPF acknowledges that some areas will be at risk of flooding from flood sources other than fluvial or tidal systems. All sources of flooding must be considered when looking to locate new development. Other sources of flooding that require consideration when situating new development allocations include:

- Flooding from the Land - Surface Water;
- Flooding from Groundwater;
- Flooding from Sewers and Drains; and,
- Flooding from Manmade or Artificial Sources.

4.1.4 ECC must demonstrate that it has considered a range of possible sites in conjunction with the Flood Zone information from the SFRA and the EA and has applied the Sequential Test in the mineral site allocation process.

4.1.5 It is acknowledged within the NPPF that minerals have to be extracted where they are located but their operational workings 'should not increase flood risk elsewhere and need to be designed, worked and restored accordingly'. For this reason sand and gravel extraction sites are classified as Water Compatible development notwithstanding that such development can still give rise to flooding problems.

4.1.6 Where sand and gravel workings are located within the floodplain, steps should be taken to apply a sequential approach within the site itself to ensure that ancillary and supporting infrastructure and buildings are located in areas of least flood risk to reduce the risk of being adversely affected by flooding or increasing flood risk elsewhere.

4.1.7 It should also be noted that essential ancillary sleeping or residential accommodation for staff required by all Water Compatible development including sand and gravel workings are subject to a specific flood warning and evacuation plan. ECC should assess whether the requirement for the mineral could first be met from areas at no risk of flooding and, if not, that there is justification for the level of development that may ultimately need to take place in areas that are at risk of flooding.

4.1.8 Table 4-1 provides a summary of the vulnerability classifications for mineral sites based on Table 2 of the NPPF Technical Guidance. Table 4-2 demonstrates which types of mineral development site are appropriate within each Flood Zone and where the Exception Test is required.

Table 4-1 Flood Risk Vulnerability Classifications (NPPF Technical Guidance Table 2)

Development Type	Vulnerability Classification
Minerals working and processing (except for sand and gravel working)	Less Vulnerable
Sand and Gravel Working. Essential ancillary sleeping or residential accommodation for staff required by this use, *subject to a specific flood warning and evacuation plan.*	Water Compatible
Docks, marinas and wharves. Essential ancillary sleeping or residential accommodation for staff required by this use, *subject to a specific flood warning and evacuation plan.*	Water Compatible

Table 4-2 Flood risk vulnerability and flood zone 'compatibility' (Table 3 NPPF Technical Guidance, March 2012)

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	1	✓	✓	✓	✓	✓
	2	✓	✓	Exception Test required	✓	✓
	3A	Exception Test required	✓	×	Exception Test required	✓
	3B	Exception Test required	✓	×	×	×

✓ - Development is appropriate × - Development should not be permitted

4.1.9 Table 4-1 and 4-2 demonstrate that mineral developments are classified as either Water Compatible or Less Vulnerable development and as such are permitted within Flood Zones 1, 2 and 3a, subject to the satisfaction of the Sequential Test. Table 4-2 confirms that the Exception Test is not usually applicable to minerals development sites due to their vulnerability classification; however any essential ancillary sleeping or residential accommodation for staff required by Water Compatible development, such as sand and gravel workings, are subject to a specific flood warning and evacuation plan.

4.1.10 Any proposed development on a windfall site will by definition differ to a site allocated in the MLP that has been sequentially tested. Therefore, the Sequential Test will need to be applied at the planning application stage and should be subject to the same consideration of flood risk as other development sites.

4.1.11 Where a flood source other than tidal and fluvial is identified that does not affect the ability of a site to pass the Sequential Test, a site specific FRA should still be completed to assess the full impacts of flooding to the site from all sources. i.e. a site may be located in Flood Zone 1 and be considered to pass the Sequential Test but still be at risk from surface water or groundwater flooding which should be fully investigated in a site specific FRA.

4.2 Using the SFRA Maps, Data and GIS Layers

4.2.1 Table 4-3 highlights which GIS layers and SFRA data should be used in carrying out the Sequential Test. The table poses some example questions which provide some guidance in where to look within the SFRA for the information.

Table 4-3 Sequential Test Key - A Guide to using the SFRA GIS Layers

Category	GIS Layer & Figure	Example Questions
Development Vulnerability	Not applicable refer to Table 2 in NPPF Technical Guidance	Question 1 - Is the proposed development defined as 'more vulnerable' according to Table 2 of NPPF Technical Guidance?
		Question 2 - Is the proposed development defined as 'less vulnerable' according to Table 2 of NPPF Technical Guidance?
		Question 3 - Is the proposed development defined as 'water compatible development' according to Table 2 of NPPF Technical Guidance?
Flood Zone Classification	EA main river maps.	Question 4 - Is the site located near a watercourse?
	SFRA fluvial FZ2, FZ3a & FZ3b layers. Also examine historical floodplain and take into consideration climate change outlines. See Figures 3.0 – 3.7 in Appendix B.	Question 5 – Through consultation of the EA's Flood Zone maps, is the development site located in Flood Zone 1?
		Question 6 - Through consultation of the EA's Flood Zone maps, is the development site located in Flood Zone 2?
		Question 7 - Through consultation of the EA's Flood Zone maps, is the development site located in Flood Zone 3a?
		Question 8 - Through consultation of the EA's Flood Zone maps, is the development site located in Flood Zone 3b?
		Question 9 - Can the development be located in Flood Zone 1?
		Question 10 - Can the development be located in Flood Zone 2?
		Question 11 - Can the development be located in Flood Zone 3a?
Other Flood Sources	SFRA fluvial FZ3 & FZ2 outlines plus climate change	Question 12 – Is the site impacted by the effects of climate change
	Sewer Flood Layer & Historical Flood Outlines	Question 13 - Is the site in an area potentially at risk from sewer flooding?
	Historical Flood Outlines, Parish Council data, groundwater vulnerability maps	Question 14 - Is the site in an area potentially at risk from overland flow flooding?
		Question 15 - Is the site located in an area of rising groundwater levels?
		Question 16 - Does the site have a history of flooding from any other source?
Flood Risk Management	Flood Defence Layer (NFCDD), Flood Warning Layer, Areas Benefiting from Flood Defences Layer, Parish Council data	Question 17 - Does the site benefit from flood risk management measures?
		Question 18 - Can the development be relocated to an area benefiting from flood risk management measures or of lower flood risk?

4.3 How to apply the Sequential Test where there are gaps in data

4.3.1 It should be noted that some watercourses in the study area do not have Flood Zones associated with them or do not have all Flood Zones defined. This is not to suggest these watercourses do not flood, moreover that modelled data is not currently available. Therefore, allocations adjacent to watercourses where Flood Zones have not been defined cannot be assessed against all aspects of the Sequential Test using the existing data.

4.3.2 To overcome gaps in existing data and to enable ECC to proceed with application of the Sequential Test the following criteria should be considered:

- **For watercourses where no Flood Zones have been defined:**
  - For application of the Sequential Test, the site should be considered as lying within Flood Zone 3a until proven otherwise.
  - If a site is within 8m of a watercourse and promoted for development, further investigation should be undertaken to determine the suitability of the site for the proposed development.
  - If following further investigation the site is found to lie within Flood Zone 3b the development may not be appropriate against the policies presented in the NPPF;
- **For watercourses where Flood Zone 3b (functional floodplain) has not been defined:**
  - If a proposed development site is located in Flood Zone 3a, there is a possibility it may also fall within Flood Zone 3b. Further investigation should be undertaken to define Flood Zone 3b for the local water course(s).
  - According to the PPS25 Practice Guide, when applying the Sequential Test the site should be considered as lying within Flood Zone 3b until proven otherwise.
  - If following further investigation the site is found to lie within Flood Zone 3b the development may not be appropriate against the polices presented in the NPPF;
- **For watercourses where the effect of climate change on Flood Zones has not been defined:**
  - For any development located in or adjacent to a Flood Zone boundary, there is a possibility that when considering the effects of climate change the site may be at greater flood risk. For example if a site is clearly identified to be located in Flood Zone 2 (present day), when the effects of climate change are considered the site may be found to lie within Flood Zone 3.
  - For application of the Sequential Test sites located in Flood Zone 3 or at the boundary of Flood Zone 2 and 3, where the effects of climate change are not defined, the sites can be considered to lie within the higher risk Flood Zone however, the effects of climate change should be investigated further as part of a site specific FRA.
  - If following further investigation the site is found to lie within a different Flood Zone, the Sequential Test should be re-applied to determine if the proposed development is appropriate.

5 LEVEL 1 SFRA METHODOLOGY

5.1 Stakeholder Consultation

5.1.1 The key stakeholders that have provided data and information and been involved in the preparation of this Level 1 SFRA are ECC, each of the 12 District Councils within ECC, the EA, and Water Utilities Companies Thames Water and Anglian Water.

Local Authorities

5.1.2 As described in Section 1.1, a key part of the preparation of the Level 1 SFRA is to collect, collate and review information relating to flood risk in the study area including a review of the Level 1 (and where available Level 2) SFRA reports completed by each local authority.

5.1.3 Six of the 12 local authorities within ECC have completed an SFRA for their local authority area in 2009, with one SFRA written in 2004 and five in 2008. There was little to be gained from re-gathering data (historic flood records, surface water flooding, groundwater flooding etc) which each local authority illustrated in their respective SFRA. Therefore, instead of re-gathering existing data, each local authority was contacted to confirm that the data presented in their SFRAs was still the most up to date information available.

Environment Agency

5.1.4 The EA is the principal holder of flood risk data in the UK. The EA has discretionary powers under the Water Resource Act (1991) to manage flood risk and, as a result, hold the majority of flood risk data available for the study area. Essex falls within both the Thames and Anglian regions of the EA.

5.1.5 Data that the EA provided can be summarised as:

- Catchment Flood Management Plans (CFMP) for North and South Essex;
- Strategic Flood Risk Mapping (SFRM) outlines and supporting data;
- Details and locations of historical flood events;
- LiDAR Topographic Data;
- Details and locations of flood defence assets and flood warning procedures.

Essex County Council

5.1.6 ECC supplied GIS layers of the study area and the Minerals sites to be assessed. In addition, other datasets from third parties including the Flood Map for Surface Water (FMfSW) and Areas Susceptible to Groundwater Flooding (AStGWF) from the EA and geological datasets from the British Geological Survey (BGS) that have been licensed for use by ECC, have been made available by ECC for use in this study.

5.1.7 A comprehensive record of all the data used throughout the production of this Level 1 SFRA is presented in the GIS Layer Register (Appendix A).

Water Companies

5.1.8 Thames Water are the responsible Water Company for the following administrative areas; Epping Forest, Harlow, Brentwood, Chelmsford, Basildon. Anglian Water provides coverage for the remaining local authority areas within Essex.

5.1.9 Thames Water and Anglian Water have been asked to supply details of sewer flooding in Essex in the form of their DG5 registers.

5.2 Data Review

5.2.1 This section provides a summary of the datasets used in the Level 1 SFRA along with details of any limitations or assumptions made during their use.

Main Rivers

5.2.2 The EA provided a GIS layer with all watercourses designated as 'main river' for which they are responsible.

Flood Zones

5.2.3 As part of a Level 1 SFRA, the NPPF requires definition of the Flood Zones which correspond to the probability of flooding from tidal and fluvial flood sources. Table 5-1 shows the definition of each Flood Zone for tidal and fluvial sources.

Table 5-1 Fluvial Flood Zones (Table 1 NPPF Technical Guidance, March 2012)

Flood Zone	Tidal Flood Zone	Fluvial Flood Zone	Probability of Flooding
Flood Zone 1	At risk from flood event less than the 1 in 1000 year event (less than 0.1% annual probability of flooding each year)	At risk from flood event less than the 1 in 1000 year event (less than 0.1% annual probability of flooding each year)	**Low Probability**
Flood Zone 2	At risk from flood event between the 1 in 200 and 1 in 1000 year event (between 0.5% and 0.1% annual probability of flooding each year)	At risk from flood event between the 1 in 100 and 1 in 1000 year event (between 1% and 0.1% annual probability of flooding each year)	**Medium Probability**
Flood Zone 3a	At risk from flood event greater than or equal to the 1 in 200 year event (greater than 2% annual probability of flooding each year)	At risk from flood event less than or equal to the 1 in 100 year event (greater than 1% annual probability of flooding each year)	**High Probability**
Flood Zone 3b	Land where water has to flow or be stored in times of flood, or land purposely designed to be flooded in an extreme flood event (0.1% annual probability). The 1 in 20 year annual probability floodplain is the starting point for consideration but local circumstances should be considered and an alternative probability can be agreed between the Local Planning Authority and the EA		**Functional Floodplain**

5.2.4 The EA has supplied GIS outlines of Flood Zones 2 and 3a. These Flood Zones have been prepared using the best available data from appropriate hydraulic models and following the precautionary principle as detailed in the NPPF Technical Guidance.

Flood Zone 3b – Functional Floodplain

5.2.5 Functional floodplains have the highest probability of flooding of all the Flood Zones defined within Table 1 of the NPPF Technical Guidance and Table 5-1 above. A functional floodplain is defined as an area of land where water has to flow or be stored at times of flood and has an annual probability of flooding of 5% (i.e. from a 1 in 20 year return period event).

5.2.6 Hydraulic modelling of the functional floodplain has been undertaken on a number of watercourses in the study area as part of the EA Strategic Flood Risk Mapping programme, or as part of SFRAs for individual local authorities.

5.2.7 Where available, the EA and/or local authority have supplied modelled flood outlines for the functional floodplain for the watercourses shown in Table 5-2. The return periods used to map the functional floodplain are predominantly the 1 in 20 year flood event, or the 1 in 25 year

flood event, both of which are considered suitable to define the Flood Zone 3b Functional Floodplain.

5.2.8 A summary of the GIS layers used throughout the mapping in this SFRA is included in Appendix A.

Flood Zone 3a with Climate Change

5.2.9 To ensure sustainable development now and in the future, the NPPF requires that the effects of climate change should be taken into account in an SFRA and that flood outlines delineating climate change should be presented.

5.2.10 The NPPF suggests that when completing an SFRA, planning bodies will need to agree how to factor climate change and over what time frame. The standard approach adopted by the EA in their Strategic Flood Risk Mapping is to include a net increase of 20% over and above peak flows, which is added to the 1 in 100 year flood event to account for climate change. This approach has been adopted for the watercourses in Table 5-2, and GIS outlines of these flood extent have been supplied for this Level 1 SFRA.

5.2.11 In areas where climate change has not been modelled or mapped it has been agreed with the Council and the EA that Flood Zone 2 should be used as a surrogate for Flood Zone 3 plus climate change until such time that more detailed information is available, such as a Level 2 SFRA, an EA Strategic Flood Risk Mapping (SFRM) study or a site-specific FRA.

5.2.12 A summary of the GIS layers used throughout the mapping in this SFRA is included in Appendix A.

Table 5-2 Watercourses with Functional Floodplain & Climate Change Flood Zones

Watercourse	Local Authority	Modelled Return Period for Flood Zone 3b Functional Floodplain	Modelled Return Period for Flood Zone 3a with Climate Change
Birch Brook	Tendring	✓ (1 in 25 year (0.4%))	✓
Blackwater	Uttlesford	✓ (1 in 25 year (0.4%))	✓
Brain	Braintree	✓ (1 in 25 year (0.4%))	✓
Cam & Granta	Uttlesford	✓ (1 in 25 year (0.4%))	×
Holland Brook	Tendring	✓ (1 in 25 year (0.4%))	✓
Pant	Braintree	✓ (1 in 25 year (0.4%))	✓
Pods Brook	Braintree	✓ (1 in 25 year (0.4%))	✓
River Lee	Epping Forest	✓ (1 in 20 year (0.5%))	✓
River Slade	Uttlesford	✓ (1 in 25 year (0.4%))	✓
River Roding	Epping Forest	✓ (1 in 20 year (0.5%))	✓
Spiketts Brook	Tendring	✓ (1 in 25 year (0.4%))	×

River Stort	Epping Forest	✓ (1 in 20 year (0.5%))	✓
River Chelmer	Chelmsford	✓ (1 in 20 year (0.5%))	✓
River Colne	Colchester	✓ (1 in 20 year (0.5%))	✓
River Stour	Harlow	✓ (1 in 20 year (0.5%))	✓

Flood Defences

5.2.13 Flood defences are typically engineered structures designed to limit the impact of flooding. Flood defences take several forms including bunds/embankments, canalised channels, culverts and flood storage areas.

5.2.14 Information on flood defences throughout the study area has been requested from the EA as a GIS layer of the National Flood and Coastal Defence Database (NFCDD), listing details of structures and flood defences. The NFCDD aims to provide the following information:

- The location, composition and condition of fluvial and tidal defences and watercourses referenced to identified risk areas;
- The types of asset (i.e. property, infrastructure, environmental) at risk within identified risk areas and including those protected by fluvial, tidal and coastal defences;
- The extent of floods related to different flooding scenarios (e.g. different return periods and different types of flood event such as overtopping or embankment failure).

5.2.15 The EA Flood Zone Map defines the extent of flooding ignoring the presence of defences. The reason for this approach is to make an allowance for residual flood risk in the event of a failure or breach/blockage/overtopping of the flood defences. This conservative approach over time will reduce reliance on flood defences and raise the awareness of flood risk in defended areas to help ensure that it is managed appropriately as part of development proposals.

Flood Warning Areas

5.2.16 The Civil Contingencies Act[41] requires that the EA 'maintain arrangements to warn the public of emergencies'. As a Category 1 responder, the EA has a duty to maintain arrangements to warn, inform and advise the public in relation to particular emergencies.

5.2.17 ECC also has a duty under the Civil Contingencies Act to warn and inform the public and that is done mainly through the Communications Unit.

5.2.18 The EA have provided details of areas benefiting from an EA flood warning system which should be used by emergency planners in conjunction with the Flood Zone maps and flood defence information to assist in developing emergency plans for areas at risk of flooding with the study area.

Environment Agency Flood Map for Surface Water (FMfSW)

5.2.19 The EA Flood Map for Surface Water (FMfSW) gives an indication of the broad areas across Essex that are likely to be at risk of surface water flooding. The document entitled 'Using Surface Water Flood Risk Information' explains how EA Surface Water Flood Risk Information can be used by planning authorities to help fulfil their planning role as well as local resilience

[41] HMSO (2004) Civil Contingencies Act

forums (LRFs) and regional resilience teams (RRTs) to help plan their emergency response to surface water flooding; and LLFAs to help fulfil their local flood risk management role.

5.2.20 The FMfSW maps are not suitable for identifying whether an individual property will flood, neither is the intended to be definitive. Rather the FMfSW provides information to support local flood risk management in the absence of any better information.

Mapping

5.2.21 The FMfSW has been prepared for two return periods. The 0.5% AEP (1 in 200 year annual probability) and the 3.3% AEP (1 in 30 year annual probability). For the purpose of this Level 1 SFRA, the dataset for the 0.5% AEP rainfall event has been mapped in Figures 4.0 – 4.7.

5.2.22 Two categories have been used; shallow, relating to flood depths between 0.1m and 0.3m, and deep, which refers to depths >0.3m.

	Shallow >0.1m
	Deep >0.3m

Figure 5.1 Legend for FMfSW

Limitations

5.2.23 When using the FMfSW, the EA have stated that planning authorities should not:

- Use the EA surface water flood maps as the sole evidence for any specific planning decision at any scale without further supporting studies or evidence;
- Use the EA surface water flood maps to identify individual properties at risk of surface water flooding;
- Rely on the EA surface water flood maps alone to show expected areas of surface water flooding;
- Interpret the EA surface water flood maps as defining the flood extent for a specific probability;
- Use the EA surface water flood maps for screening planning applications for consulting with the EA;
- With respect to mapping, the FMfSW layers should only be published or provided externally with an OS base map scale of 1:25,000 or smaller (i.e. 1:50,000 is ok, 1:10,000 is not) and with a zoom scale of 1:10,000 or smaller (i.e. 1:50,000 is ok, 1:5,000 is not).

5.2.24 Due to the way they have been produced and the fact that the extents are indicative, the EA surface water flood maps are not appropriate to act as the sole evidence for any specific planning decision (such as us objecting to a planning application) at any scale without further supporting studies or evidence.

5.2.25 In the light of these recommendations, this mapping has been used purely as an initial high-level overview of pluvial flood risk across the minerals sites.

5.2.26 It is noted that ECC are preparing a Surface Water Management Plan (SWMP) for the South Essex Indicative Flood Risk Area and are also undertaking studies in Harlow, Colchester, Chelmsford and Maldon. However the surface water flood risk mapping from these studies is

not yet available and it is considered that for the purposes of this Level 1 SFRA, the EA FMfSW provides a suitable dataset for the study area.

Geology

5.2.27 GIS layers of the solid and drift geology across the study area have been supplied by ECC, originally provided by the BGS and licensed for use by ECC to assist with this study.

EA Areas Susceptible to Groundwater Flooding (AStGWF)

5.2.28 As part of the SFRA, an assessment of the risk of groundwater flooding needs to be considered; however, a quantified assessment of risk from groundwater flooding is difficult to undertake, especially on a strategic scale. This is due to lack of groundwater level records, the variability in geological conditions and the lack of predictive tools (such as modelling) that can be used to make assessments of groundwater flow and risk of groundwater flooding following rainfall events.

5.2.29 The EA Areas Susceptible to Groundwater Flooding (AStGWF) dataset is a strategic scale map showing groundwater flood areas on a 1km square grid. The EA has provided information with the data and guidance for using it, which is summarised below.

5.2.30 The AStGWF dataset has been prepared primarily as part of the PFRA process, to allow LLFAs across England and Wales to obtain a broad feel for the wider areas which might be at risk from groundwater flooding.

5.2.31 The data has used the top two susceptibility bands of the BGS 1:50,000 Groundwater Flood Susceptibility Map and therefore covers consolidated aquifers and superficial deposits. It does not take account of the chance of flooding from groundwater rebound. It shows the proportion of each 1m square where geological and hydrogeological conditions show that groundwater might emerge. The susceptible areas are represented by one of four area categories showing the proportion of each 1km square that is susceptible to groundwater emergence. It does not show the likelihood of groundwater flooding occurring.

5.2.32 The dataset covers a large area of land, and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding.

Limitations

5.2.33 The AStGWF dataset has not been formally assessed as appropriate for any other use than the PFRA.

5.2.34 The data should not be interpreted as identifying areas where groundwater is actually likely to flow or pond, thus causing flooding, but may be of use to LLFAs in identifying, where, for example, further studies may be useful.

5.2.35 The AStGWF should not be used as the sole evidence for any specific flood risk management, land use planning or other decision at any scale. The data may however help to identify areas for assessment at a local scale where finer resolution datasets exist.

Borehole Records

5.2.36 As part of the data gathering process for this Level 1 SFRA, ECC has provided borehole records for a large number of the mineral sites. This information is specific to each site and will need to be considered during the preparation of a site specific FRAs for each site where necessary.

Sewer Flooding

5.2.37 Areas at risk from sewer flooding have been determined through review of records from DG5 registers provided by Thames Water and Anglian Water. In order to fulfil statutory commitments set by OFWAT, water companies must maintain verifiable records of sewer flooding, which is achieved through their DG5 registers. Water companies are required to record flooding arising from public foul, combined or surface water sewers and identify where properties have suffered internal or external flooding.

5.2.38 The data provided by each water company is limited to postcodes, resulting in the coverage of relatively large areas by comparatively limited and isolated recorded flood events. The data also only covers records over the last ten years. It should be noted that the flood records provided could be misleading as they may not provide a complete and accurate record of flood events in the study area over the last 10 years as some minor flooding incidents may go unreported, particularly if no properties are affected by internal flooding. In addition, it should be noted that Thames Water and Anglian Water concentrate on alleviating sewer flooding in these locations identified on the DG5 register and therefore the probability of sewer flooding reoccurring that these locations will be greatly reduced or removed.

5.2.39 Available data has been mapped showing the areas that have been most and least affected by sewer flooding over the last 10 years. For this study, data has been mapped as total sewer flooding incidents which include data for both foul and surface water flooding incidents.

5.2.40 As outlined previously, data provided by Water Companies is limited and does not represent a comprehensive record of instances of sewer flooding as some events may not have been recorded and remedial works may have subsequently been undertaken.

LiDAR Topographic Survey

5.2.41 The EA has provided Light Detection and Ranging (LiDAR) data for the study area. LiDAR is an airborne mapping technique, which uses a laser to measure the distance between the aircraft and the ground. The data varies in accuracy depending on the nature of the terrain such as in woodlands, complex urban areas and near lakes, where the accuracy reduces due to the limitations in the technique. However, LIDAR is generally recognised to have an accuracy of +/- 300mm.

5.2.42 The data set covers the entire study area. It was captured by the EA during 2006 and 2009; the LiDAR used is an amalgamation of 2m, 1m and 0.25m data that was provided by the EA.

5.2.43 This data is important because an accurate and up to date Digital Terrain Model (DTM) is required in order to produce high-resolution flood risk mapping.

5.3 Mapped Outputs

5.3.1 The chief outputs of this Level 1 SFRA are maps displaying the proposed development sites in relation to flood risk and assessment tables providing an analysis of the flood zones present on each site.

5.3.2 **Overview maps** are included in **Appendix B** and a Table summarising the findings for all minerals sites are included in **Section 6**.

5.3.3 Detailed Assessment Maps for **minerals** sites located within Flood Zones 2 and 3, or immediately adjacent to a watercourse, are provided in **Appendix C**.

6 MINERAL SITE LEVEL 1 ASSESSMENT

6.1 Overview

6.1.1 Table 6-1 provides a summary of the assessment of the mineral sites (based upon the site boundary provided by the site promoter), including the Site ID, location, area, and a summary of the risk from each source of flooding. A breakdown of the percentage area within each Flood Zone has been included to provide a useful tool for future analysis with respect to the Sequential Test.

6.1.2 Table 6-1 identifies that 16 sites lie either entirely or partially within Flood Zone 2 or 3a. Furthermore, four of the sites are defined as Flood Zone 1 but are located immediately adjacent to watercourses. For each of these 20 sites, detailed assessment maps have been prepared to enable a more detailed understanding of the source and extent of flooding. These maps are included in Appendix C and are ordered alphabetically and numerically by Site ID.

6.2 Site Referencing Approach

6.2.1 For ease of reference ECC have adopted a systematic referencing system for the minerals sites which relates to the use of the site as follows:

A – Sand and gravel extraction

B – Silica sand extraction

D – Transhipment sites

6.2.2 **It is emphasised that although the site boundaries are considered to be final, they remain subject to planning permission at a later date.**

6.2.3 Sites which have been carried forward as preferred sites in the MLP Plan have been identified in Table 6-1.

6.3 Summary of NPPF Position

6.3.1 Minerals working and processing, other than sand and gravel working, are defined as Less Vulnerable according to the NPPF and are therefore appropriate within Flood Zones 2 and 3a, subject to the satisfaction of the Sequential Test.

6.3.2 Sand and gravel extraction sites (together with essential ancillary sleeping or residential accommodation for staff required by these uses[42] (subject to a specific flood warning and evacuation plan)), and docks, marinas and wharves are classified as Water Compatible and are appropriate within Flood Zones 1, 2, 3a and 3b. However, it should be noted that ancillary and supporting infrastructure and buildings associated with the sand and gravel working may cause an increase in flood risk, which is not acceptable in line with the requirements of the NPPF. Ancillary infrastructure and buildings can reduce the storage capacity of the floodplain and can alter the natural flow of floodwater by blocking flow paths, thereby increasing flood risk to adjacent land. Typically, sand and gravel extracted in the spring and summer months are sold directly, leading to small stockpiles. However, stockpiles are often increased in late summer and autumn to provide sales during the winter months when pumps are switched off and excavation is inhibited. This leads to a larger potential impact on storage in the flood cell in the winter months.

[42] Table 2 of the CLG (March 2012) National Planning Policy Framework Technical Guidance

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Table 6-1 Level 1 Assessment – Minerals Sites

** Based on EA 'Flood Map for Surface Water' (Shallow (0.1 -0.3m) Deep (>0.3m)). See Section 5 for information on appropriate use and limitations.*
† Based on DG5 Register obtained from Thames Water and Anglian Water respectively.
 # Based on EA 'Areas Susceptible to Groundwater Flooding' (proportion of 1km square within that is susceptible to groundwater emergence). See Section 5 for information on appropriate use and limitations.
Preferred *Identified as a preferred site in the Replacement Minerals Local Plan: Pre Submission Draft (Essex County Council, November 2012).*

Site Ref	Site Name	Local Authority	Area (Ha)	Flooding from Rivers (FZ %)					Flood Map for Surface Water *	Sewer Flooding†	Aquifer Type	Groundwater Vulnerability Classification	Areas Susceptible to Groundwater Flooding #	After-use
				FZ3b	FZ3a	FZ3aCC	FZ2	FZ1						
A1	A1 Coleman's Farm, Little Braxted Lane, Witham	Braintree	60.3	25	6	0.3	4.4	64.3	Yes (Shallow/Deep)	×	MINOR	MINOR_H	>75%	Water. Recreation and nature conservation.
	A1 Appleford Farm, Little Braxted Lane, Witham	Braintree	93.5	8	2.5	0.2	18.5	70.8	Yes (Shallow/Deep)	×	MINOR	MINOR_H	>75%	
A2	Bradwell Quarry, Rivenhall Airfield	Braintree	25.5	0	0	0	0	100	Yes (Shallow)	×	-		0%	Managed habitats incl. arable.
A3 **Preferred**	Bradwell Quarry, Rivenhall Airfield	Braintree	9.3	0	0	0	0	100	Yes (Shallow)	×	-		<25%	Managed habitats incl. arable.
A4 **Preferred**	Bradwell Quarry, Rivenhall Airfield	Braintree	25.3	0	0	0	0	100	Yes (Shallow/Deep)	×	-		<25%	Managed habitats incl. arable.
A5 **Preferred**	Bradwell Quarry, Rivenhall Airfield	Braintree	44.9	0	0	0	0	100	Yes (Shallow)	×	-		<25%	Managed habitats incl. arable.
A6 **Preferred**	Bradwell Quarry, Rivenhall Airfield	Braintree	48.5	0	0	0	0	100	Yes (Shallow/Deep)	×	-		<25%	Strategic Waste Management Facility. Managed habitats incl. arable.
A7 **Preferred**	Bradwell Quarry, Rivenhall Airfield	Braintree	94.6	0	0	0	0	100	Yes (Shallow/Deep)	×	-		<25%	Managed habitats incl. arable.
A8	Bradwell Quarry, Rivenhall Airfield	Braintree	53.7	0	0	0	0	100	Yes (Shallow/Deep)	×	-		<25%	Agricultural use.
A9 **Preferred**	Broadfields Farm, Rayne	Braintree	90.9	0	0	0	0	100	Yes (Shallow)	×	-		<25%	Managed habitats incl. arable.
A10	Covenbrook Hall Farm, Stisted	Braintree	29.2	0	0	0	0	100	Yes (Shallow/Deep)	×	MINOR	MINOR_I	<25%	Agricultural and Reservoir.
A11	Tile Kiln, Valley Farm, Sible Hedingham	Braintree	4.1	0	0	0	0	100	Yes (Shallow)	×	MINOR	MINOR_I	25 – 50%	Agricultural use
A12	Bellhouse Farm South	Colchester	20.6	0	5	0	0.7	94.3	Yes (Deep)	×	MINOR	MINOR_I	25 – 50%	Nature conservation and open space
A13 **Preferred**	Fiveways Fruit Farm	Colchester	15.0	0	0	0	0	100	Yes (Shallow)	×	MINOR	MINOR_I	<25%	Green infrastructure and amenity.
A14	Holmwood Farm	Colchester	7.7	0	0	0	0	100	Yes (Shallow)	×	MINOR	MINOR_I	<25%	Agricultural use
A15	Admirals Fm, Great Bentley	Tendring	55.1	0	0.0	0	0	100	Yes (Shallow/Deep)	×	MINOR	MINOR_I MINOR_L Within Great Bentley SPZ	<25%	Agricultural, reservoir and woodland
A16	Church Farm, Alresford	Tendring	25.7	0	0.6	0	0	99.3	No	×	MINOR	MINOR_I	25 – 50%	Agricultural, reservoir and woodland
A17	Frating Hall Farm, Frating	Tendring	53.2	0	0.0	0	0	100	Yes (Shallow)	✓	MINOR	MINOR_I Within Goldacre Farm SPZ	25 – 50%	Agricultural, Reservoir
A18	Gurnhams, Little Bentley	Tendring	69.7	0	5.2	0	3.8	91.0	Yes (Shallow/Deep)	×	MINOR	MINOR_H MINOR_I MINOR_L	<25%	Agricultural use
A19	Lodge Farm, Alresford	Tendring	10.9	0	0.0	0	0	100	No	×	MINOR	MINOR_I	25 – 50%	Agricultural use and woodland
A20 **Preferred**	Sunnymead, Elmstead & Heath Farms, Alresford	Tendring	65.3	0	0.0	0	0	100	Yes (Shallow)	×	MINOR	MINOR_I	25 – 50%	Managed habitats incl. arable.
A21	Thorrington Hall Farm, Thorrington	Tendring	143	0	1.8	0	0.8	97.4	Yes (Shallow/Deep)	×	MINOR	MINOR_I	25 – 50%	Agricultural and wet grassland
A22 **Preferred**	Little Bullocks Farm, Canfield – Area A	Uttlesford	6.4	0	6.7	0	1.5	91.8	Yes (Shallow/Deep)	×	-		25 – 50%	Agriculture, amenity, nature conservation.
A23 **Preferred**	Little Bullocks Farm, Canfield – Area B	Uttlesford	4.9	0	0	0	0	100	Yes (Shallow)	×	-		<25%	Agriculture, amenity, nature conservation.
A25	Elsenham Quarry, Elsenham	Uttlesford	38.6	0	0	0	0	100	Yes (Shallow)	×	-		<25%	Agricultural use
A26	Frogs Hall, Takeley	Uttlesford	28.1	0	9.2	0	3.1	87.7	Yes (Shallow/Deep)	×	-		25 – 50%	Agricultural and woodland.
A27	Land at Ugley, Ugley	Uttlesford	11.7	0	0	0	0.1	99.9	Yes (Shallow/Deep)	×	MAJOR	MAJOR_I	<25%	Agricultural use
A28	Tower Field Western Extension, Fingringhoe	Colchester	1.5	0	0	0	0	100	Yes (Shallow)	✓	MINOR	MINOR_I	<25%	Agricultural use

Site Ref	Site Name	Local Authority	Area (Ha)	Flooding from Rivers (FZ %)					Flood Map for Surface Water *	Sewer Flooding†	Aquifer Type	Groundwater Vulnerability Classification	Areas Susceptible to Groundwater Flooding #	After-use
				FZ3b	FZ3a	FZ3aCC	FZ2	FZ1						
A29	30 Acre Field West, Fingringhoe	Colchester	10.3	0	0	0	0	100	Yes (Shallow)	✓	MINOR	MINOR_I MINOR_L	0%	Agricultural use
A30	30 Acre Field South, Fingringhoe	Colchester	5	0	0	0	0	100	Yes (Shallow)	×	MINOR	MINOR_L	<25%	Agricultural use
A31 **Preferred**	Birch	Colchester	30	0	4.7	0	1	94.3	Yes (Shallow/Deep)	×	MINOR	MINOR_I MINOR_L	50 – 75%	Managed habitats incl. arable.
A33	Armigers Farm	Uttlesford	14.4	0	0	0	0	100	Yes (Deep)	×	-		<25%	Agricultural and Nature Conservation
A34	Thorrington Hall Farm	Tendring	36.2	0	0.25	0	0.75	99	Yes (Shallow)	×	MINOR	MINOR_I	<25%	Agricultural and wet grassland
A35	Tyndales Farm, Danbury	Chelmsford / Maldon	29.9	0	0	0	0	100	Yes (Shallow)	✓	MINOR	MINOR_I MINOR_L	50 – 75%	Agricultural use
A36	Olivers Nurseries	Braintree / Maldon	4.3	0	0	0	0	100	No	×	MINOR	MINOR_I	>75%	Agriculture, Reservoir.
A37	Alsteads Farm	Chelmsford	78	0	0	0	0	100	Yes (Shallow/Deep)	×	-		<25%	Agricultural with biodiversity enhancement
A38 **Preferred**	Blackley Quarry, Gate Farm Site 1	Chelmsford	22.6	0	0	0	0	100	Yes (Shallow)	×	-		0%	Agriculture
A39 **Preferred**	Blackley Quarry, Gate Farm, Site 2	Chelmsford	20.9	0	0	0	0	100	Yes (Shallow/Deep)	×	-		<25%	Agriculture
A40 **Preferred**	Shellow Cross Farm	Chelmsford / Epping Forest	111	0	0	0	0	100	Yes (Shallow/Deep)	×	-		<25%	Agriculture and nature conservation.
A41	A41a Patch Park Farm (North of R. Roding)	Epping Forest	43.6	89	1.7	0.6	1.5	7.3	Yes (Shallow/Deep)	×	MINOR	MINOR_L MINOR_H	50 – 75%	Agriculture and Nature Conservation
	A41b Patch Park Farm Plant Area & Access (South of R. Roding)	Epping Forest	6.6	38.1	5.0	2.2	28.4	26.3	Yes (Shallow/Deep)	×	MINOR	MINOR_L MINOR_H	50 – 75%	
A43	Parkgate Farm West	Braintree	71.2	0	0	0	0.0	100	Yes (Shallow/Deep)	×	MINOR	MINOR_I	<25%	Agriculture, Nature Conservation and Amenity
	Parkgate Farm East	Braintree	122.7	0	0	0	0.0	100	Yes (Shallow)	×	-		<25%	
A44	White House Farm	Maldon	60	0	0	0	0	100	Yes (Shallow)	×	MINOR	MINOR_I	<25%	Agricultural use
A45	Ardleigh Rail 2 (Site A)	Tendring	35.8	0	0	0	0	100	Yes (Shallow)	×	MINOR	MINOR_I	<25%	Lakes, Nature Conservation, Woodland and Agriculture
	Ardleigh Rail 2 (Site B South)	Tendring	5.6	0	11.4	0	2.5	86.1	Yes (Shallow)	×	MINOR	MINOR_I	0%	
	Ardleigh Rail 2 (Site B North)	Tendring	35.3	0	0	0	0	100	Yes (Shallow)	×	MINOR	MINOR_I	0%	
A46 **Preferred**	Colemans Farm	Braintree	36	0.3	0.7	0.6	5.1	93.3	Yes (Shallow/Deep)	×	MINOR	MINOR_H	>75%	Water. Recreation and nature conservation.
B1 **Preferred**	Slough Fm, Ardleigh - Area 1	Tendring	15.6	0	0	0	0.0	100	Yes (Shallow)	×	MINOR	MINOR_I	<25%	Agriculture
B3	Slough Fm, Ardleigh - Area 3	Tendring	8.2	0	0	0	0.0	100	Yes (Shallow)	×	MINOR	MINOR_I	25 – 50%	Agricultural use
D2 **Preferred**	Ballast Quay, Fingringhoe	Colchester	5.3	0	7.0	0	0.0	93	Yes (Shallow)	×	MINOR	MINOR_I	<25%	-
D3	Sadds Wharf, Maldon	Maldon	2.1	0	100	0	0.0	0	Yes (Shallow/Deep)	×	MINOR	MINOR_H	50 - 75%	-
D5	Brightlingsea Quarry Wharf (A21, A34 Conveyor)	Tendring	3.7	0	55	0	0.8	44.2	Yes (Shallow)	×	MINOR	MINOR_I	25 – 50%	-
D6	Ardleigh Rail Transhipment Site	Tendring	13.5	0	0	0	0	100	Yes (Shallow)	×	MINOR	MINOR_I	25 – 50%	-

6.4 Flooding from Rivers

6.4.1 Table 6-1 and the maps included in Appendix C identify that **two sites lie almost entirely within Flood Zones 2 and 3**;

A41 Patch Park Farm, Epping Forest

D3 Sadds Wharf, Maldon

6.4.2 **14 sites have portions of land that have been defined as Flood Zone 2 or 3;**

A1 Appleford and Coleman's Farm, Witham, Braintree

A12 Colchester Quarry, Bellhouse Farm South

A16 Church Farm, Alresford

A18 Gurnhams, Little Bentley

A21 Thorrington Hall Farm, Thorrington

A22 Little Bullocks Farm, Canfield *(*Preferred Site*)*

A26 Frogs Hall, Takeley

A27 Land at Ugley, Uttlesford

A31 Birch Extraction, Colchester (Preferred Site)

A34 Thorrington Hall Farm

A45 Ardleigh Extraction, Tendring

A46 Coleman's Farm, Witham, Braintree (Preferred Site)

D2 Ballast Quay, Fringringhoe, Colchester (Preferred Site)

D5 Brightlingsea Quarry Wharf, Tendring

6.4.3 **Four sites are located in Flood Zone 1 but are immediately adjacent to a watercourse**;

A9 Broadfield Farm, Rayne (Preferred Site)

A20 Sunnymead, Elmstead and Heath Farms, Alresford (Preferred Site)

A40 Shellow Cross Farm, Chelmsford (Preferred Site)

A44 White House Farm, Woodham Walter, Maldon

6.4.4 **The remaining 20 sites are located in Flood Zone 1** at Low Probability of flooding from tidal and fluvial sources.

6.4.5 Mineral extraction in the floodplain can have two opposite impacts:

- Increase the level of flood risk through the reduction of storage capacity due to stockpiling and associated infrastructure; or,

- Reduce the level of flood risk by providing additional capacity for floodwater storage during its operation phase.

6.4.6 Minerals can only be worked where they naturally occur. This has implications when carrying out the Sequential Test (steering development to lowest flood risk) as reasonable alternative sites may not always be available. This is particularly the case with deposits of sand and gravel as many of the deposits are located within natural river floodplains which are often inundated during flood events, therefore would not be considered as 'preferred' in accordance with the Sequential Test.

6.4.7 In light of this, sand and gravel working (together with essential ancillary sleeping or residential accommodation for staff required by these uses[43] (subject to a specific flood warning and evacuation plan)) are classified as Water Compatible development. Although acknowledging that guidance on flood risk and mineral working could be open to interpretation, the EA advise that the Sequential Test should still be applied to sand and gravel working, notwithstanding that this is classified as Water Compatible development. The NPPF Technical Guidance suggests that the Sequential Test should still be applied to Water Compatible development, and it is recommended that this is the approach adopted by ECC in formulating its minerals strategy.

6.4.8 Where processing plant are to form an integral part of a sand and gravel working, the EA takes the view that the development should not be classified as Water Compatible development, and should be regarded as Less Vulnerable development (and therefore not allowed in Flood Zone 3b – as set out in Table 4-2). This is particularly likely to apply where a new working is opened (as distinct from an extension to an existing pit). Therefore, where a possible sand and gravel site includes land in Flood Zone 3b, unless classified as an extension site, ECC are advised to treat the site with caution. At site allocation stage ECC will need to be satisfied that any stockpiles and non-essential ancillary buildings are able to be accommodated outside of Flood Zone 3b if the site is to be considered further. At the planning application stage a site specific FRA will need to demonstrate that the development will not reduce the storage capacity of the floodplain, obstruct flow paths or increase flood risk to adjacent ground. Compensation or other mitigation measures may be needed in order to achieve this. A sequential approach to development layout should be adopted as a means of achieving this.

6.4.9 The majority of mineral sites within Essex are located in Flood Zones 1, with only 16 of the 50 assessed sites being located entirely or partially in Flood Zones 2 or 3. Those sites located in Flood Zone 1 are appropriate in line with the Sequential Test.

6.4.10 For those sites located within a range of Flood Zone classifications, the sequential approach should be applied within the site to ensure that stockpiles and ancillary buildings are located in areas of least flood risk to avoid being adversely affected by flooding or increasing flood risk elsewhere.

6.4.11 For the majority of the potential mineral sites under assessment by ECC, this will be feasible. However, for site A41 Patch Park Farm in Epping Forest, and D3 Sadds Wharf in Maldon, this may not be achievable. Therefore the requirement for new minerals sites at these two locations may require strong arguments to pass the Sequential Test in accordance with the NPPF.

6.4.12 Further details regarding the Sequential Test are provided in Section 4.

[43] Table 2 of the CLG (March 2012) National Planning Policy Framework Technical Guidance

6.5 Flooding from Surface Water

6.5.1 Intense periods of rainfall over a short duration or periods of prolonged rainfall can lead to overland flow as rainwater may be unable to infiltrate into the ground or enter drainage systems.

6.5.2 One of the main issues with pluvial flooding is that relatively small changes to hard surface and surface gradients can cause flooding. As a result, development for minerals sites including the stockpiles and ancillary buildings could lead to more frequent surface water flooding which can cause disruption to the site and surrounding land.

6.5.3 Reference has been made to the EA 'Flood Map for Surface Water' which is presented in Appendix B Figures 4.0 – 4.7. These highlight areas where surface water flooding may be an issue and should be considered in more detail as part of a site specific FRA. Table 6-1 provides a summary of the susceptibility of surface water flooding and concludes that 28 of the 57 sites are within areas identified to be at increased risk of surface water flooding to depths greater than 0.3m.

6.5.4 Due to the scale and permeable nature of the proposed mineral sites, it is considered that any problems encountered from pluvial flooding are more likely to inconvenience the operator and are unlikely to be significant in assessing the suitability of sites providing sufficient drainage is incorporated within the site to ensure there is no increased risk of flooding elsewhere as a direct result of site activities.

6.6 Flooding from Groundwater

6.6.1 Groundwater flooding is occurs when water levels in the ground rise above surface elevation, which is most likely to occur in low-lying areas underlain by permeable rocks (aquifers).

6.6.2 Chalk underlies the whole of the Essex study area. Whilst it is closer to the surface in the north west of the region, it is mainly beneath deep deposits of London Clay for the rest of the study area. The existence of impermeable London Clay largely prevents the infiltration of rainfall into the chalk aquifer and also prevents groundwater from rising from the chalk aquifer to the surface. The risk of groundwater flooding in these areas is deemed to be low. Within river catchments, where river terrace gravels and superficial deposits are present, the risk of groundwater flooding may be increased.

6.6.3 Minerals workings in most cases excavate below the natural water table, which during periods of heavy rainfall may rise. Mineral workings often operate a pumped system and can therefore interfere with groundwater flow. These issues would be most appropriately addressed in an FRA at the planning application stage for each site.

6.6.4 There is limited data available with regard to groundwater flooding incidents in the study area. However, the presence of London clay and the limits on groundwater abstraction suggest that the risk of groundwater flooding is low. The presence of aquifers beneath each of the potential mineral sites is noted in Table 6-1. The EA dataset 'Areas Susceptible to Groundwater Flooding' (AStGWF) has also been used to provide a broad feel for the wider areas which might be at risk from groundwater flooding in the study area. The susceptible areas are represented by four categories showing the proportion of each 1km square that may be susceptible to groundwater emergence. It does not show the likelihood of groundwater flooding occurring. Details of the appropriate use and limitations of this dataset are included in Section 5.2.

6.7 Flooding from Sewers

6.7.1 Sewer flooding generally results in localised short term flooding caused by intense rainfall events overloading the capacity of sewers. Flooding can also occur as a result of blockage by

debris or sediment poor maintenance, structural failure or surcharging of the system due to high water levels in the receiving fluvial system.

6.7.2 Anglian Water and Thames Water maintain a register of historical sewer flooding events (DG5 register), which has been provided as part of the SFRA study. Section 5.2 of this report discusses the available sewer flooding data in more detail with a position statement regarding limitation and uncertainties of the data.

6.7.3 Minerals sites are generally located in rural areas remote from settlements and scattered housing, therefore, sewer flooding is not thought to be a large issue with regard to flood risk at proposed minerals sites. The datasets from Thames Water and Anglian Water identify historic records of sewer flooding in the vicinity of 4 of the mineral sites; A17, A28, A29 and A35, which should be taken into consideration throughout the development of these sites.

6.8 Flooding from Reservoirs, Canals & Artificial Sources

6.8.1 Canals in Essex include the Stort Navigation which is the canalised section of the River Stort running 22km from Bishops Stortford to the River Lee Navigation, the Chelmer and Blackwater navigation which flows from Chelmsford Basin to Heybridge sea lock at the mouth of the Blackwater and the Mundon Canal which is 1.25 miles long from Southey Creek on the Blackwater to White House Farm in Mundon.

6.8.2 All of these canals have the potential to cause flooding of potential mineral sites especially if they are in an elevated section. The risk posed by canals is reduced when compared to the risk posed by fluvial watercourses as canals are managed through 'draw down' if levels become dangerously high.

6.8.3 None of the minerals sites have been identified as being located within close proximity to any of these canals, or any other artificial sources.

6.9 Sequential Working and Restoration of Minerals Sites

6.9.1 Mineral extraction is a temporary use of land and the careful restoration of a site to beneficial after-use can avoid permanent adverse impacts on the local environment and provide opportunities for positive enhancement of the local area. The eventual after-use is therefore an important consideration when selecting sites.

6.9.2 Policy S12 of the ECC MLP states that proposals for minerals development will be permitted provided that it can be demonstrated that the land is capable of being restored at the earliest opportunity to an acceptable environmental condition and beneficial after-use, with positive benefits to the environment, biodiversity and/or local communities.

6.9.3 Where appropriate, proposals shall demonstrate the best available techniques to ensure that flood risk is not increased, and proposals shall demonstrate that there will not be an unacceptable adverse impact on groundwater conditions, surface water drainage and the capacity of soils for future use, having due regard to any relevant Surface Water or Shoreline Management Plans.

6.9.4 'Restoration' covers any operations designed to return the land to an acceptable landform, environmental condition and beneficial after-use. The restoration of mineral sites in the past has predominantly been achieved through infilling with waste material and capping with clays and soils to enable a return to agricultural use, or alternatively the creation of water bodies. There has since been a decline in the need for agricultural land; changes in the way in which waste disposal is taxed and regulated have also led to less inert material being available for use as fill. Biodiversity and amenity after uses have therefore become more common after uses for minerals sites.

6.9.5 There are a number of potential restoration uses for minerals sites as discussed in more detail below.

Habitat Creation

6.9.6 Mineral sites can be restored to create a variety of habitats including wetlands, wetland grassland, ponds, backwaters, marshes and wet woodland. These restored mineral sites can provide valuable stopping off points for migrating wildfowl and where marginal vegetation is present they can also provide nesting sites and a good habitat for invertebrates. The MLP states that wherever possible, mineral site restoration should contribute towards the conservation of priority habitats in order for ECC as the MPA to be compliant with the 'duty' placed upon it by the Natural Environment and Rural Communities Act 2006.

6.9.7 Priority Habitats are defined in the NPPF as being the Habitats of Principle Importance included in the England Biodiversity List published by the Secretary of State under section 41 of the Natural Environment and Rural Communities Act 2006. They are habitats identified as requiring action in the UK Biodiversity Action Plan (UK BAP) and continue to be regarded as conservation priorities. The MLP proposes ambitious targets for the creation of a minimum of 200 hectares of UK priority habitat creation in Essex by 2029.

6.9.8 Apart from the obvious habitat and environmental benefits of minerals restoration, this process also offers social and potentially commercial incentives. An example of a successful restoration project is the 'Funky Footprints' site near to Shepperton in Surrey. This former sand and gravel quarry now includes lakes, reed beds, woodland, pond dipping platforms and a bird watching hide. It was awarded the Quarry Products Association Restoration award in 2007 and is a good example of how minerals sites can be restored to supporting education and the environment at the same time.

Water Supply

6.9.9 Minerals sites can be restored and used for winter water storage for agricultural spray irrigation or potable water supply. These uses may also create a greater opportunity for boating, walking, cycling, camping etc.

6.9.10 If the minerals site is to be used as a potable water supply, the potential adverse impact on local habitats through the use of herbicides and pesticides for weed control need to be fully understood.

Flood Storage

6.9.11 Research carried out by Symonds Group on behalf of Defra, the Mineral Industry Sustainable Technology and the Mineral Industry Research Organisation looked into the influence of aggregate quarrying in floodplains on flood risk. The results showed that sand and gravel extraction in a floodplain will create a void that can be used to provide potential storage during a flood event, generally reducing flow and water levels in the vicinity of the extraction. However, long term benefits will only accrue where larger workings up-stream of a vulnerable settlement are restored to an open water environment; it is also thought that any benefits are diminished where workings are more than 2km upstream of a settlement.

6.9.12 This potential sequential working and restoration is likely to be most effective at a strategic (county) scale and is suggested in the PPS25 Practice Guide.

6.9.13 Options to create flood storage areas should be investigated on a site by site basis in consultation with the EA. In addition, any areas safeguarded for flood storage will require

maintenance to ensure their efficient operation during a storm event. If the flood storage areas are not maintained, there could be potential for increased flood risk to areas downstream.

6.9.14 Table 6-1 provides an indication of the potential intended after-use of the preferred mineral sites, which has been referenced from the MLP Submission Document. As part of this Level 1 SFRA, an initial high level review has been undertaken of all the mineral sites to determine whether there is any potential to deliver flood storage benefits. Table 6-2 provides a summary of the sites considered, and the assessments made.

Table 6-2 Sites considered for potential flood storage benefits

Site Ref and Name	Potential for Flood Storage
A1 Appleford and Coleman's Farm, Witham, Braintree **A46 Coleman's Farm, Witham, Braintree (Preferred)** (Appendix B Figure 3.6)	There may be potential to restore Site A1 (or Site A46) to low level and thereby increase the area of land designated as the floodplain of the River Blackwater. This would provide additional storage within the floodplain during high flows. However, it is considered that the immediate area downstream of the site is not heavily developed, and the presence of the A12 road may already provide protection to the settlement of Witham. As a result, a flood storage scheme may not provide much quantifiable benefit to the surrounding areas.
A12 Colchester Quarry, Bellhouse Farm South (Appendix B Figure 3.6)	Site A12 is located adjacent to the floodplain of the Roman River. However, there are no apparent areas of land or settlements at risk of fluvial flooding downstream that would benefit from such a scheme.
A22 Little Bullocks Farm, Canfield (Preferred) **A26 Frogs Hall, Takeley** (Appendix B Figure 3.1)	These sites are both located in the floodplain, but are unlikely to be suitable for future flood storage due to their size. In addition, there are no immediately obvious settlements downstream that are currently at risk and would benefit from such a scheme at either site.
A21 and A34 Thorrington Hall Farm, Thorrington	These sites are located adjacent to the River Colne which is tidally influenced. It is therefore considered that a flood storage area in this location would be of limited benefit.
A31 Birch Extraction, Colchester (Preferred)	A small drainage ditch flows through the northern part of Site A31 and joins a tributary of the Roman River. Given the size of the watercourse and the location high up in the catchment, there is little opportunity to provide flood storage benefits. The MLP states that it is proposed to restore this site to low-level. It will be necessary to consider how the area will be effectively drained, and to ensure that the restoration of the site does not increase the flood risk to the downstream area.
A41 Patch Park Farm	This site is located in Flood Zone 3b Functional Floodplain; in order to use this site as a flood storage area, a control system would be required to draw down water prior to a flood event to provide space for floodwater storage. Such a scheme is likely to be very costly, and given the location, may not provide much additional benefit to areas downstream.

6.9.15 It is concluded that in the light of the size and location of these sites, they are unlikely to be appropriate for provision of large scale fluvial flood storage benefits. However it should be noted that there are still opportunities to provide benefits to the local area and local communities through retention of land within the floodplain of local watercourses and the creation of marshland and wetland habitats as part of the after-uses of these sites. The creation of these types of habitats can also be of benefit as part of the management of surface water flood risk through the use of SuDS techniques.

Restoring Sites in Areas identified to be at risk of Groundwater Flooding

6.9.16 When a site specific hydrogeological survey has identified a site as having a high water table there may be opportunity for this flood risk to be mitigated through raising of ground levels as part of the restoration of the minerals site. The impacts of this on both the site and surrounding area should be considered on a site by site basis as part of the restoration process.

7 EMERGENCY PLANNING AND FLOOD RISK

7.1 Overview

7.1.1 A key consideration for any new development is whether adequate flood warning systems and procedures are in place to ensure that occupants of the site are able to act upon the warnings and are equipped to take steps to remain safe in the event of a flood.

7.1.2 For sand and gravel workings, the NPPF Technical Guidance states that any essential ancillary sleeping or residential accommodation for staff required by the workings will only be permitted in areas of flood risk *subject to a specific warning and evacuation plan*.

7.2 Flood Warning Systems

7.2.1 The EA operates a flood warning service to provide warnings when there is an increased risk of flooding. Appendix B Figure 7 shows the coverage of flood warnings across Essex, which largely corresponds to the area covered by Flood Zone 2 – Medium Probability of fluvial or tidal flooding. The flood warning system consists of two warning codes, as follows:

- Flood Alert – Flooding is possible. Be prepared.
- Flood Warning – Flooding is expected. Immediate action required.

7.2.2 Flood warnings are disseminated through a variety of mediums that include TV, radio, an automated voice messaging service direct to a telephone/fax/pager, SMS, the internet and/or loudhailer. There is also an emergency Floodline number (0845 988 1188) and a quick dial number for individual rivers.

7.3 Flood Evacuation Plans

7.3.1 Proposals for new minerals development that may be at risk of flooding need to include details of safe access and egress routes to dry ground beyond the flooded area and may also require places of safe refuge on the site if evacuation is not possible. Flood evacuation plans should include:

- Details of how a flood warning is to be provided;
- What will be done to protect the vulnerable parts of the development and its contents, where appropriate;
- Details of safe access to and from the site for occupants.

7.3.2 Local Authorities are classified as Category 1 responders in the context of the Civil Contingencies Act 2004. As such their responsibilities include risk assessment, emergency planning and warning and informing the public. ECC have emergency plans in place which ensure that ECC work closely with other Category 1 Responders, such as the Emergency Services, to minimise the impact of flooding.

7.4 Recommendations

7.4.1 It is recommended that ECC should seek opportunities to:

- Ensure that all new minerals developments that are located within flood risk areas create a Flood Emergency and Evacuation Plan using information provided by site-specific FRAs in order that the risk to occupants and site equipment and development is minimised in a flood event.

- Ensure that the SFRA is used to inform the local emergency plans with regards to access and egress routes, temporary shelter and accommodation and control and command locations.
- Through the planning process, ensure that future strategic or critical infrastructure is located in areas at least risk of flooding.

8 SUSTAINABLE DRAINAGE SYSTEMS (SUDS)

8.1 Introduction

8.1.1 Dewatering and pumping during mineral extraction will require the use of appropriate Sustainable Drainage Systems (SuDS) techniques to ensure that the risk of flooding on the surrounding area is not increased and where possible is reduced.

8.1.2 The construction of any ancillary buildings and paved areas as part of the mineral sites will also need to comply with the requirements for surface water management and be addressed as part of the site-specific FRA. Drainage of rainwater from roofs and paved areas around buildings associated with minerals sites should comply with the 2002 Amendment of Building Regulations Part H (3). The requirements are as follows:

1. Adequate provision shall be made for rainwater to be carried from the roof of the building.
2. Paved areas around the building shall be so constructed as to be adequately drained.
3. Rainwater from a system provided pursuant to sub-paragraphs (1) or (2) shall discharge to one of the following in order of priority:
    - An adequate soakaway or some other adequate infiltration system; or where that is not reasonably practicable;
    - A watercourse; or where that is not reasonably practicable
    - A sewer.

8.1.3 Site promoters should consult with the EA and ECC about their proposals for surface water management and site drainage through the use of SuDS to ensure that they are adopting the most effective methods for their site.

8.2 What are SuDS?

8.2.1 Sustainable Drainage Systems (SuDS) are typically softer engineering solutions inspired by natural drainage processes such as ponds and swales which manage water as close to its source as possible. Wherever possible, a SuDS technique should seek to contribute to each of the three goals identified below with the preferred system contributing significantly to each objective. Where possible SuDS solutions for a site should seek to:

1. Reduce flood risk (to the site and neighbouring areas),
2. Reduce pollution, and,
3. Provide landscape and wildlife benefits.

8.2.2 These goals can be achieved by utilising a management plan incorporating a chain of techniques, as outlined in Interim Code of Practice for Sustainable Drainage Systems[44], where each component adds to the performance of the whole system:

Prevention	good site design and upkeep to prevent runoff and pollution (e.g. limited paved areas, regular pavement sweeping)
Source Control	runoff control at/near to source (e.g. rainwater harvesting, green roofs, pervious pavements)

[44] (2004) Interim Code of Practice for Sustainable Drainage Systems

Site Control	water management from a multitude of catchments (e.g. route water from roofs, impermeable paved areas to one infiltration/holding site)
Regional Control	integrate runoff management systems from a number of sites (e.g. into a detention pond)

8.2.3 The application of SuDS is not limited to a single technique per site. Often a successful SuDS solution will utilise a combination of techniques, providing flood risk, pollution and landscape/wildlife benefits. In addition, SuDS can be employed on a strategic scale, for example with a number of sites contributing to large scale jointly funded and managed SuDS. It should be noted, each development site must offset its own increase in runoff and attenuation cannot be "traded" between developments.

8.2.4 SuDS techniques can be used to reduce the rate and volume and improve the water quality of surface water discharges from sites to the receiving environment (i.e. natural watercourse or public sewer etc), which is of particular importance for mineral sites. Various SuDS techniques are available and operate on two main principles:

- Infiltration
- Attenuation

8.2.5 All systems generally fall into one of these two categories, or a combination of the two.

8.3 Why use SuDS?

8.3.1 Traditionally, built developments have utilised piped drainage systems to manage storm water and convey surface water run-off away from developed areas as quickly as possible. Typically, these systems connect to the public sewer system for treatment and/or disposal to local watercourses. Whilst this approach rapidly transfers storm water from developed areas, the alteration of natural drainage processes can potentially impact on downstream areas by increasing flood risk, reduction in water quality, loss of water resource and detriment to wildlife. Therefore, receiving watercourses have greater sensitivity to rainfall intensity, volume and catchment land uses post development.

8.3.2 Certain measures can be taken to protect more sensitive areas by reducing or prohibiting infiltration. In marginal areas where polluted water may have an impact on the groundwater, runoff can pass through one or more treatment stages depending on the potential level of pollution and hydro-geological conditions. If all infiltration was prohibited it is likely that a SuDS attenuation system would still represent an improved system over a traditional piped system enabling an improvement to the quality of the surface water runoff.

8.3.3 Current planning policy outlines that runoff rates post development must not exceed the existing (pre-development) rates. In addition, opportunities should be sought to achieve Greenfield runoff rates.

Planning

8.3.4 All relevant organisations should meet at an early stage to agree on the most appropriate drainage system for the particular development. These organisations may include the Local Authority, the Sewage Undertaker, Highways Authority, and the EA.

8.3.5 It can be difficult to 'design in' an integrated SUDS scheme once a site layout has already been decided on and in order to be most beneficial, SUDS should be considered from the outset.

8.3.6 There are, at present, no legally binding obligations relating to the provision and maintenance of SuDS. However, the most appropriate agreement is under Section 106 of the Town and

Country Planning Act. Under this agreement a SuDS maintenance procedure can be determined.

8.4 Infiltration SuDS

8.4.1 Infiltration SuDS rely on discharges to ground, where suitable ground conditions are available. Therefore, infiltration SuDS are reliant on the local ground conditions (i.e. permeability of soils and geology, the groundwater table depth and the importance of underlying aquifers as a potable resource) for their successful operation.

8.4.2 Various infiltration SuDS techniques are available for directing the surface water run-off to ground. Development pressures and maximisation of the developable area may reduce the area available for infiltration systems but this should not be a limiting factor for the use of SuDS. Either sufficient area is required for infiltration or a combined approach with attenuation could be used to manage surface water runoff. Attenuation storage may be provided in the sub-base of a permeable surface, within the chamber of a soakaway or as a pond/water feature.

8.4.3 Infiltration measures include the use of permeable surfaces and other systems that are generally located below ground.

Permeable Surfaces

8.4.4 Permeable surfaces are designed to allow water to drain through to a sub-base at a rate greater than the predicted rainfall for a specified event. Permeable surfaces act by directly intercepting the rain where it falls and control runoff at source. Runoff during low intensity rainfall events is prevented by permeable surfaces. During intense rainfall events runoff generation may occur from permeable surfaces. The use of permeable sub-base can be used to temporarily store infiltrated run-off underneath the surface and allows the water to percolate into the underlying soils. Alternatively, stored water within the sub-base may be collected at a low point and discharged from the site at an agreed rate.

8.4.5 Programmes should be implemented to ensure that permeable surfaces are kept well maintained to ensure the performance of these systems is not reduced. The use of grit and salt during winter months may adversely affect the drainage potential of certain permeable surfaces.

8.4.6 Types of permeable surfaces include:

- Grass/landscaped areas
- Gravel
- Solid Paving with Void Spaces
- Permeable Pavements

Sub-Surface Infiltration

8.4.7 Where permeable surfaces are not a practical option more defined infiltration systems are available. In order to infiltrate the generated run-off to ground, a storage system is provided that allows the infiltration of the stored water into the surrounding ground through both the sides and base of the storage. These systems are constructed below ground and therefore may be advantageous with regards to the developable area of the site. Consideration needs to be given to construction methods, maintenance access and depth to the water table. The provision of large volumes of infiltration/sub-surface storage has potential cost implications. In addition, these systems should not be built within 5m of buildings, beneath roads or in soil that may dissolve or erode.

8.4.8 Various methods for providing infiltration below the ground include:

- Geocellular Systems
- Filter Drain
- Soakaway (Chamber)
- Soakaway (Trench)
- Soakaway (Granular Soakaway)

Table 8-1 Suitability of Infiltration Methods with respect to the wider aims of SuDS.

Infiltration Method	Reduce Flood Risk (Y/N)	Reduce Pollution (Y/N)	Landscape and Wildlife Benefits (Y/N)
Permeable Surface	Y	Y	N
Sub-surface Infiltration	Y	Y	N

8.5 Attenuation SuDS

8.5.1 If ground conditions are not suitable for infiltration techniques then management of surface water runoff prior to discharge should be undertaken using attenuation techniques. This technique attenuates discharge from a site to reduce flood risk both within and to the surrounding area. It is important to assess the volume of water required to be stored prior to discharge to ensure adequate provision is made for storage. The amount of storage required should be calculated prior to detailed design of the development to ensure that surface water flooding issues are not created within the site.

8.5.2 The rate of discharge from the site should be agreed with the Local Planning Authority and the EA. If surface water cannot be discharged to a local watercourse then liaison with the Sewer Undertaker should be undertaken to agree rates of discharge and the adoption of the SuDS system.

8.5.3 Large volumes of water may be required to be stored on site. Storage areas may be constructed above or below ground. Depending on the attenuation/storage systems implemented, appropriate maintenance procedures should be implemented to ensure continued performance of the system. On-site storage measures include basins, ponds, and other engineered forms consisting of underground storage.

Basins

8.5.4 Basins are areas that have been contoured (or alternatively embanked) to allow for the temporary storage of run-off from a developed site. Basins are designed to drain free of water and remain waterless in dry weather. These may form areas of public open space or recreational areas. Basins also provide areas for treatment of water by settlement of solids in ponded water and the absorption of pollutants by aquatic vegetation or biological activity. The construction of basins uses relatively simple techniques. Local varieties of vegetation should be used wherever possible and should be fully established before the basins are used. Access to the basin should be provided so that inspection and maintenance is not restricted. This may include inspections, regular cutting of grass, annual clearance of aquatic vegetation and silt removal as required.

Ponds

8.5.5 Ponds are designed to hold the additional surface water run-off generated by the site during rainfall events. The ponds are designed to control discharge rates by storing the collected run-off and releasing it slowly once the risk of flooding has passed. Ponds can provide wildlife habitats, water features to enhance the urban landscape and, where water quality and flooding risks are acceptable, they can be used for recreation. It may be possible to integrate ponds and wetlands into public areas to create new community ponds. Ponds and wetlands trap silt

that may need to be removed periodically. Ideally, the contaminants should be removed at source to prevent silt from reaching the pond or wetland in the first place. In situations where this is not possible, consideration should be given to a small detention basin placed at the inlet to the pond in order to trap and subsequently remove the silt. Depending on the setting of a pond, health and safety issues may be important issues that need to be taken into consideration. The design of the pond can help to minimise any health and safety issues (i.e. shallower margins to the pond reduce the danger of falling in, fenced margins).

8.5.6 Various types of ponds are available for utilising as SuDS measures. These include:

- Balancing/Attenuating Ponds
- Flood Storage Reservoirs
- Lagoons
- Retention Ponds
- Wetlands

Table 8-2 Suitability of Attenuation Methods towards the Three Goals of SuDS.

Infiltration Method	Reduce Flood Risk (Y/N)	Reduce Pollution (Y/N)	Landscape and Wildlife Benefits (Y/N)
Basins	Y	Y	Y
Ponds	Y	Y	Y

8.6 Alternative Forms of Attenuation

8.6.1 Site constraints and limitations such as developable area, economic viability and contamination may require engineered solutions to be implemented. These methods predominantly require the provision of storage beneath the ground surface, which may be advantageous with regards to the developable area of the site but should be used only if methods in the previous section cannot be used. When implementing such approaches, consideration needs to be given to construction methods, maintenance access and to any development that takes place over the storage facility. The provision of large volumes of storage underground also has potential cost implications.

8.6.2 Methods for providing alternative attenuation include:

- Deep Shafts
- Geocellular Systems
- Oversized Pipes
- Rainwater Harvesting
- Tanks
- Green Roofs

8.6.3 In some situations it may be preferable to combine infiltration and attenuation systems to maximise the management of surface water runoff, developable area and green open space.

8.7 Broad-Scale Assessment of SuDS Suitability

8.7.1 The underlying ground conditions of a development site will often determine the type of SuDS approach to be used at development sites. A broad assessment of the presence of aquifers underlying the proposed mineral sites has been identified in Table 6-1. This provides a suitable starting point, however further ground investigations will be required on site to

determine the suitability of SuDS. The information presented in the broad scale mapping is provided as a guide and should not be used to accept or refuse SuDS techniques.

8.7.2 The EA has identified Groundwater Source Protection Zones (GSPZs) which are concerned with protecting the catchment area for public and private water supply from potential polluting sources. Table 6-1 identifies that Site A15 and A18 lie within or immediately adjacent to the Great Bentley SPZ and Site A17 and A21 lie within or immediately adjacent to the Goldacre Farm SPZ. Where mineral resources of interest coincide with GSPZs, great care will need to be exercised to ensure that groundwater sources are protected and this will in turn impact on the type of SuDS that can be considered as part of the surface water management strategy for these sites.

9 SITE SPECIFIC FRA GUIDANCE

9.1 Overview

9.1.1 This Level 1 SFRA for ECC provides a high level assessment of the flood risk posed to the area. However, this document has a strategic scope and therefore it is essential that site-specific Flood Risk Assessments (FRAs) are also developed for individual development proposals and that where necessary and appropriate, suitable mitigation measures are incorporated.

9.1.2 This section presents recommendations and guidance for site-specific FRAs prepared for submission with planning applications for mineral sites in Essex.

9.2 When is a Flood Risk Assessment Required?

9.2.1 The NPPF states that a site-specific FRA is required in the following circumstances:

- For proposals of 1 hectare or greater in Flood Zone 1;
- all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the LPA by the EA); and,
- where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

9.2.2 A FRA should be proportionate to the degree of flood risk as well as the scale, nature and location of the proposed development.

9.2.3 All of the minerals sites that have been assessed in this SFRA are greater than 1 hectare in site area and would therefore require a site specific FRA.

9.3 FRA Staged Approach

9.3.1 When informing site developers of the requirements of a site specific FRA for a development site, consideration should be given to the position of the development relative to flood sources, the vulnerability of the proposed minerals development and its scale.

9.3.2 The EA provides flood risk standing advice for applicants and agents on their website http://www.environment-agency.gov.uk/research/planning/82587.aspx which includes a matrix to determine the level of assessment that is required based on Flood Zone classification and development type. Within this matrix are links to FRA Guidance notes and advice for applicants as to which data they will need to purchase from the EA in order to carry out their FRA.

9.3.3 The Practice Guide to PPS25 sets out a staged approach to site-specific FRA, with the findings from each stage informing both the next level and the site layout, throughout the development process. A summary of the three levels of FRAs is described below.

Level 1 Screening Study

9.3.4 The Level 1 FRA is intended to identify any flooding or surface water management issues related to the development site that may require further investigation. The study should be based on readily available existing information, including:

- SFRA,
- EA Flood Maps,

- Standing Advice

9.3.5 The Level 1 FRA will determine the need for a Level 2 or 3 FRA.

Level 2 Scoping Study

9.3.6 Where the Level 1 FRA indicates that the site may lie in an area at risk of flooding, or may increase flood risk elsewhere due to runoff, a Level 2 FRA should be carried out. This report will confirm sources of flooding which may affect the site and should include the following;

- Appraisal of available and adequacy of existing information;
- Qualitative appraisal of the flood risk posed to the site, the potential impact of the development on flood risk on and off the site;
- An appraisal of the scope of possible measures to reduce the flood risk to acceptable levels.

9.3.7 This Level may identify that sufficient quantitative information is already available to complete a FRA appropriate to the scale and nature of the development.

Level 3 Detailed Study

9.3.8 Undertaken if the Level 2 FRA concludes that further quantitative analysis is required in order to assess flood risk issues related to the development site. This Level should include:

- Quantitative appraisal of the potential flood risk to the development;
- Quantitative appraisal of the potential impact of development on the site under investigation on flood risk on and off the site;
- Quantitative demonstration of the effectiveness of any proposed mitigation measures.

9.4 Flood Zone 1

9.4.1 Minerals developments classified as Water Compatible or Less Vulnerable are appropriate within Flood Zone 1. The policy aim set out in the NPPF for development in Flood Zone 1 is for developers and local authorities should seek opportunities to reduce the overall level of flood risk to the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

9.4.2 This is to ensure storm water generated by the site is managed in a sustainable manner and does not increase the burden on existing infrastructure and/or flood risk to neighbouring property. The FRA can be brief unless the factors above or local considerations require particular attention.

9.5 Flood Zone 2

9.5.1 All developments proposed within Flood Zone 2 require a site specific FRA. Minerals developments classified as Water Compatible or Less Vulnerable are appropriate within Flood Zone 2, subject to the satisfaction of the Sequential Test.

9.5.2 In Flood Zones 1 and 2, the NPPF requires developers to seek opportunities to reduce the overall level of flood risk to the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

9.6 Flood Zone 3a

9.6.1 All developments proposed within Flood Zone 3a require a FRA. Minerals developments classified as Water Compatible or Less Vulnerable are appropriate within Flood Zone 3a, subject to the satisfaction of the Sequential Test. The NPPF policy aims for this zone are:

- Reduce the overall level of flood risk in the area through the layout and form of the development and appropriate application of sustainable drainage techniques;
- Relocate existing development to land in zones with a lower probability of flooding;
- Create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

9.7 Flood Zone 3b

9.7.1 All developments proposed within Flood Zone 3b require a FRA. Minerals developments classified as Water Compatible, such as sand and gravel workings are permitted in Flood Zone 3b (subject to the satisfaction of the Sequential Test). Minerals developments classified as Less Vulnerable are not permitted in Flood Zone 3b.

9.7.2 The NPPF policy aims for this zone are:

- Reduce the overall level of flood risk in the area through the outlay and form of the development and appropriate application of sustainable drainage techniques;
- Relocate existing development to land in zones with a lower probability of flooding.

9.7.3 Water Compatible uses that are permitted in this zone should be designed and constructed to:

- Remain operational and safe for use in times of flood;
- Result in no net loss of floodplain storage;
- Not impede flood risk elsewhere.

9.7.4 At all stages, the ECC and, where necessary, the EA and statutory water undertaker should be consulted to ensure the FRA provides the necessary information to fulfil the requirements for planning applications.

9.8 Summary

9.8.1 To achieve the aims of the NPPF with regard to site-specific FRAs, ECC should:

- Ensure the Sequential Test is undertaken for all occasions and windfall sites promoted for development within their administrative areas;
- Have regard to the vulnerability classification of developments and local emergency planning issues when determining suitable locations for minerals development sites;
- Have regard to the cumulative impact of development on flood risk; In Flood Zones 2 and 3 the mapped/known risk of flooding comes from either rivers or the sea. In these areas the impact of minor developments have on flooding by causing flood levels to rise is usually small. In some circumstances however, the cumulative effect of many minor developments in the same area can have a serious impact and must therefore be considered.
- Determine decisions for windfall development through application of the Sequential Test. Where this is not practical ECC should balance the flood risk at an individual site, the type of development proposed, emergency planning and the contribution the development would make to the wider sustainability of the area before determining a decision;

- Consider flood risk as one of a number of policies that in tandem can provide mechanisms to deliver sustainable developments with multiple benefits;
- Engage with developers and local regulators throughout the development process to develop and instigate initiatives for the reduction of flood risk;
- Require site specific FRAs in accordance with NPPF guidelines.

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