The Sizewell C Project

5.9 Rail Flood Risk Assessment

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Planning Act 2008
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Contents

Tables

Plates

None provided.

Figures (provided separately)

Appendices

None provided.

Executive Summary

This Flood Risk Assessment (FRA) presents an assessment of existing flood risk from all sources of flooding to the proposed rail development and is submitted as part of the application for development consent for Sizewell C Project. The rail proposals comprise a temporary rail extension west to east rail route that would connect the existing Saxmundham to Leiston branch line to the Sizewell C main development site, known as the rail extension route, and upgrades to the existing Saxmundham to Leiston branch line. The FRA also describes future flood risk to the site taking account of climate change and considers possible changes in flood risk to off-site receptors as a result of the proposed development. It also presents mechanisms for managing residual risk.

The rail extension route is not at fluvial flood risk. The Saxmundham to Leiston branch line has a short section that crosses Flood Zones 2 and 3. However, the risk of fluvial flooding here is low, due to the existing culvert enabling flow conveyance under the existing railway line and the higher topographic levels of the railway line compared to the surrounding ground levels.

Flood risk from surface water is variable across the site. The majority of the site is at 'Very Low' risk of flooding from surface water. Isolated areas of 'High' risk have been avoided in terms of vulnerable uses or integrated into the drainage system.

The flood risk from tidal, groundwater, sewers and reservoirs is considered to be low.

The rail extension route has been designed using sustainable drainage systems (SuDS) principles to collect run-off in swales which would then infiltrate to ground. The improvements to the Saxmundham to Leiston branch line would not change the existing impermeable area.

The proposed development is classed as 'Essential Infrastructure' under the NPPF. As per **Table 2.3**, the Flood Risk Vulnerability and Flood Zone Compatibility table, the rail extension route is considered appropriate in terms of flood risk vulnerability and, passes the Sequential Test. The existing Saxmundham to Leiston branch line improvements requires the application of the Exception Test due to the watercourse crossings. The Exception Test is passed as the proposed works have no effect on the existing watercourse crossings.

Therefore, the proposed development is considered to be appropriate in terms of flood risk, the proposed mitigation measures, and in accordance with NPPF guidance.

1 Introduction

1.1 Background

1.1.1. This Flood Risk Assessment (FRA) describes the risk of flooding, from all sources, to the rail proposals and the predicted impact on flood risk in general. This FRA is submitted as part of the application for development consent for 'Sizewell C Project'[1].

1.1.2. The construction of the Sizewell C Project would require the delivery of substantial amounts of construction materials. SZC Co. has developed an integrated transport strategy for the use of rail in the delivery of freight during construction, reducing heavy goods vehicle (HGV) movements on local roads.

1.1.3. This FRA covers two sites that together make one of the Sizewell C Project's associated development sites. These sites provide the improvements and extensions to existing rail infrastructure necessary to facilitate the integrated transport strategy**.** Firstly, upgrades to the existing Saxmundham to Leiston branch line, including upgrades to various level crossings. Secondly, a temporary rail extension route from west to east that would connect the existing Saxmundham to Leiston branch line to the Sizewell C main development site.

1.1.4. This FRA also describes how the risk of flooding would be managed and provides recommendations to minimise any residual flood risk impacts associated with the proposed development.

1.1.5. The rail extension route would connect to the existing Saxmundham to Leiston branch line. The rail extension route runs from the Saxmundham to Leiston branch line in a north-easterly direction before entering the main development site at the B1122 (Abbey Road) level crossing, as shown in **Volume 9, Chapter 2, Figure 2.1** of the **ES**.

1.1.6. A further section of rail within the main development site runs from the B1122 (Abbey Road) level crossing into the temporary construction area of the main development site. This section of the rail extension line is covered within the separate **Main Development Site FRA** (Doc Ref. 5.2) and is not included in this FRA.

1.1.7. Once the proposed rail extension route is no longer required for the construction of the Sizewell C Project, the use of the temporary rail infrastructure would cease and the proposed rail extension route and

[1] SZC Co.'s proposal to build and operate a new nuclear power station, comprising two UK European Pressurised Reactors™ (EPRs™), at Sizewell in Suffolk, north of the existing Sizewell B power station.

associated level crossings at Buckleswood Road and the B1122 (Abbey Road) would be removed and the land reinstated to agricultural use. The improvements to the Saxmundham to Leiston branch line and associated level crossing upgrades would remain as permanent, as shown in **Volume 9 Chapter 2 Figures 2.2** and **2.3** of the **ES**.

2 Legislation, policy and guidance

2.1 Introduction

2.1.1. This section identifies and describes the legislation, policy and guidance of relevance to the FRA for the proposed development.

2.1.2. Legislation and policy have been considered at a national and local level. The following are relevant as they have influenced the scope and/or methodology adopted for the FRA:

- Overarching National Planning Policy Statement (EN-1) (Ref. 1.1);
- ONR/EA Joint Advice Note: Principles for Flood and Coastal Erosion Risk Management (Ref. 1.2);
- National Planning Policy Framework (Ref. 1.3);
- National Planning Policy Guidance (Ref. 1.4);
- Flood Risk Assessments: Climate Change Allowances (Environment Agency) (Ref. 1.5);
- Suffolk Coastal Local Plan - Core Strategy and Development. (Ref. 1.6);
- Suffolk Coastal Local Plan - Remaining 'Saved Policies' (Ref. 1.7);
- Suffolk Coastal Local Plan – Final Draft Plan (Ref. 1.8); and
- Suffolk Flood Risk Management Strategy (Ref. 1.9).
- Leiston Surface Water Management Plan (SWMP) (Ref. 1.10)

2.2 Legislation

a) Flood and Water Management Act 2010

2.2.1. The Flood and Water Management Act (FWMA) was enacted in 2010. It aims to improve both flood risk management and the way we manage our water resources by creating clearer roles and responsibilities. This includes a lead role for upper tier and unitary local authorities in managing local flood risk (from surface water, groundwater and ordinary watercourses) and a

strategic overview role of all flood risk for the Environment Agency. The FWMA provides opportunities for a more comprehensive, risk-based approach on land use planning and flood risk management by Local Authorities and other key partners.

2.3 National policies and guidance

a) Overarching National Policy Statement for Energy EN-1

2.3.1. The Overarching National Policy Statement for Energy (EN-1) (Ref. 1.1) was prepared in 2011 and provides specific guidance on the development of energy infrastructure in relation to flood risk for the lifetime of the facilities. The national flood risk policies reflected in this document have since been superseded, however the guiding principles are still applicable and are also embedded in the current national policies (NPPF). EN-1 confirms that an FRA is required to assess flood risk from all sources for the lifetime of the project by competent people. The FRA would, among other aspects, need to identify flood risk reduction and management measures. Residual risks would also require assessment to consider their acceptability.

2.3.2. In relation to surface water management, EN-1 promotes the appropriate use of sustainable drainage (SuDS) to facilitate the sustainable development of energy developments. The SuDS should aim to prevent an increase in surface water flood risk associated with the increase in discharge from the site.

b) Joint Office for Nuclear Regulation and Environment Agency Principles for Flood and Coastal Erosion Risk Management Advice Note

2.3.3. The Office for Nuclear Regulation and Environment Agency joint advice note sets out *"the approach to flood risk in the nuclear new-build programme in England."* (Ref. 1.2). The note states that flood hazard analysis should be reported to the Environment Agency via planning submissions in the form of Flood Risk Assessments and to the Office for Nuclear Regulation in nuclear safety cases.

2.3.4. The principle of the flood risk analysis set out in the note is that all flood risk analysis work would be suitable for both the FRA and nuclear safety case(s).

2.3.5. Appendix D of the joint advice note, confirms that for associated development site if the associated infrastructure is not critical to the day to day running of the site, such as a road built to assist with local transport capacity improvements, *"then the most relevant climate change criteria must be applied in accordance with national planning policy".*

c) National Planning Policy Framework and Guidance

2.3.6. The National Planning Policy Framework (NPPF) (Ref. 1.3) sets out the Government's planning policies for England. The NPPF seeks to ensure that flood risk is considered at all stages of the planning and development process, to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk of flooding. Where there are no reasonably available sites in Flood Zone 1, the local planning authority can consider reasonably available sites in Flood Zone 2. Only when there are no reasonably available sites for development in Flood Zones 1 and 2 should the suitability of sites in Flood Zone 3 be considered.

2.3.7. In addition, the NPPF states that "*the development should be made safe for its lifetime without increasing flood risk elsewhere*." For a development to be considered acceptable with regards to flood risk, the sequential test requirements must be satisfied, along with demonstrating the development:

- within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
- is appropriately flood resistant and resilient;
- it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
- any residual risk can be safely managed; and
- safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

2.3.8. Further details of the requirements for sequential testing and sustainable drainage are provided in the following two sections.

i. Sequential Testing

2.3.9. The National Planning Practice Guidance on Flood Risk and Coastal Change (Ref. 1.4) supports the NPPF with additional guidance on flood risk vulnerability classifications and managing residual risks. The National Planning Practice Guidance provides further description of Flood Zones (**Table 2.1**), Vulnerability Classifications (**Table 2.2**) and Compatibility Matrix (**Table 2.3**) in order to assess the suitability of a specific site for a certain type of development.

Table 2.1: Summary of flood zone definitions

Flood zone	Probability of flooding	Return periods
1	Low	Land having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
2	Medium	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% - 0.1%); or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% - 0.1%).
3a	High	Land having a 1 in 100 or greater annual probability of river flooding (≥1%); or Land having a 1 in 200 or greater annual probability of sea flooding (≥0.5%).
3b	High – Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on Flood Maps)

Table 2.2: Summary of flood risk vulnerability classifications

Vulnerability classification	Description
Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly Vulnerable	• Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').

More Vulnerable	• Hospitals • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.
Water Compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas and wharves. • Navigation facilities. • Ministry of Defence defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Table 2.3: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood risk vulnerability classification		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b 'Functional Floodplain'	Exception Test required	✓	×	×	×
Key: ✓ Development is appropriate × Development should not be permitted						

2.3.10. Following application of the Sequential Test, if it is not possible (consistent with wider sustainability objectives) for the development to be located in zones with a lower probability of flooding, the Exception Test can be applied, if appropriate. For the Exception Test to be passed:

- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and
- a site-specific FRA must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

2.3.11. Where the Exception Test is required, both elements of the Exception Test will have to be passed for development to be allocated or permitted. Within each flood zone, surface water and other sources of flooding also need to be taken into account in applying the sequential approach to the location of development.

ii. Sustainable drainage and surface water

2.3.12. The National Planning Practice Guidance on Flood Risk and Coastal Change (Ref. 1.4) supports the NPPF with additional guidance on flood risk, which states that

> *"developers should seek opportunities to reduce the overall level of flood risk in the area and beyond. This can be achieved, for instance, through the layout and form of development, including green infrastructure and the appropriate application of sustainable drainage systems, through safeguarding land for flood risk management, or where appropriate, through designing off-site works required to protect and support development in ways that benefit the area more generally."*

2.3.13. In order to manage surface water on the site, it is necessary to consider the appropriateness of various SuDS measures, using the SuDS hierarchy set out in the National Planning Practice Guidance (Ref. 1.4).

2.3.14. The aim should be to discharge surface run off as high up the drainage options hierarchy as reasonably practicable. These are listed with the most favorable option first and least preferable last:

> *"1) Updated the sea level rise allowances using UKCP18 projections.*
>
> *2) Added guidance on how to a) calculate flood storage compensation, b) use peak rainfall allowances to help design drainage systems, c) account for the impact of climate change on storm surge, d) assess and design access and escape routes for less vulnerable development.*
>
> *3) Changed the guidance on how to apply peak river flow allowances so the approach is the same for both flood zones 2 and 3." (Ref.1.5).*

2.3.15. The National Planning Practice Guidance acknowledges that some types of sustainable drainage systems may not be practicable in all locations. Locations may be constrained in areas of risk flood.

2.3.16. The Environment Agency classifies surface water flood risk (Ref. 1.11) into four categories; 'very low', 'low', 'medium' and 'high' (**Table 2.4**).

Table 2.4: Summary of flood risk from surface water definition

Probability of surface water flooding	Return periods
Very low	Land with less than 1 in 1,000 annual probability of surface water flooding (<0.1%).
Low	Land with between 1 in 1,000 and 1 in 100 annual probability of surface water flooding (0.1% - 1%).
Medium	Land with between 1 in 100 and 1 in 30 annual probability of surface water flooding (1% - 3.3%).

Probability of surface water flooding	Return periods
High	Land with greater than 1 in 30 annual probability of surface water flooding (>3.3%).

d) Flood Risk Assessments: climate change allowances

2.3.17. The Environment Agency's online advice note 'Flood Risk Assessments: Climate Change Allowances' (Ref. 1.5) was published in February 2016 and amended in April 2016, February 2017 and February 2019.

2.3.18. This advice note provides guidance for determining appropriate climate change allowances for fluvial, tidal and peak rainfall intensities. The climate change allowances consider the geographical location, life span of the proposed development, flood risk, vulnerability classification associated with the type of development and critical drainage areas. The guidance on peak rainfall intensity allowances is outlined in **Table 2.5**.

Table 2.5: Peak rainfall intensity allowance in small and urban catchments (1961-90 baseline) (Source: Table 2, Environment Agency Climate Change Allowances)

	Total potential change anticipated for 2010-2039	Total potential change anticipated for 2040-2059	Total potential change anticipated for 2060-2115
Upper End	10%	20%	40%
Central	5%	10%	20%

2.4 Local plans

a) Suffolk Coastal Local Plan

i. Final Draft Proposed Local Plan

2.4.1. On 1 April 2019, East Suffolk Council (ESC) was created, merging the former districts of Suffolk Coastal District Council (SCDC) and Waveney District Council (WDC).

2.4.2. The ESC is in the process of replacing the former SCDC Local Plan. The final draft of the new local plan was published, and a six-week period set for the receipt of representations in relation to legal compliance and soundness between 14 January 2019 and 25 February 2019. The SCDC have previously stated that the adoption of the plan is scheduled for Spring 2020 (Ref. 1.8).

ii. Existing Local Plan

2.4.3. The existing SCDC Local Plan sets out how the area should be developed. It incorporates the Core Strategy and Development Management Policies (Ref. 1.6) and Saved Policies from the Suffolk Coastal Local Plan (incorporating the First and Second Alterations) (Ref. 1.7). These documents form part of the formal Development Plan and are used in the determination of planning applications.

2.4.4. Six policies within the Core Strategy and Development Management Policies document (2013) (Ref. 1.6) have been identified as relevant for the proposed development, as outlined in **Table 2.6**. No reference to the allocation of the proposed development site has been found in the SCDC Local Plan.

Table 2.6: Relevant Suffolk Coastal Local Plan policies

Policy number	Policy name	Summary
SP1	Sustainable Development	To deliver sustainable communities through better integrated and sustainable patterns of land use, movement, activity and development.
SP6	Regeneration	Economic Regeneration, including diversification, is considered to be a priority in the following areas: The town of Leiston, where the decommissioning of Sizewell A nuclear power station has added to the impact of the decline in local engineering; Saxmundham, where limited employment opportunities and community facilities has led to outward commuting.
SP11	Accessibility	The transfer of freight from road to rail will be encouraged.
SP12	Climate Change	The District Council will contribute towards the mitigation of the effects of new development on Climate Change by minimising the risk of flooding and ensuring appropriate management of land within floodplains.
SP13	Nuclear Energy	The local issues that need to be adequately addressed consist of at least the following: Transport issues such as the routing of vehicles during construction, improvements to the road system (including the A12), and use of rail and sea for access all having regard to such factors as residential amenity;
DM28	Flood Risk	Proposals for new development, or the intensification of existing development, will not be permitted in areas at high risk from flooding, i.e. Flood Zones 2 and 3, unless the applicant has satisfied the safety requirements in NPPF (and any successor).

b) Suffolk Flood Risk Management Strategy

2.4.5. Suffolk County Council (SCC) is responsible for coordinating a partnership approach to flood and coastal risk management with all risk management authorities in Suffolk. They do this through the Suffolk Flood Risk Management Partnership who produced the Local Flood Risk Management Strategy in March 2016 (Ref. 1.9).

2.4.6. The objective of the strategy is *"to take a pragmatic approach to reduce the current flood risk and ensure that we do nothing to make this worse in the future."* This objective is in accordance with the principles laid out in the NPPF.

2.4.7. Seven objectives of the Local Flood Risk Management Strategy have been identified, two of which are of relevance to the proposed development:

- Objective 3: To prevent an increase in flood risk as a result of development by preventing additional water entering existing drainage systems wherever possible.
- Objective 4: Take a sustainable and holistic approach to flood and coastal management, seeking to deliver wider economic, environmental and social benefits, climate change mitigation and improvements under the Water Framework Directive.

c) Leiston Surface Water Management Plan

2.4.8. The Leiston SWMP was published in 2017 (Ref. 1.10). It used a one-dimension hydraulic model to obtain a more accurate assessment of flooding for the town and surrounding area. The aim of the plan was to identify areas at risk of surface water flooding and assist with the development of capital schemes in future studies.

2.4.9. The modelled extents cover the entirety of the rail extension route site, and the eastern section of the Saxmundham to Leiston branch line improvements.

3 Development description and scope of this assessment

3.1 The existing site

a) Rail extension route

3.1.1. The rail extension route comprises approximately 23 hectares (ha) of primarily agricultural land located immediately north-west of the village of Leiston. The site extends in a north-easterly direction from the existing Saxmundham to Leiston branch line. The site's eastern extent is located at

the level crossing of the B1122 (Abbey Road), where the proposed rail track will continue into the main development site

3.1.2. The site is gently sloping arable farmland, interspersed with scattered woodlands, copses and hedgerows.

b) Saxmundham to Leiston branch line improvements

3.1.3. The Saxmundham to Leiston branch line is an existing length of railway that is approximately 8 km in length and runs from Saxmundham to Leiston, terminating at Sizewell Halt (**Figure 5**). The Saxmundham to Leiston branch line is approximately 2km to the south-west of the main development site at its closest point at the Sizewell level crossing in the east of Leiston.

3.1.4. Currently, there are no regular freight services on the Saxmundham to Leiston branch line which is currently only used by occasional maintenance trains – see **Volume 9, Chapter 1** of the **ES**.

3.2 The proposed site masterplan and design

a) Rail extension route

3.2.1. The rail extension route would connect to the existing Saxmundham to Leiston branch line with a new junction, located approximately 500m east of the existing Saxmundham Road level crossing and approximately 230m south of Buckle's Wood (**Figure 5**).

3.2.2. The route would then run north-east through agricultural fields before intersecting Buckleswood Road, where an automatic barrier crossing is proposed.

3.2.3. Schedule 1 of the **Draft Development Consent Order** (**Draft DCO**) (Doc Ref 3.1) describes the authorised development. The **Draft DCO** states that the proposed rail extension route will be constructed, operated and maintained anywhere within the area as shown on the **Work Plans** (Doc Ref. 2.3) (showing lateral limits of deviation) and to a maximum of +/- 1 metre (m) vertically.

3.2.4. A landscape bund is proposed along the northern boundary of the rail extension route to screen the proposed development from receptors north of the line. A second landscape bund is proposed along part of the southern edge of the rail extension route.

3.2.5. From Buckleswood Road, the rail extension route would continue further north-east, through open countryside and farmland to the south of Abbey Lane.

3.2.6. South of Abbey Lane, the rail extension route would turn to the east and enter the main development site at the proposed B1122 (Abbey Road) level crossing.

b) Saxmundham to Leiston branch line improvements

3.2.7. The proposed permanent improvement works to the Saxmundham to Leiston branch line include the renewal of the entire track and eight level crossing upgrades, which are;

- Knodishall level crossing;
- Westhouse level crossing;
- Saxmundham level crossing;
- Leiston level crossing;
- Bratts Black House crossing;
- Snowdens crossing;
- Buckle's Wood crossing; and
- Summerhill crossing.

3.2.8. On the Saxmundham to Leiston branch line, some maintenance works to existing culverts may be required. This is likely to include bracing but would not require works to the watercourse itself. These works would form part of Network Rail's standard asset management procedures to ensure operational maintenance of the existing branch line. Therefore, this work does not form part of the DCO proposals.

3.2.9. The proposed rail extension route would connect to the Saxmundham to Leiston branch line approximately 500m to the west of Leiston to facilitate freight movements to the main development site.

3.3 Topography

a) Rail extension route

3.3.1. The remotely sensed Light Detection and Ranging (LiDAR) data (Ref. 1.12) showing the topography of the site is provided in **Figure 1**. The ground slopes in a north-easterly direction from approximately 22m above ordnance datum (AoD) at the south-west of the rail extension route to approximately 8.75m AoD to the north-east of the rail extension route.

b) Saxmundham to Leiston branch line improvements

3.3.2. The LiDAR data (Ref. 1.12) shows the topography of the site provided in **Figure 5**. Topography surrounding the Saxmundham to Leiston branch line slopes gradually from approximately 38m AoD in the west to 18m AoD in the east. However, the line itself is both cut into the hillside and raised above lower ground levels, which reduces the gradient of this change.

3.4 Geology and hydrogeology

a) Overview

3.4.1. The Suffolk Coastal and Waveney District Councils Strategic Flood Risk Assessment (SFRA) (Ref. 1.13) states that:

> *"towards the east of the District the main soil types are deep well-drained sandy soils, deep well-drained sandy often ferruginous soils and deep stone less non-calcareous and calcareous clayey soils. These soil types allow free drainage."*

3.4.2. The Aquifer Designation map (Ref. 1.14) indicates the bedrock geology of the area is classified as a 'Principal' aquifer. Principal aquifers are defined by the Environment Agency as:

> *"geology that exhibit high permeability and/or provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale".*

3.4.3. The Groundwater Vulnerability Map (Ref. 1.15) is intended to:

> *"show the vulnerability of groundwater to a pollutant discharged at ground level based on the hydrological, geological, hydrogeological and soil properties" (Ref. 1.23).*

3.4.4. Groundwater vulnerability classification is a product of soil type and the underlying geology. However, the depth to groundwater is not considered. The Groundwater Vulnerability Map indicates the site is in an area defined as a Minor Aquifer. The vulnerability of this aquifer classification transitions from 'low', through 'Intermediate' to 'high' in a west to east direction.

3.4.5. The Leiston Surface Water Management Plan (Ref. 1.10) identifies that the soil type transitions in a west to east direction of:

- Loam to Clayey Loam, Chalky;
- Clay to Sandy Loam; and
- Sandy Loam.

b) Rail extension route

3.4.6. British Geological Survey (BGS) online geology viewer mapping (Ref. 1.16) show the Crag Group (marine deposits) as the dominant solid geology type found within the site. The Crag Group has variable permeability.

3.4.7. The BGS map records superficial geology for the site as the Lowestoft Formation, formed of both glacial till and a mixture of sand and gravel (Ref. 1.16).

3.4.8. The Aquifer Designation map classifies the superficial geology as a 'Secondary undifferentiated' aquifer. Secondary undifferentiated aquifers are defined in cases where it has not been possible to attribute either category A or B to a rock type.

c) Saxmundham to Leiston branch line improvements

3.4.9. The BGS online geology viewer mapping (Ref. 1.16) show the Crag Group (marine deposits) as the dominant solid geology type found within the site. The Crag Group has variable permeability.

3.4.10. The BGS map records superficial geology for much of the site as the Lowestoft Formation. There is a small section of Alluvium deposit associated with the Hundred Stream (**Figure 6**). As the Saxmundham to Leiston branch line enters the town of Leiston there are also areas of sand and gravel from the Lowestoft Formation.

3.4.11. The Aquifer Designation map classifies the superficial geology as predominantly 'Secondary undifferentiated', with small sections of 'Secondary A' in Leiston. Secondary A aquifers are permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers; whereas secondary undifferentiated aquifers are defined in cases where it has not been possible to attribute either category A or B to a rock type.

3.5 Hydrology

a) Rail extension route

3.5.1. The site is entirely located in the Leiston Beck catchment (Ref. 1.17).

3.5.2. The Environment Agency 'Main Rivers' are typically larger rivers and streams which they maintain and improve. The Environment Agency also has the power to improve and construct work on main rivers to manage flood risk.

3.5.3. Ordinary watercourses are the remaining watercourses that are not classified as Main Rivers. Lead local flood authorities, local authorities and internal

drainage boards have powers to carry out flood risk management work on ordinary watercourses within their geographical areas.

3.5.4. The site does not intersect any Main Rivers. There are two Environment Agency Main Rivers within 1km of the site. The Leiston Beck and Hundred River are located approximately 500m to the east and 800m to the west of the site respectively (**Figure 2**).

3.5.5. **Figure 3** shows areas at risk of surface water flooding, which is used to identify ordinary watercourses and ponds in the vicinity of, or within the site.

3.5.6. An ordinary watercourse is identified to the east of the B1122 (Abbey Road). This watercourse flows east into the Leiston Drain (**Figure 3**).

3.5.7. The ordinary watercourses were identified using Ordnance Survey (OS) 2017 mapping. There is potential for further unidentified local drainage ditches to cross the rail extension route.

3.5.8. A licensed groundwater abstraction point is located approximately 600m to the east of the site and another 264m to the south-west of the site, according to the Environment Agency's East Anglia Water Resources Licence Trading map (Ref. 1.18).

3.5.9. The site lies within 'zone three' of the source protection zones, identified as a 'total catchment'. The 'total catchment' zone is defined as the total area needed to support the abstraction or discharge from the protected groundwater source (Ref. 1.19).

b) Saxmundham to Leiston branch line improvements

3.5.10. The Saxmundham to Leiston branch line crosses three watercourse catchments. From west to east these are; the River Fromus catchment, the Hundred River catchment and the Leiston Beck catchment (Ref. 1.17).

3.5.11. The Hundred River runs from the north to the south and crosses beneath the Saxmundham to Leiston branch line through a culvert approximately 500m west of the Saxmundham level crossing.

3.5.12. A tributary of the Hundred River also flows from the west of the Main River. The tributary is also classified as a main river and runs from north of the track before joining the Hundred approximately 1km to the southeast (**Figure 6**).

3.5.13. For both the Hundred River and its tributary, the proposed development will not change the existing crossing and therefore will not affect flood risk.

3.5.14. There is one groundwater abstraction point within 1km of the site (Ref. 1.18). The abstraction point is located 180m north of the Saxmundham to Leiston

branch line, immediately west of Summerhill School in Leiston. There are no surface water extraction points within 1km of the site.

3.5.15. The site lies within 'zone three' of the source protection zones, identified as a 'total catchment'. The 'total catchment' zone is defined as the total area needed to support the abstraction or discharge from the protected groundwater source (Ref. 1.19).

4 Flood risk appraisal

4.1 Historical flooding

4.1.1. The SFRA historic flood record maps provide location points for recorded historic flood events from fluvial, tidal, sewer, groundwater, highway drainage and surface water sources (Ref. 1.13).

a) Rail extension route

4.1.2. These maps do not identify any historic flooding as having occurred within the proposed development boundary.

4.1.3. An absence of record does not necessarily confirm that no flooding has occurred.

b) Saxmundham to Leiston branch line improvements

4.1.4. There are two historic records of flooding near to the Saxmundham to Leiston branch line although none are recorded along the line itself.

4.1.5. The first is from foul or surface sewer flooding immediately south of the rail bridge at the junction between Saxmundham Road and Abbey Lane.

4.1.6. The second instance is on Valley Road, towards the eastern end of the Saxmundham to Leiston branch line and is thought to be derived from a combination of foul or surface sewer, highway drainage and surface water flooding.

4.2 Tidal / coastal flood risk

a) Rail extension route

4.2.1. The flood map for planning (Ref. 1.20) shows the site is in Flood Zone 1 - low risk of flooding (**Figure 2**). Flood Zone 1 is defined by the Environment Agency as *"land having less than 1 in 1,000 annual probability of river or sea flooding."*

4.2.2. The risk of flooding from tidal or coastal sources to the rail extension route is considered to be low.

b) Saxmundham to Leiston branch line improvements

4.2.3. The flood map for planning (Ref.1.20) shows the site is almost entirely in Flood Zone 1 (**Figure 2**). There is a small section of the site in Flood Zones 2 and 3, associated with the Hundred River (**Figure 2**). This is not tidally influenced.

4.2.4. The risk of flooding from tidal or coastal sources to the Saxmundham to Leiston branch line improvements is considered to be low.

4.3 Fluvial flood risk

a) Rail extension route

4.3.1. The flood map for planning confirms the site is in Flood Zone 1 - low risk of flooding (**Figure 2**). Flood Zone 1 is defined by the Environment Agency as *"land having less than 1 in 1,000 annual probability of river or sea flooding."*

4.3.2. The risk of flooding from fluvial sources to the rail extension route is considered to be low.

b) Saxmundham to Leiston branch line improvements

4.3.3. The flood map for planning (Ref. 1.20) shows the site is almost entirely located in Flood Zone 1 (**Figure 6**). Flood Zone 1 is defined by the Environment Agency as *"land having less than 1 in 1,000 annual probability of river or sea flooding."*

4.3.4. The Hundred River runs under the track via a culvert approximately 600m west of the Saxmundham level crossing. At this location, the site crosses the Flood Zone 2 and 3 boundaries (**Figure 6**). Review of the LiDAR data in this location shows that the edge of the Flood Zone 2 extent is situated at approximately 15.3m AoD, 2.2m lower than the railway that sits at approximately 17.5m AoD. Therefore, it is suggested that the railway is located outside of the flood extent and is at low risk of fluvial flooding.

4.3.5. A tributary of the Hundred River runs beneath the Saxmundham to Leiston branch line via a culvert, approximately 500m to the west of the Westhouse Level Crossing (**Figure 6**). However, there are no modelled Flood Zone 2 or 3 extents for this tributary. Therefore, the Environment Agency risk of surface water flooding dataset has been used as a proxy of flood extent at this location.

4.3.6. Review of the LiDAR shows that the railway is situated at an elevation of 21m AoD. The edge of the 1 in 30-year risk of surface water flooding or 'high' risk extent is situated at approximately 20m AoD. However, the edge of the 1 in 1000-year, or 'low' risk of surface water flooding extent is situated 21m AoD.

4.3.7. Downstream of the culvert, the edge of the 'high' and 'low' risk of surface water flooding levels are 19.4m AoD and 19.8m AoD respectively. Given this difference between the extents either side of the culvert, it is likely that the methodology used in the Environment Agency risk of surface water flooding dataset, which is unlikely to have accounted for the culvert in this location, is leading to artificially higher water levels upstream of the culvert. Given the conservative approach to surface water modelling and the higher topographic levels of the existing rail when compared to downstream topography, the fluvial flood risk in this location is considered to be low.

4.3.8. The works associated with the culverts relate to minor strengthening and do not affect the conveyance of the existing structure. The risk of flooding from fluvial sources to the Saxmundham to Leiston branch line improvements is considered to be mostly low with a small area of medium to high risk which will not be affected by the proposed development.

4.4 Surface water (pluvial) flood risk

a) Rail extension route

4.4.1. **Figure 3** provides the Environment Agency 'long term flood risk map' dataset (Ref. 1.11), which highlights the risk of surface water flooding to the site.

4.4.2. The majority of the site is at 'very low' risk of surface water flooding. In the field south of Buckleswood Road, several small isolated areas of 'low' to 'high' surface water flood risk are identified. Analysis of topographic data indicates these isolated areas are associated with topographical low points, while the regular lines represent ridge and furrows associated with ploughing of the agricultural land. Along Buckleswood Road, there are areas of 'low' to 'high' surface water flood risk, these areas are related to a ditch that run parallel to the existing road, which according to LiDAR data, is situated approximately 1m lower than the road.

4.4.3. The long term flood risk map for surface water (Ref. 1.11) indicates a potential surface water flow route towards the north of the rail extension route, running through the site along a field boundary from west to east. The OS mapping shows identifies that a field drain is located along this boundary. The masterplan for the rail extension route as in **Figure 2.1**, **Volume 9**, **Chapter 2** of the **ES** proposes that the public right of way footpath will be diverted east, via the B1122 (Abbey Road). In doing so, the footpath will follow a path similar to that of the surface water flood risk flow route and field

drain. Along this path, there is predominantly a 'low' risk of surface water flooding, interspersed with localised areas of 'medium' and 'high' risk. According to LiDAR data, the field drain is situated at approximately 10m AoD, whereas the adjacent land where the footpath is proposed is situated at approximately 11.5m AoD. There is potential to make minor adjustments during the detailed design to ensure the alignment of the footpath is outside of the areas of 'medium' and 'high' surface water flood risk.

4.4.4. The surface water flood risk identified above increases in severity from 'low' to 'high' as the field drain nears the B1122 (Abbey Road). Review of the LiDAR data identifies that the extent of 'high' risk is isolated to an area of lower topography to the west of the road, with the lowest levels within and adjacent to the ditch that runs parallel to the B1122, of approximately 6.6m AoD. The road is situated at 9.1m AoD, 2.5m above the bed levels identified within the ditch. Further review of the risk of surface water flooding dataset shows that the boundary of the 'low' risk in this location is 8.6m AoD, 500mm lower than the road level. This surface water flow route runs in a southerly direction to the west of the B1122 for approximately 125m (from the edge of the field boundary), where it is culverted beneath the road and drains east, connecting to an ordinary watercourse (**Figure 3**). It is likely that this culvert will not have been accounted for in the Environment Agency risk of surface water flooding dataset due to the modelling methodology, leading to artificially higher water levels upstream of the culvert. Given the conservative approach to surface water modelling and the higher topographic levels of the B1122, the surface water flood risk along the eastern boundary of the rail extension route is considered to be 'low'.

4.4.5. Review of the surface water flood risk dataset has identified three locations where the rail extension route will have to cross over ditches. Firstly, as the rail crosses Buckleswood Road. Secondly as the rail route runs over a field drain, located to the north of the narrow section of the site boundary. The third ditch is located just before the rail crosses the B1122 (Abbey Road). Where the proposed track crosses these areas of surface water flood risk, it is proposed that the drainage design will incorporate a channel opening at least similar to downstream openings to ensure the flow route remains operational. Any culverts will be sized appropriately to the agreement of SSC.

b) Saxmundham to Leiston branch line improvements

4.4.6. **Figure 7** indicates the majority of the site is at 'very low' risk of surface water flooding.

4.4.7. Isolated sections of the Saxmundham to Leiston branch line have varied levels of surface water flood risk, ranging from 'low' to 'high'.

4.4.8. The north-west tributary of the Hundred River has an area of high surface water flood risk. This watercourse is culverted beneath the Saxmundham to Leiston branch line between the Westhouse and Knodishall level crossings. The proposed rail improvement works associated with this DCO will not change the existing crossing and therefore will not affect the conveyance of the culvert and therefore flood risk.

4.4.9. Further locations of low to high surface water flood risk are predominantly found at the level crossings. The Saxmundham, Leiston and Sizewell level crossings have the most notable with occurrences of 'low', 'medium' and 'high' surface water flood risk.

4.4.10. The risk of surface water flooding to the majority of the Saxmundham to Leiston branch line site is considered to be low, with a few localised areas at medium to high risk. The proposed works will not change this risk.

4.5 Groundwater flood risk

a) Rail extension route

4.5.1. The BGS Susceptibility to Groundwater Flooding map from the SFRA (Ref. 1.13) identifies there is limited potential for groundwater flooding to occur.

4.5.2. Historic borehole logs available through the BGS (Ref 1.16) identified the closest borehole to the site was located approximately 900m to the southeast of the site on High Street, Leiston. This borehole states *"water bearing strata 51'-0"* [15.54m] *from ground level".*

4.5.3. Suffolk County Council's Preliminary Flood Risk Assessment (Ref. 1.21) indicates that:

> *"there is no consistent local information available which provides evidence of possible future groundwater flood risk in Suffolk"*.

4.5.4. The SFRA has no records of any groundwater incidents in the area.

4.5.5. The risk of groundwater flooding to the rail extension route is considered as low.

b) Saxmundham to Leiston branch line improvements

4.5.6. According to the Geology of Britain viewer and the SFRA, the main soil types in the area are significantly permeable. Permeable soils have the potential to present groundwater flooding problems in areas with high water table.

4.5.7. The BGS susceptibility to groundwater flooding map from the SFRA identifies for all of the site there is "*Limited potential for groundwater flooding to occur*".

4.5.8. The Suffolk County Council Preliminary Flood Risk Assessment indicates that *"there is no consistent local information available which provides evidence of possible future groundwater flood risk in Suffolk"* (Ref. 1.21). The SFRA has no records of any groundwater incident in the area.

4.5.9. The risk of groundwater flooding to the Saxmundham to Leiston branch line improvements site is considered to be low.

4.6 Sewer flood risk

a) Rail extension route

4.6.1. The site is largely greenfield in nature with two existing roads (Buckleswood Road, and B1122 (Abbey Road)) crossing the site. Currently, sewers have not been identified on the site.

4.6.2. The Suffolk Coastal and Waveney District Councils Level 1 SFRA does not identify any flooding to have occurred on site from foul or surface water sewers. The SFRA also does not identify any flooding from highway drainage to have occurred on either Buckleswood Road or B1122 (Abbey Road).

4.6.3. The risk of flooding from sewers on the rail extension route is considered to be low.

b) Saxmundham to Leiston branch line improvements

4.6.4. The site currently exists as railway with associated infrastructure. The rural location indicates there is a low likelihood of sewers on site nearby. There is no identified existing risk of internal flooding from sewers.

4.6.5. The risk of sewer flooding to the Saxmundham to Leiston branch line improvements site is considered to be low.

4.7 Flood risk from reservoirs and other artificial sources

4.7.1. Flooding from reservoirs is defined as an uncontrolled release of water from large raised reservoirs with greater than 25,000m^3 able to escape.

4.7.2. The Flood Risk from Reservoirs map (Ref. 1.22) indicates the proposed development is not at risk of reservoir flooding.

4.7.3. No other artificial sources of flood risk have been identified in the area.

4.8 Summary of potential flood mechanisms

4.8.1. A summary of flood risk to the proposed development is provided in **Table 4.1**.

Table 4.1: Summary of flood risk to the rail extension route and Saxmundham to Leiston branch line

Source of flooding	Flood risk	Description
Rail extension route		
Tidal / Coastal	Low	*Flood Zone 1 - Low:* less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%)
Fluvial	Low: majority of the site	*Flood Zone 1 - Low*: less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%)
Surface Water	Very Low: majority of the site	Less than 1 in 1,000 annual probability of surface water flooding in any year (<0.1%)
	Low/ Medium: isolated areas south of Buckleswood Road	Low: land with between 1 in 1,000 and 1 in 100 annual probability of surface water flooding (0.1% - 1%) Medium: Land with between 1 in 100 and 1 in 30 annual probability of surface water flooding (1% - 3.3%)
	High: flow route along field boundary towards the B1122 (Abbey Road)	Greater than 1 in 30 annual probability of surface water flooding in any year (>3.3%).
Groundwater	Low	Local borehole data suggests water below 15m beneath ground level. SFRA Groundwater Flooding map: *limited potential for groundwater flooding to occur*.
Sewer	Low	*Low*: site is mostly greenfield in nature with an existing road, no known sewers on site.
Reservoirs and other artificial sources	Low	Not at risk of flooding from reservoirs. No other artificial sources of flooding identified.
Saxmundham to Leiston Branch Line Improvements		
Tidal / Coastal	Low	*Flood Zone 1 - Low:* less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%)
Fluvial	Low: majority of the site	*Flood Zone 1 - Low*: less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%)
	High: where the Hundred River is culverted beneath the Saxmundham to Leiston branch line	*Flood Zone 3 – High:* equal to or greater than 1 in 100 annual probability of river flooding (≥1%)

Source of flooding	Flood risk	Description
Surface Water	Very Low: majority of the site	Less than 1 in 1,000 annual probability of surface water flooding in any year (<0.1%)
	Low / Medium: Leiston and Sizewell level crossings.	Low: land with between 1 in 1,000 and 1 in 100 annual probability of surface water flooding (0.1% - 1%) Medium: land with between 1 in 100 and 1 in 30 annual probability of surface water flooding (1% - 3.3%)
	High: north-west tributary of the Hundred River; Saxmundham level crossing.	Greater than 1 in 30 annual probability of surface water flooding in any year (>3.3%).
Groundwater	Low	SFRA groundwater vulnerability map suggests limited probably for groundwater flooding to occur.
Sewers	Low	Existing rail track, no sewers on site.
Reservoirs and other artificial sources	Low	Not at risk of flooding from reservoirs. No other artificial sources of flooding identified.

5 Flood risk management

5.1 The Sequential and Exception Tests – application of flood risk vulnerability and flood zone compatibility

a) Rail extension route

5.1.1. The rail extension route will remain in place and be operational for the duration of the construction of the Sizewell C Project (expected to be between 9–12 years in total) and will be removed upon completion of construction.

5.1.2. In terms of flood risk and vulnerability, the rail extension route is classified as 'Essential Infrastructure' in accordance with the definitions given in **Table 2.2**. The site is located wholly in Flood Zone 1 (defined in **Table 2.1**).

5.1.3. Given this, the rail extension route is considered to be appropriate for this flood zone in accordance with the flood risk vulnerability and flood zone compatibility table (**Table 2.3**) and passes the Sequential Test.

b) Saxmundham to Leiston branch line improvements

5.1.4. In terms of flood risk and vulnerability, the Saxmundham to Leiston branch line is classified as 'Essential Infrastructure' in accordance with the definitions given in **Table 2.2**.

5.1.5. The majority of the site is in Flood Zone 1. However, one small section (**Figure 6**) is within Flood Zone 2 and 3 extents (**Table 2.1**). As defined in the flood zone compatibility table (**Table 2.3**), the Saxmundham to Leiston branch line upgrades must demonstrate it meets the requirements of the Exception Test.

5.1.6. Of the approximately 7,400m total length of the Saxmundham to Leiston branch line, 72m, or less than 1% is within the Flood Zone 2 and 3 extent, associated with the Hundred River.

5.1.7. The Saxmundham to Leiston branch line is an existing section of railway that would undergo improvement works. The OS terrain 50 data shows the railway sits at approximately 18m AoD, while the Hundred River's floodplain is situated approximately 3m lower at 15m AoD where the culvert runs under the track.

5.1.8. Relocation of the railway and associated infrastructure to avoid this relatively small area of flood risk would cause a substantially larger impact, both environmentally and social-economically to the local area it serves.

5.1.9. The adoption of the **integrated transport strategy** to transport construction materials has the added community benefit by reducing HGV road traffic to the local area. To facilitate this **integrated transport strategy**, the Saxmundham to Leiston branch line upgrades are a necessary requirement. Due to the nature of the works proposed along the Saxmundham to Leiston branch line within this DCO application, there will be no changes to the existing watercourse crossings and therefore flood risk will not be affected.

5.1.10. Regular maintenance will be scheduled to the existing culvert, so it remains clear of debris and fully operational to prevent change in flood risk elsewhere.

5.1.11. As the Saxmundham to Leiston branch line is to enable the national critical infrastructure, it is considered to demonstrate wider community sustainability benefits. The improvement works do not increase the existing flood risk. It is considered that the Saxmundham to Leiston branch line upgrades pass the Exception Test.

5.2 Application of climate change

5.2.1. Given the potential sources of flooding, the actual flood risk posed to the site is derived from surface water sources. Therefore, the climate change allowance to be applied relates to an increase in the intensity of rainfall events likely to affect surface water.

5.2.2. The NPPF requires that the development remains safe through the development's lifetime. The site is not within a critical drainage area. In

accordance with the guidance climate change allowances (Ref. 1.5) have been considered within the development of the Outline Drainage Strategy at Appendix 2A, Volume 2 of the Environmental Statement (**Book 6**), to account for the range of impact both on and off site for the 2010 – 2039 and 2060 – 2115 epochs for the rail extension route and Saxmundham to Leiston branch line improvements respectively.

5.2.3. The Flood Zones shown on the Environment Agency's flood map for planning (Rivers and Sea) (Ref. 1.20) do not take account of the possible impacts of climate change and consequent changes in the future probability of fluvial flooding. This also applies to the flood extents of the flood map for surface water.

5.2.4. The rail extension route is in Flood Zone 1 with the nearest Flood Zone 2 and 3 approximately 350m away. Minimum topographic levels within the site are approximately 7.2m AoD. The topographic level of the flood extent (Flood Zone 2 and 3) nearest to the site is approximately 5.1m AoD.

5.2.5. Due to the geographical and elevation distances between the modelled flood extents and the site, the risk of fluvial or tidal flooding to the site is considered to be low now and when taking into account climate change.

5.3 Impacts of flood risk on the development and the development on flood risk

a) Rail extension route

5.3.1. As set out above, the site is entirely located in Flood Zone 1 and at low risk of fluvial flooding.

5.3.2. The existing site is currently 'greenfield', with no impermeable surfaces and small localised areas of surface water flood risk and associated flow routes. The proposed development is understood to remain permeable, although associated earthworks may alter the surface water flow routes.

5.3.3. The current high-level proposed site layout, as in **Volume 9, Chapter 2 Figure 2.1** of the **ES**, used to inform this FRA indicates the track crosses three areas at risk of flooding from surface water (**Figure 4**). One of these locations is on Buckleswood Road.

5.3.4. The second area of potential surface water flood risk is an identified flow route that runs west to east across the proposed track. The third area of surface water flood risk is located just before the rail crosses the B1122. Where the track crosses these surface water flow paths, it is proposed that the drainage design would incorporate a channel opening at least similar to

downstream openings to ensure the flow route remains operational and to the agreement of SCC.

5.3.5. SuDS would be implemented for the operation of the proposed rail extension route, specifically the inclusion of swales alongside the track with the potential for a larger infiltration pond at low points or adjacent to the cuttings, if required. Whilst the rail extension route is located within Flood Zone 1, it is anticipated that drainage would be required along the rail extension route that will collect and hold runoff on a temporary basis allowing infiltration to ground over time. This would ensure track stability and durability throughout operation and also to ensure that there would be no flooding which could prevent operation. The drainage design will incorporate any local surface water issues.

5.3.6. Where the rail extension route is in cutting, the drainage infrastructure would be designed to collect runoff from the both sides of the track and the cutting. Swales are proposed to the north of the route (between the landscape bund and the track), up to 1m wide and located 200mm below the base of the sub-ballast. Runoff which does not infiltrate will pass though the sub-ballast to the swales. If the infiltration rate is low, then the width of the swales could be increased to up to 3m.

5.3.7. Where the rail extension route is at grade or on embankment, the drainage infrastructure would be designed to collect runoff from the track and any overland flow which is interrupted by the embankment or track. Swales would be provided on the north side of the track (between the landscape bund and the track), with side slopes at a gradient of 1 in 3 and a width of 1m at base. The base of the swales will be 200mm below the base of the sub-ballast if the track is on the level or at the toe of the embankment. If the infiltration rate is low, then the width of the swales can be increased to up to 3m.

5.3.8. There is also the potential for a larger infiltration basin at the eastern end of the site, between the landscape bund and the southern boundary to provide for additional temporary storage if required.

5.3.9. The gradient of the swales will match that of the rail extension route so that ultimately run-off which does not infiltrate within the cutting will filter along the swales until the end of the cutting is reached.

5.3.10. If the ground on which the rail extension route is laid is found to be highly permeable following infiltration testing, drainage infrastructure may not be required. The proposal therefore enables a resilient drainage strategy irrespective of the outcome of the infiltration tests.

5.3.11. Once the operation of the rail extension route has ceased, the site would be returned to its pre-development, agricultural use. The removal of the development would include the removal of any related drainage and SuDS measures, which would have no adverse impact on flood risk to the site.

b) Saxmundham to Leiston branch line improvements

5.3.12. The existing site is already developed as a railway with existing permeable surfaces and integrated drainage systems. Therefore, the proposed rail improvements would not likely increase the impermeable areas on the site.

5.3.13. The site is predominantly located in Flood Zone 1 and at low risk of fluvial flooding, with one 72m section within Flood Zone 2 and 3 extents.

5.3.14. The Saxmundham to Leiston branch line proposed works will not change the existing watercourse crossings for works associated with this DCO application and therefore will not affect flood risk.

5.4 Applicability of Sustainable Drainage Systems

5.4.1. In accordance with National Planning Practice Guidance for Flood Risk and Coastal Change (Ref. 1.2), the sustainable drainage hierarchy has been applied to the proposed development and comments on the suitability of options are provided in **Table 5.1**.

Table 5.1: Application of sustainable drainage hierarchy

Option	Comment	Viability
Into the ground (infiltration)	An initial review of geological conditions on site indicates that a limited amount of infiltration is likely to be possible as a form of surface water disposal. Infiltration testing will be carried out. The **drainage strategy** includes flexibility in design and sizing to accommodate the permeability of the soil.	Some potential
To a surface water body	The local land drainage network runs in an easterly direction, joining the Leiston Beck Main River approximately 350m east of the site boundary.	Potential
To a surface water sewer, highway drain, or another drainage system	There appears to be a land drain on western side of B1122 (Abbey Road). Highway drainage infrastructure is noticeable. Assumed that the highway drainage discharges to the land drain although this has not been confirmed.	Some potential
To a combined sewer	Sewer records have not been obtained at present. To discharge to a combined sewer is the lowest on the SuDS hierarchy. Other more suitable opportunities are to be pursued prior to investigating combined sewers.	No potential

5.5 Access

5.5.1. Due to the culvert that runs beneath the Saxmundham to Leiston branch line, it is recommended for the site management to subscribe to regional flood warnings from the Meteorological Office to inform safe access and egress for workers during high intensity rainfall in line with the **Code of Construction Practice (CoCP)** (Doc Ref. 8.11). This will be managed in conjunction with the flood risk emergency plan to be developed for the Sizewell C Project.

a) Rail extension route

5.5.2. During construction, the site would be accessed directly off the B1122 (Abbey Road) and Buckleswood Road. Throughout construction and operation, there would be no pedestrian access to the rail extension route.

b) Saxmundham to Leiston branch line improvements

5.5.3. During construction, the site would be accessed directly via the level crossings along the route. Throughout construction and operation, there would be no pedestrian access to the railway.

6 Residual risk

6.1.1. In any development there is always a potential for there to be a residual flood risk to people and property due to:

- the failure of systems and defences;
- more extreme events than those defined in the NPPF; or
- uncertainties associated with modelled water levels.

6.1.2. Residual risk may remain after flood risk management or mitigation measures have been installed. Therefore, an FRA should consider the residual flood risk and the need for any further measures to ensure the residual risk is managed appropriately.

6.1.3. Climate change is a potential residual risk for the site. The flood zones shown on the Environment Agency's flood map for planning do not take account of the possible impacts of climate change and consequent changes in the future probability of fluvial flooding. This also applies to the flood extents of the flood map for surface water.

6.1.4. A flood risk emergency plan would be in place for the construction and operation of the bypass. The flood risk emergency plan would be developed in accordance with NPPF and Environment Agency guidance.

6.1.5. Monitoring of the weather would be in place to monitor storm conditions. This would probably involve the registration of appropriate staff to the Environment Agency flood warnings and Met Office weather warnings to manage the potential impacts of flooding. This could lead to, if necessary, the halting of construction.

6.1.6. Sustainable drainage and existing land drainage structures require regular maintenance to ensure continuing operation to design performance standards. Poor maintenance could result in increased risk of flooding from surface water. The sustainable drainage features would require regular maintenance to prevent blockage.

6.1.7. Maintenance plans or schedules would be developed during the detailed design phase and implemented during the construction and operational phases of the development to ensure the continued efficacy of the surface water drainage system. Typical maintenance of dry swales includes mowing and occasional sediment removal, unless additional sediment trap measures are put in place.

7 Summary and conclusions

7.1.1. This report has considered all sources of flood risk to both the rail extension route and the Saxmundham to Leiston branch line aspects of the proposed development.

7.1.2. **Table 4.1** summarises the flood risk from tidal, groundwater, sewers and reservoirs as low.

7.1.3. The rail extension route is at low fluvial flood risk. The Saxmundham to Leiston branch line has a short section that crosses Flood Zone 2 and 3. However, the risk of fluvial flooding here is low, due to the existing culvert enabling flow conveyance under the railway line and the higher topographic levels of the railway line compared to the surrounding ground levels.

7.1.4. Flood risk from surface water is variable across the site. The majority of the site is at 'very low' risk of flooding from surface water. Isolated areas of 'high' risk have been avoided in terms of vulnerable uses or integrated into the drainage system.

7.1.5. The proposed development will have no adverse impact on flood risk. The Saxmundham to Leiston branch line will not change the existing impermeable area. The rail extension route has been designed using SuDS principles to collect run-off in swales which would then infiltrate to ground.

7.1.6. As a result of locating areas where works are proposed entirely in Flood Zone 1, there would be no loss in functional floodplain storage or displacement of sea or river flood water as a result of the proposed development.

7.1.7. The proposed development is classed as being 'Essential Infrastructure' under the NPPF. As per **Table 2.3**, the rail extension route is considered appropriate in terms of flood risk vulnerability and, therefore, passes the Sequential Test. The Saxmundham to Leiston branch line improvements pass the Exception Test due to the wider sustainability benefit it brings as part of the wider Sizewell C national critical infrastructure provision and the proposed works having no effect on the existing watercourse crossings and hence flood risk.

7.1.8. The proposed development is considered to be appropriate in terms of flood risk based on the information presented, the proposed mitigation measures and in accordance with NPPF guidance.

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