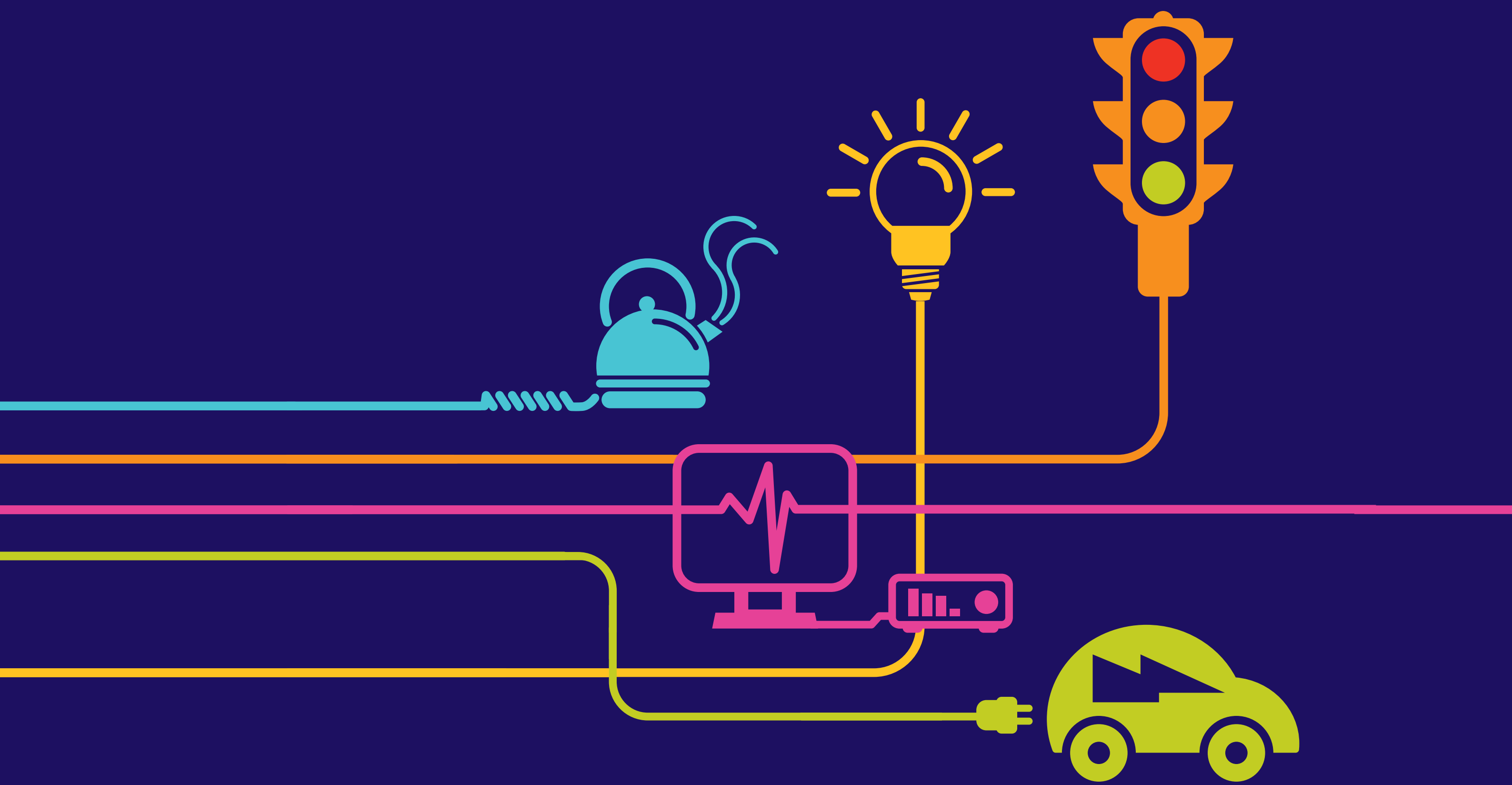
Document 5.23.5.1A

nationalgrid

Environmental Statement
Flood Risk Assessment
Hinkley Point C Connection Route

Hinkley Point C Connection Project

Regulation 5(2)(e) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009



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EXECUTIVE SUMMARY

EX1.1 This Flood Risk Assessment (FRA) accompanies National Grid Electricity Transmission Limited's (National Grid) application for development consent to construct, operate and maintain a new 400,000 volt (400kV) connection between Bridgwater, Somerset and Seabank Substation, north of Avonmouth ("the Proposed Development").

EX1.2 The Proposed Development comprises construction of overhead lines and underground cables as well as the removal of existing transmission lines. This FRA covers the overhead lines and underground cables only. Separate FRAs have been prepared for the Bridgwater Tee cable sealing end (CSE) compounds, the South of Mendip Hills CSE compound, Sandford Substation and Seabank Substation.

EX1.3 This FRA complies with the requirements set out in National Policy Statements published by the Department for Energy and Climate Change (July 2011), specifically Overarching Energy Policy (EN-1) and Electricity Networks Infrastructure Policy (EN-5). It also complies with the Planning Practice Guidance (PPG) on Flood Risk and Coastal Change which came into effect in March 2014 and the National Planning Policy Framework (March 2012) (NPPF) to which this PPG refers.

EX1.4 The NPPF sets out a Sequential Test, which states that preference should be given to development located within Flood Zone 1. If there is no reasonably available site in Flood Zone 1, then built development can be located in Flood Zone 2. If there is no reasonably available site in Flood Zone 1 or 2, then nationally significant energy infrastructure projects such as the Hinkley Point C Connection project - classified as "Essential Infrastructure" - can be located in Flood Zone 3 subject to passing a series of tests known as the Exception Test.

EX1.5 **Volume 5.2.1** describes the alternatives considered for the Proposed Development, including options for the route and method of connection (overhead line or underground cable). This demonstrates compliance with the principle of the Sequential Approach. The Sequential and Exception Tests are applied within the constraints of the preferred route and connection option. The Sequential Test report is included in **Volume 5.23.5.2, Appendix A** and demonstrates that the least vulnerable route has been selected from the reasonably practical routes available.

EX1.6 For the overhead lines and underground cables which form part of the Proposed Development, it is demonstrated that the requirements of both the Sequential Test and the Exception Test have been met.

EX1.7 With regard to the Exception Test it has been demonstrated that:

- the proposed route would provide wider sustainability benefits to the community that outweigh the flood risk, which has been assessed in the context of the Local Planning Authorities' Strategic Flood Risk Assessments; and
- the works related to the overhead line and underground cable route would be safe for their lifetime taking account of the vulnerability of their users, and would not increase flood risk elsewhere during the operational phase of the works.

EX1.8 The assessment of the flood hazard and risk has been undertaken for both the construction phase and the operational phase. The potential sources of flooding along the proposed route include fluvial, tidal, surface water, groundwater, water services, and reservoirs and other artificial sources.

EX1.9 Following the application to National Grid from EdF energy for a modification to its connection date, to be two years later than described in the DCO submission, a revised construction programme has been prepared. In light of this, a review of the submitted Environmental Statement (ES) and Supporting Documents has been undertaken and is presented in the ES Sensitivity Test (**Voume 5.29.1**) and Supporting Documents Sensitivity Test (**Volume 5.29.2**).

EX1.10 The Flood Risk Assessment (FRA) Sensitivity Test **(Volume 5.29.2.3)** considers the implications of a construction programme lasting up to seven years instead of the five year programme originally considered within this Volume. The findings of the flood risk assessment, described in this volume, remain valid for the proposed seven year construction programme and the associated mitigation measures are equally applicable. References to the construction programme in this document have therefore been updated to include both five and seven year construction programmes.

EX1.11 An assessment of the flood hazards during construction and operation has concluded that:

- The primary flood hazards to which both the Proposed Development and the construction phase works are exposed is fluvial and tidal flooding.
- The exposure to the fluvial and tidal flood hazards, and therefore the likelihood of an event occurring, is lower for the construction phase than for the operational phase due to the different timeframes for each phase: five years for construction (seven years in the FRA Sensitivity Test, **Volume 5.29.2.3**); 40 years for operation.
- The severity of the impact of a flood event (from any source) on the construction phase works is significantly higher than the impact on the permanent works.
- The overall balance of risk between "higher likelihood, lower severity" events during the operational phase (on the permanent works) and "lower likelihood, higher severity" events during the construction phase (on the temporary works) is such that the overall flood risk is higher during the construction phase. This principle applies to both the impact on the construction works, and the impact resulting from the construction works on flood risk elsewhere.
- Whilst the primary exposure to flood hazard is from fluvial and tidal events, there are isolated locations within some Route Sections that are exposed to other sources of flood hazard.
- There is a need for mitigation measures to be developed with regard to various flood risks. This has a significant focus on mitigating the potential impact on flood risk elsewhere as a result of the construction works.

EX1.12 Given that the construction phase has been identified as being at greatest risk from flooding and also of having the potential to increase flood risk elsewhere, detailed specific consideration has been given to flood risk during the construction phase.

EX1.13 The severity of flood impact to the construction phase is assessed as Moderate; defined as having the potential to cause cessation of work, evacuation, risk to programme with extensive areas of land inundated. This FRA provides information on how this risk can be managed, although there remains a residual risk of flooding to the works associated with the construction phase.

EX1.14 The construction phase is assessed as having the potential to result in a High Risk of causing flooding elsewhere, in the absence of mitigation measures. Mitigation measures are therefore proposed that, when implemented, would reduce this to a Moderate Risk.

EX1.15 In most Route Sections the proposed mitigation measures will ensure that there is a low or very low impact on nearby receptors. Only in the Somerset Levels and Moors South and North (Route Sections B and D) is the residual risk Moderate. This means that there remains the possibility that the construction works in this area could increase the flood risk locally (above the existing flood risk) that may not have occurred if the flood event occurred without the presence of the temporary construction works.

EX1.16 The proposed mitigation measures provide significant mitigation, reducing the risk as far as is reasonably practicable. Whilst the risks are not completely eliminated, the residual risk is short term, lasting only for the duration of the construction programme.

EX1.17 When operational, the Proposed Development is fully resilient to inundation from all sources of flood risk. This FRA demonstrates that the Proposed Development has a High likelihood of being flooded but as the development is water compatible, the severity is low, making the overall risk Low.

EX1.18 When the Proposed Development is operational this FRA demonstrates that the Proposed Development would not increase flood risk elsewhere.

EX1.19 The impact of climate change has been assessed using the latest UKCP09 projections. This covers the anticipated operational life of the works to 2060. The overhead lines and the underground cables are resilient to flooding, and would remain so with regard to extreme events under this climate change scenario. It may be anticipated that the works may be flooded to greater depths, more frequently, or for more prolonged durations, but this would not impact on operational aspects.

EX1.20 In the event that the works are required beyond 2060, the climate change impacts would be negligible. Even under the H++ climate change scenario, there would be no detriment to the operation of Hinkley C Connection route, despite the higher likelihood of flooding occurring along the route as the works are resilient to significant flood depths for prolonged periods.

EX1.21 This report has been reissued in response to the Environment Agency's consultation response (EA Ref WX/2009/111876/14-L01) and letter dated 25 November 2014 (EA Ref WX/2014/126241/02). The Environment Agency requested amendments relate to:

- providing an estimate of the increase in flood level as a consequence of the construction phase specifically with regard to haul road construction;
- clearance height above Main Rivers; and

- clarification of stockpile volumes and their impact.

EX1.22 Minor amendments and clarifications have also been made. These are largely related to amendments to figures and some descriptions of specific elements within Tables, and inclusion of the revised construction programme of up to seven years.

1. INTRODUCTION

1.1 Background

1.1.1 In September 2007, National Grid received an application for the connection of a new nuclear power station at Hinkley Point, Somerset (Hinkley Point C Power Station) to the high voltage electricity transmission system. This connection, in combination with others in the South West and South Wales and Gloucestershire, triggered the need for new transmission capacity in the region.

1.1.2 A detailed explanation of the need for the Proposed Development is contained in National Grid document 'Need Case for the South West and South Wales and Gloucestershire Regions' (**Volume 7.5,** Ref.1.1).

1.1.3 As part of the application for development consent, a Flood Risk Assessment (FRA) is required. This should demonstrate that flood risk from all sources has been considered, and that a series of criteria are met, referred to as the Sequential Test and the Exception Test. These criteria are considered in detail within section 3 of this FRA.

1.1.4 This FRA accompanies National Grid Electricity Transmission Limited's (National Grid) application for development consent to construct, operate and maintain a new 400,000 volt (400kV) connection between Bridgwater, Somerset and Seabank Substation, north of Avonmouth ("the Proposed Development"). The main component of the Proposed Development is the construction of a new 400kV electricity connection of approximately 57km in length. The connection will comprise new overhead lines and new underground cables as well as the removal of some existing overhead lines.

1.1.5 That part of the Proposed Development that comprises an electric line above ground within section 16 of the Planning Act 2008 is a Nationally Significant Infrastructure Project (NSIP) for the purposes of that Act. Under Section 31 of the Planning Act 2008, development consent is required for development to the extent that it is or forms part of an NSIP. Development consent is granted by the making of a Development Consent Order (DCO) for which application may be made under section 37 of the Planning Act 2008.

1.1.6 In addition to these works there is other associated infrastructure that is integral to the Proposed Development comprising:

- two single circuit cable sealing end (CSE) compounds at Bridgwater Tee just north of Bridgwater;
- a double circuit CSE compound south of the Mendip Hills;
- a new substation at Sandford, North Somerset; and
- an extension and modifications to the existing Seabank 400kV Substation 3km north of Avonmouth.

1.1.7 This FRA is one of a series of five FRAs related to the Proposed Development. This FRA covers the overhead line and underground cable route (**Inset 1.1**). Separate FRAs have been prepared for:

- the Bridgwater Tee CSE compounds (**Volume 5.23.1**);

- the South of Mendip Hills CSE compound (**Volume 5.23.2**);
- Sandford Substation (**Volume 5.23.3**); and
- Seabank Substation **(Volume 5.23.4)**.

1.1.8 Within the wider context for this FRA the Sequential Test Report (**Volume 5.23.5.2, Appendix A**) sets out the Sequential Test for the preferred route as a whole, and the justification for the route selection on the basis of flood risk.

Modification to Connection Date

1.1.9 National Grid has received an application from EdF Energy for a modification to the connection date for the Hinkley Point C Power Station that seeks connection two years later than the present connection date described in the submitted DCO application.

1.1.10 As a result of the application from EdF Energy, on the 19 August 2014 a formal offer for a revised connection date was made by National Grid to EdF Energy. In a statement to PINS at the Preliminary Meeting for the Examination of the Proposed Development on 19th January 2015, both parties set out that they are "*fully agreed that this programme should form the basis for planning the Hinkley Point C Connection works*".

1.1.11 To meet the revised connection date offered, the construction programme, as presented and assessed in the submitted ES (Volume 5.3.2, Appendix 3B), has also been revised.

1.1.12 The revisions to the construction programme are not restricted to moving the start of construction to a later date than presented in the submitted ES. The duration of the construction of the various individual proposed development components has changed; the duration of some development components have increased, others have decreased.

Revised Construction Programme

1.1.13 The duration of the total Revised Construction Programme is 76 months. This is 25 months longer than the Preliminary Construction Programme detailed and assessed in the submitted ES.

1.1.14 The Proposed Development does not alter from that described in the submitted Environmental Statement (ES) as a result of the revised connection date offered; the only change is to the duration of the construction phase.

ES Sensitivity Test

1.1.15 In light of the modifications to the connection date and the Revised Construction Programme to be employed, a review of the Environmental Impact Assessment (EIA) and submitted ES and Supporting Documentation has been undertaken by National Grid.

1.1.16 The ES Sensitivity Test has been undertaken to consider where there are changes to the environmental effects described in the submitted ES as a result of the Revised Construction Programme. The sensitivity test comprises the following documents:

- ES Sensitivity Test (**Volume 5.29.1**) - provides a sensitivity test of the submitted ES; and
- Supporting Documents Sensitivity Test (**Volume 5.29.2**) – provides a sensitivity test of the submitted Supporting Documents

Flood Risk Assessment (FRA) Sensitivity Test

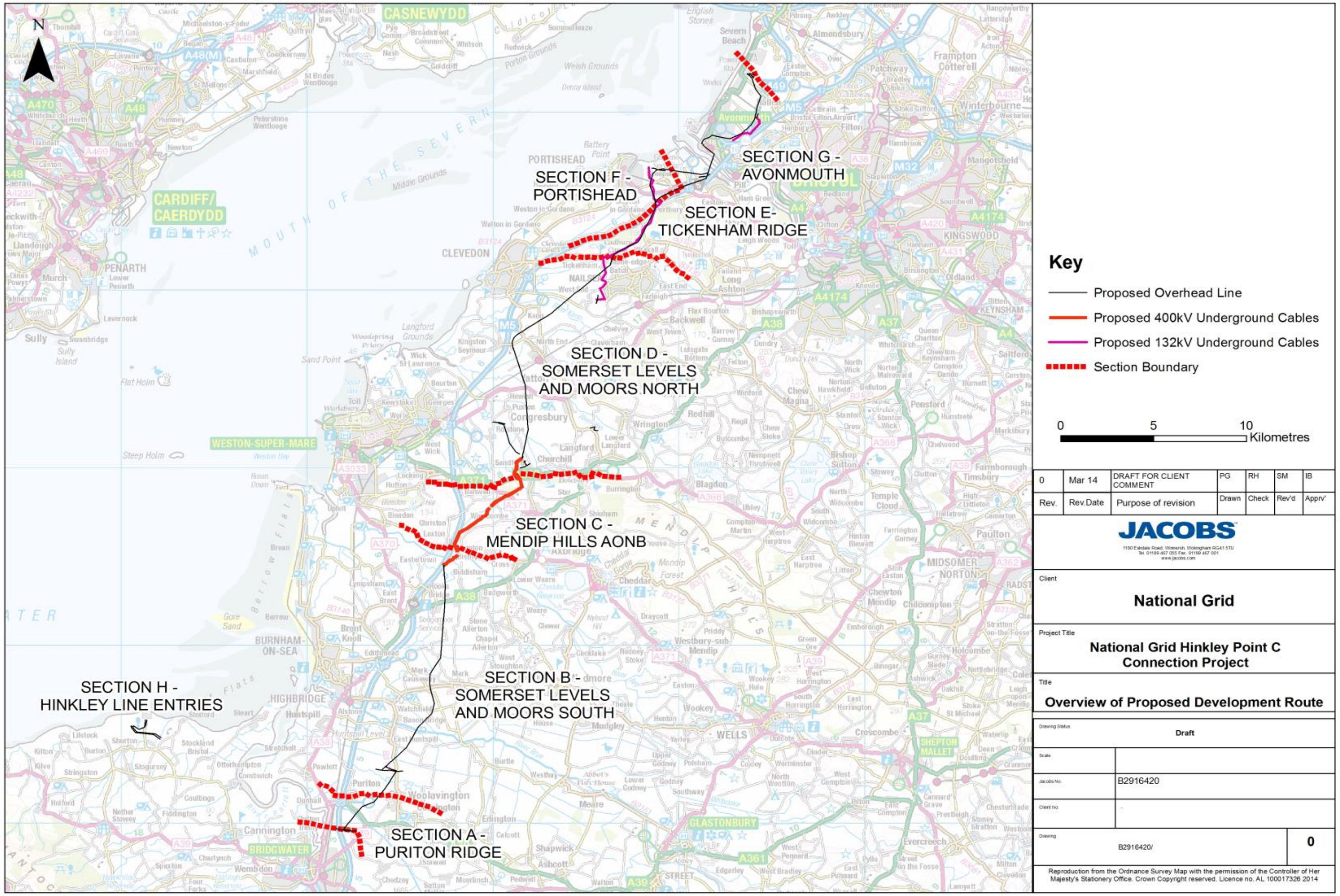
1.1.17 A Sensitivity Test has been prepared to support the Flood Risk Assessments. The FRA Sensitivity Test report is included as Volume 5.29.2.3 of the Environmental Statement.

1.1.18 The FRA Sensitivity Test considers the implications of a construction programme lasting up to seven years instead of the five year programme originally considered within this Volume. The Sensitivity Test report concluded that the conservative approach adopted in the assessment of flood risk for a five year construction programme, is still conservative when the construction programme is extended to 76 months (assessed as seven years).

1.1.19 The findings of the flood risk assessment, described in this volume, remain valid for the proposed seven year construction programme and the associated mitigation measures are equally applicable.

1.1.20 References to the construction programme in this document have been updated accordingly.

Inset 1.1: Overview of Proposed Route



1.1.21 This FRA has been prepared in accordance with the requirements set out in National Policy Statements (NPS) published by the Department for Energy and Climate Change (July 2011), specifically Overarching Energy Policy (EN-1) and Electricity Networks Infrastructure Policy (EN-5). It also complies with the Planning Practice Guidance (PPG) on Flood Risk and Coastal Change (Ref.1.2) which supplements the National Planning Policy Framework (NPPF) (Ref.1.3) and supersedes the Technical Guidance to the National Planning Policy Framework (Ref.1.4). This reference to the PPG is relevant because the PPG is a "successor" document to the guidance referred to in NPS EN-1.

1.2 Flood Risk Assessment Structure

1.2.1 The main sections within this FRA address all of the requirements identified within the NPS, as well as those requirements in the NPPF and the PPG on Flood Risk and Coastal Change, where the NPS refers to these other planning documents. **Volume 5.23.5.2, Appendix B** lists all of the requirements within EN-1 and EN-5 and how these points have been addressed within the FRA.

1.2.2 This FRA is structured as follows:

- **Section 2** provides an overview of the Proposed Development and the physical characteristics of the development area. It also covers the planning policy context specifically with regard to the FRA including the relevant National Policy Statements on energy and electricity networks, local planning documents, and the Sequential and Exception Test requirements.

- **Section 3** provides an overview of the flood hazards and of the risks for the route as a whole for both the operational phase and the construction phase. The operational phase is reported first as it lasts for the longer duration and demonstrates the long term hazards and risks of the area. This is followed by an assessment of how these hazards affect the shorter construction phase and how this changes the risks.

- **Section 4** describes the flood hazard and risks associated with all flood sources including an assessment of estimated flood levels through the operational life of the overhead lines and underground cables, anticipated to be from around 2020 to 2060. The route is assessed in eight Sections, Sections A to H in accordance with other parts of the Environmental Statement.

- **Section 5** describes the flood hazard and risks associated with all flood sources including an assessment of estimated flood levels through the construction period. The route is assessed in the same eight Route Sections, from Section A to H.

- **Section 6** considers the impact of climate change and focuses on sea level rise, increased river flows and increased rainfall intensities, covering the period to 2060. Consideration is also given to continued operation of the route beyond 2060.

- **Section 7** describes the flood risk management measures proposed related to both the flood risk posed to the works and the potential impact that the works could have on flood risk elsewhere. This section also summarises how the Sequential and Exception Tests are met.

- **Section 8** summarises the main conclusions from this FRA.
- **Section 9** lists the references for the study.

2. DEVELOPMENT DESCRIPTION AND POLICY CONTEXT

2.1 Introduction

2.1.1 This section provides details of the Proposed Development (section 2.2) and how it would be constructed (section 2.3). This is followed by a description of the landscape for each Route Section (sections 2.4 to 2.11). The key structures and the key construction aspects are described (sections 2.12 and 2.13).

2.1.2 The planning policy context for the FRA is covered with regard to:

- the requirements of the National Policy Statements (NPS) on Energy (section 2.14);
- local development documents providing the normal local context for planning applications (section 2.15); and
- the requirements of the Sequential Test and the Exception Test (sections 2.16 and 2.17).

2.2 Project Description

2.2.1 The proposed Hinkley Point C Connection project includes the following principal elements:

- construction of 57km of 400kV electricity transmission connection (see **Volume 5.3.3, Figure 3.1 and Figure 3.2**) between Bridgwater in Somerset and Seabank, near Avonmouth, comprising:
  - installation of a 400kV overhead line;
  - installation of 400kV underground cables;
- modifications to existing overhead lines at Hinkley Point, Somerset (see **Volume 5.3.3, Figure 3.1.20**);
- construction of three 400kV CSE compounds along the route of the connection (see **Volume 5.3.3, Figure 3.1.2** and **Figure 3.1.6**);
- construction of a 400/132kV substation at Sandford, North Somerset (see **Volume 5.3.3, Figure 3.1.9**);
- extension of the existing 400kV substation at Seabank (see **Volume 5.3.3, Figure 3.1.19**);;
- the removal of existing 132kV overhead lines and the construction of replacement 132kV overhead lines and 132kV underground cables (see **Volume 5.3.3, Figure 3.1**);
- extensions/modifications to existing 132kV substations at Churchill, Portishead, Avonmouth and Seabank (see **Volume 5.3.3, Figures 3.1.10, 3.1.16, 3.1.18** and **3.1.19**); and
- associated works, for example, temporary access roads, highway works, temporary construction compounds, scaffolding, work sites and ancillary works (see **Volume 5.3.3, Figure 3.1**).

Construction of 57km of 400kV Transmission Connection

2.2.2 The main component of the Hinkley Point C Connection project is the construction of a new 400kV electricity connection of approximately 57km between Bridgwater, Somerset and Seabank Substation, near Avonmouth. The connection will comprise new overhead lines and new underground cables as described below.

Installation of 400kV Overhead Line

2.2.3 The new 400kV overhead line between Bridgwater, Somerset and Seabank Substation, near Avonmouth, will comprise three parts:

1) Construction of a new 400kV overhead line of approximately 4.5km from the existing Hinkley to Bridgwater 275kV overhead line on Horsey Level (which would be uprated to 400kV operation) to the existing Hinkley to Melksham 400kV overhead line north of Woolavington.
2) Construction of a new 400kV overhead line of approximately 12.75km from the existing Hinkley to Melksham 400kV overhead line north of Woolavington to a proposed CSE compound south of the Mendip Hills and the River Axe.
3) Construction of a 400kV overhead line from the proposed Sandford Substation to Seabank Substation. In the Portishead/Portbury area two options are included within the Development Consent Order (DCO) application: National Grid's preferred route (Route Option A); and an alternative route (Route Option B). The total route length is approximately 29.8km for Route Option A and 31.2km for Route Option B.

2.2.4 The 400kV overhead line would comprise conductors supported by steel lattice pylons and T-pylons. It is proposed that Sections A (Puriton Ridge), B (Somerset Levels and Moors South), D (Somerset Levels and Moors North), E (Tickenham Ridge) and F (Portishead) would utilise the T-pylon and that Section G (Avonmouth) would utilise steel lattice pylons.

Installation of 400kV Underground Cables

2.2.5 As part of the connection between Bridgwater and Seabank, National Grid is proposing to install 400kV underground cables in two locations. These comprise:

- approximately 300m of underground cables between two single circuit CSE compounds at Bridgwater Tee, north of Bridgwater (see **Volume 5.3.3, Figure 3.1.2**) where two trenches each with up to three cables would be installed; and
- approximately 8.5km of underground cables between a CSE compound south of the Mendip Hills and the proposed Sandford Substation within which the cable sealing ends for the underground cables would be sited. The cables would be installed in four trenches approximately 1.8m deep and 2m wide each containing up to three cables (see **Volume 5.3.3, Figure 3.1.6 – 3.1.9**).

Modifications to the Overhead Lines at Hinkley Point

2.2.6 The proposed Hinkley Point C Power Station would be connected to the high voltage transmission network at a new 400kV substation (Shurton Substation) within the boundary of the power station complex. This substation formed part of

EDF Energy's proposals which were granted Development Consent in March 2013 and does not form part of this Proposed Development. To connect the proposed Shurton Substation to the transmission network, two of the existing overhead lines which currently connect into Hinkley B Substation in the vicinity of the existing Hinkley B power station would be diverted into the new Shurton Substation and a new overhead line interconnector constructed between the proposed Shurton Substation and the existing Hinkley B Substation (see **Volume 5.3.3, Figure 3.1.20**).

2.2.7 These works would include the construction of approximately 4.5km of new 400kV overhead lines and the removal of approximately 2.3km of existing overhead lines. It is proposed that the new overhead lines would utilise steel lattice pylons

Construction of Three 400kV Cable Sealing End Compounds

2.2.8 CSE compounds are required where overhead lines and underground cables connect to each other and typically include switchgear, support structures and perimeter security fencing.

2.2.9 Two single circuit CSE compounds of approximately 34m by 30m are proposed at Bridgwater Tee, north of Bridgwater to achieve a crossing of electrical circuits where the new overhead line interfaces with the existing Hinkley to Bridgwater overhead line (see **Volume 5.3.3, Figure 3.1.2**).

2.2.10 A double circuit CSE compound of approximately 65m by 40m is proposed adjacent to the east of the M5 motorway to the south of the Mendip Hills and the River Axe (see **Volume 5.3.3, Figure 3.1.6**). This compound provides the interface point between the overhead line proposed through the Somerset Levels and Moors and the underground cables proposed through the Mendip Hills which connect directly to Sandford Substation to the north.

Construction of a 400/132kV Substation at Sandford

2.2.11 To maintain supplies on the 132kV distribution network following the removal of the existing 132kV overhead line, a new 400/132kV substation is proposed adjacent to Nye Road in Sandford, North Somerset (see **Volume 5.3.3, Figure 3.1.9**). The substation would be sited within a compound of approximately 143m by 217m and would include 400kV and 132kV electrical plant and equipment, super grid transformers (SGTs) and shunt reactors, electrical switchgear, perimeter fencing, access roads and landscaping and the cable sealing ends for the northern end of the underground cable route would be situated within the proposed Sandford substation.

Extension of the Existing 400kV Substation at Seabank

2.2.12 To facilitate connection of the proposed 400kV overhead line into Seabank Substation an extension to the existing substation building of approximately 24m and a minor extension to the substation perimeter fence are required together with the installation of electrical plant, equipment and switchgear (see **Volume 5.3.3, Figure 3.1.19**).

The Removal of Existing 132kV Overhead Lines

2.2.13 As part of the Proposed Development, over 65km of existing 132kV overhead lines would be removed. The overhead lines proposed for removal are as follows:

- approximately 53.2km of the existing overhead line (**F and G Routes**) between Bridgwater and Avonmouth substations (see **Volume 5.3.3, Figure 3.1**);
- approximately 9km of the existing overhead line (**W Route**) between Nailsea and Portishead Substation (to be replaced with underground cables) (see **Volume 5.3.3, Figure 3.1.14 – 3.1.16**);
- approximately 1.4km of the existing overhead line (**AT Route**) to the south of Puxton (see **Volume 5.3.3, Figure 3.1.9**);
- approximately 550m of the existing overhead line (**N Route**) near Mead Lane, Sandford (see **Volume 5.3.3, Figure 3.1.9**);
- a short section of the existing overhead line (**BW Route**) between Portishead and Avonmouth to achieve a crossing of electrical circuits (to be replaced with underground cables) (see **Volume 5.3.3, Figure 3.1.16 – 3.1.17 and Figure 3.2**;
- approximately 2.1km of existing overhead line (**G Route**) from the existing Avonmouth Substation northwards (to be replaced with underground cables) (see **Volume 5.3.3, Figure 3.1.18**); and
- a short section of three existing 132kV overhead lines (**G, DA and BW Routes**) in the vicinity of Seabank Substation to achieve a crossing of electrical circuits (to be replaced with underground cables) (see **Volume 5.3.3, Figure 3.1.19**).

Construction of 132kV Overhead Lines

2.2.14 To maintain connections with the existing 132kV distribution network in North Somerset 132kV overhead line connections are required between the proposed Sandford Substation and the existing overhead lines feeding Weston-super-Mare (**AT Route**) (2.3km) and Churchill (**N Route**) (285m) and between Churchill Substation and an existing overhead line that currently bypasses the substation (264m) (see **Volume 5.3.3, Figure 3.1.9**).

Construction of 132kV Underground Cables

2.2.15 To facilitate construction of the proposed 400kV overhead line and to maintain connections with the existing 132kV distribution network a number of sections of 132kV underground cables are required. The underground cables proposed are as follows:

- a short section of approximately 220m of underground cable (**Y Route**) to connect Churchill Substation with an existing overhead line that currently passes by the substation(see **Volume 5.3.3, Figure 3.1.10**);
- approximately 600m of underground cables (**AT Route**) in the vicinity of the proposed Sandford Substation (see **Volume 5.3.3, Figure 3.1.9**);
- approximately 10km of underground cables (**W Route**) between Nailsea and Portishead Substation(see **Volume 5.3.3, Figures 3.1.14 – 3.1.16**);

- approximately 2.3km of underground cables (**G Route**) between the existing Avonmouth Substation and just south of the Bristol to Avonmouth railway line (see **Volume 5.3.3, Figure 3.1.18**);
- a short section of approximately 170m for Route Option A (see **Volume 5.3.3, Figure 3.1.17 and Figure 3.2**) and 620m for Route Option B (see **Volume 5.3.3, Figure 3.1.16 and Figure 3.2**) of underground cable (**BW Route**) to allow the 400kV overhead line to cross an existing 132kV overhead line to the north east of Portishead; and
- three short sections of underground cable (**G, DA and BW Routes**) of between 150m and 300m to allow the 400kV overhead line to cross three existing 132kV overhead lines in the vicinity of Seabank Substation (see **Volume 5.3.3, Figure 3.1.19**).

Extensions/Modifications to Existing 132kV Substations

2.2.16 As a result of changes to the 132kV distribution network, modifications are required to existing 132kV substations at Churchill, Portishead, Avonmouth and Seabank (see **Volume 5.3.3, Figures 3.1.10, 3.1.16, 3.1.18** and **3.1.19**). These works involve the installation of electrical plant, equipment and switchgear and are largely confined to within the existing substation compounds. In the case of Churchill and Seabank Substations, small substation extensions are also required to accommodate the electrical connections.

Associated works to facilitate construction are also required, for example, temporary access roads, highway works, temporary construction compounds, work sites and ancillary works.

2.2.17 In addition to the above, a number of other works will be required during construction and operation of the Proposed Development. These include temporary masts and supports for overhead line construction, temporary and permanent access roads, modifications to the highway network and construction storage and working areas (see **Volume 5.3.3, Figure 3.1**)..

2.3 Construction of the Proposed Development

2.3.1 Construction of all components of the Proposed Development would commence with the preparation and installation of temporary access roads and working areas. Where necessary improvements to the existing highway network would be undertaken to facilitate construction access and activities. Temporary contractor's compounds, offices and welfare facilities would also be established along the proposed route to house the staff, equipment and materials for the works. Any topsoil and subsoil excavated would be stored separately along the working area in accordance with the Draft Construction Environmental Management Plan (CEMP) (see **Volume 5.26.1**) so that it can be put back once construction activities are complete.

2.3.2 For the 400kV overhead line, foundations would be installed and the pylon components delivered to site. The lattice pylon would be erected in sections, with a mobile crane used to lift the assembled sections into position. The T-pylon consists of approximately ten sections and would either be constructed on the ground and lifted by a crane in to position or by lifting each individual section in to place. The insulators would be fastened to the pylons in preparation for the installation of the conductors (wires). The conductors would be delivered to site on drums using heavy goods vehicles (HGVs) and would be installed in sections between tension pylons using tensioning and pulling machines. Once the overhead line is constructed, the temporary access tracks and working areas at the pylon sites would be removed and the ground reinstated by removing stone and trackways.

2.3.3 For the 400kV underground cables, a working area approximately 100m wide would be created along the length of the underground cables and protected by post and wire fencing. Vegetation would be cleared and topsoil would be stripped from the areas of ground to be disturbed in the working area. Where required, drainage improvement works would be implemented to ensure the site of the cables installation is free from risk of flooding. Cable drums would be delivered to working areas using HGVs, with smaller vehicles such as tractors used to transport the drums and other materials along a temporary haul road. Up to three cables would be installed into each of four trenches approximately 1.8m deep and 2m wide. Fibre optic cables would also be installed to ensure the connection could be periodically monitored. Above ground link boxes/link box pillars would be required where individual cable sections are joined. The joints between lengths of underground cables installed from the drums would be made on-site in controlled and clean conditions. Once the cables have been laid and the trenches backfilled, the temporary haul road and access tracks would be removed and soil replaced. Wherever possible hedgerows would be planted or replaced although trees cannot be planted on top of the cables.

2.3.4 For the substations and CSE compounds, topsoil would be removed and a clean and stable working platform established for the development. Construction of concrete foundations for some of the electrical equipment would be undertaken including installing troughs for the underground cables connections. A series of earth tapes or an earth grid would be installed below the ground to create an ‘earth mat’ to make the compound electrically safe. The substation support structures and electrical equipment and the CSE structures would then be erected. Prior to the substation or CSE compounds being brought into service, commissioning tests would be undertaken. Upon completion of the works temporary site installation facilities and working areas would be removed and the soil replaced. For works at existing substations construction activities would be similar to those outlined above but on a smaller scale.

2.3.5 The construction process for 132kV steel lattice pylons would be similar to that outlined above for 400kV overhead lines. The 132kV wood pole overhead lines would not require cranes or stone pads for installation and the poles would be installed in a single operation and secured at the end of each activity avoiding the need for the working area to be fenced. The conductors would be delivered to site on drums using HGVs and would be installed in sections between tension poles using tensioning and pulling machines. Once the overhead line is constructed, the temporary access tracks and working areas would be removed and the ground reinstated by removing stone and trackways.

2.3.6 To facilitate the removal of the existing 132kV overhead lines, the area around each pylon would be cleared and where appropriate fenced. Fittings such as dampers and spacers would be removed from the conductors and the conductors would be cut into manageable lengths or winched on to drums in a reverse process to that used during installation. The pylons would either be dismantled by crane, with sections cut and lowered to the ground, or the legs of the pylon would be cut and it would be pulled to the ground using a tractor before being dismantled. Foundations would be removed to a depth of approximately 1m and subsoil and topsoil reinstated. In exceptional circumstances the entire foundation may be removed.

2.3.7 For the 132kV underground cables, a working area approximately 60m wide would be created along the length of the underground cables protected by post and wire fencing. As with the 400kV underground cables vegetation would be cleared, topsoil would be stripped from the areas of ground to be disturbed and where required, drainage improvement works would be implemented to ensure the site of the cables installation is free from risk of flooding. Cable drums would be delivered to working areas using HGVs, with smaller vehicles such as tractors used to transport the drums and other materials along a temporary haul road. Up to three cables would be installed into two trenches approximately 1.2m deep and 1m wide. In addition, below ground link pits would be required where individual sections of cable are joined. The joints between lengths of underground cables installed from the drums would be made on-site in controlled and clean conditions. Once the cables have been laid and the trenches backfilled, the temporary haul road and access tracks would be removed and soil replaced. Wherever possible hedgerows would be planted or replaced although trees cannot be planted on top of the cables.

2.3.8 The Proposed Development, at approximately 57km in length and within a narrow corridor, crosses a diversity of landscapes. To aid assessment and communication, the proposed route has been divided into seven Sections based on landscape characteristics, plus an eighth, separate Section at Hinkley Point. The route is shown in **Inset 1.1**. These Route Sections are identified as Sections A to H and are described below. **Volume 5.23.5.2, Appendix C** shows these Sections and the main features of the Proposed Development along the route.

2.3.9 Overhead lines would be supported by T-Pylons in Sections A to F, with lattice pylons being used in Sections G and H.

2.3.10 National Grid would require infrequent access to ensure the Proposed Development could be appropriately maintained. The access would typically be made by foot, 4x4 or tractor and trailer and would not typically require any temporary access; however, access to tension pylons may require temporary stone roads or aluminium trackway to be laid. Upon completion of any maintenance works, surfaces would be restored to their previous condition. The indicative accesses for future maintenance are shown at **Volume 5.3.3, Figure 3.5 – 3.6**.

2.3.11 For ease of reference to the geographic areas of concern to different stakeholders, the specific information for each Route Section (Sections A to H) is collated with regard to:

- site location;
- land use and topographic information;
- soils, geology and hydrogeology;
- hydrology and land drainage;
- water related environmental designations; and
- proposed works.

2.3.12 Maps of the permanent works are provided in **Volume 5.23.5.2, Appendix D.** The Route Section information is set out in tabular format for each Route Section in sections 2.4 to 2.11 using data derived from the following sources:

- the geology and hydrogeology of the route has been assessed using the BGS 1:625k scale mapping;
- soil classifications obtained from the NERC online Soil Portal;
- Strategic Flood Risk Assessments;
- LiDAR data;
- Environmental Statement; and
- Proposed Development details.

2.4 Route Section A – Puriton Ridge

Table 2.1 Overview of Route Section A

Route Section A Puriton Ridge	
Southern Limit and Grid Reference	Bath Road, Horsey Levels NGR 3327 1395
Northern Limit and Grid Reference	Martlands Farm NGR 3340 1415
Length (km)	2.8km
Local Authority	Sedgemoor District Council
Internal Drainage Board	Axe Brue Internal Drainage Board
CFMP	North and Mid-Somerset Catchment Flood Management Plan
Topography	Generally low lying (6-8mAOD) but includes the Puriton Ridge (50mAOD)
Hydrological and Hydrogeological Overview The southern half of Section A is low lying and very flat within Flood Zone 3, where, during a flood event, flood flow velocities would be low, but the area of flood inundation would be extensive. Many of the watercourses are embanked and convey flow from the upper catchment in high level channels through the low lying moor areas. Many of these channels are tide locked. The system is highly managed to maintain the security of the embankments from breaching. North of Kings Sedgemoor Drain the alignment crosses the high ground of Puriton Ridge. Alluvial deposits overlying undifferentiated Triassic Mudstones, Siltstones and Sandstones. Alluvium on the levels, brackish groundwater, low permeability – low flow conditions. Puriton Ridge comprises Lias Group Mudstones, Siltstones Limestone and Sandstones (Secondary A Aquifer). There is the potential for groundwater flow within perched sandy sub-layers, although this is likely to be low flow as connectivity with recharge via surface pathways are likely to be limited.	
Soil Type	Naturally wet loamy and clayey soils with low permeability. On the southern side of Puriton Ridge slightly acid loamy and clayey soils with impeded drainage. The majority of the Puriton Ridge is underlain by shallow lime rich soils over limestone.
Superficial Geology	Quaternary Alluvium except over Puriton Ridge. Tidal Flats deposits on Horsey Levels.
Bedrock Geology	South of Kings Sedgemoor Drain - Mercia Mudstone Group (MMG) (mudstones). North of the King's Sedgemoor Drain on Puriton Ridge - Blue Anchor Formation (mudstones), Westbury Formation and Cotham Member (interbedded mudstone and limestone) and the Langport Member, Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated mudstones).

Route Section A Puriton Ridge	
Main Rivers	Kings Sedgemoor Drain
Flood Zone	Flood Zone 3 south of Kings Sedgemoor Drain, Flood Zone 1 to the north.
Length in Flood Zone 3	770m
Land Use	Rural agricultural
Environmental Designations	None
Development Description Summary	
Section A extends approximately 2.8km from the Bridgwater 275/132kV substation to the east of Bridgwater near Dunwear in the south to Woolavington Road in the north. The proposed 400kV overhead line would commence at the existing Hinkley to Bridgwater 275kV overhead line (VQ Route) at Horsey Level (NGR 3327 1395). From this point, the 400kV overhead line heads north across the Kings Sedgemoor Drain and on to the high ground of Puriton Ridge to Martlands Farm (NGR 3340 1415). The proposed route in this Section is formed of overhead line on T-pylons. To facilitate the construction of the CSE compounds (see Bridgwater Tee FRA **Volume 5.23.1**) and the crossing of the electrical circuits a temporary overhead line would be installed south of the existing Hinkley to Bridgwater 275kV VQ Route overhead line. A construction compound area (Bridgwater Tee/Bath Road Compound) would be constructed immediately east of the VQ Route.	
Permanent Works	
T-pylon D	4
T-pylon D30	4
Lattice Pylons	2
Dismantled Works	
Lattice Pylons	24

2.5 Route Section B – Somerset Levels and Moors South

Table 2.2 Overview of Route Section B

Route Section B – Somerset Levels and Moors South	
Southern Limit and Grid Reference	Martlands Farm NGR 3340 1415
Northern Limit and Grid Reference	Webbington NGR 3380 1555
Length (km)	Approximately 16km
Local Authority	Sedgemoor District Council
Internal Drainage Board	Axe Brue Internal Drainage Board
CFMP	North and Mid-Somerset Catchment Flood Management Plan (Ref.2.5)
Topography	Predominantly low lying (6-8mAOD) and flat
Hydrological and Hydrogeological Overview This low lying area is prone to flooding from the Rivers Brue and Axe following prolonged rainfall and or during tide locking. Flooding generally occurs slowly and to a shallow depth but over extensive areas. The embanked watercourses are a focus for maintenance as an embankment failure could cause rapid flooding and be hazardous. Modelled flood levels are available for the River Brue. Old River Axe and the River Axe. Superficial deposits comprise Tidal Flat Deposits, the thickness is highly variable from 5m to 30m (increased thicknesses relate to buried valleys). Groundwater levels are likely to be near to surface elevation (in the top 5m), but low flow due to a lack of head gradient. Buried valleys exist near Brent Knoll and these can either be barriers or preferential pathways to groundwater flow. The Tidal Flat Deposits are designated as a secondary undifferentiated aquifer. The Blue Lias Formation between Puriton Ridge and East Huntspill along the proposed 400kV overhead line and existing F Route has been classified by the EA as a secondary A aquifer. The Charmouth Mudstone Formation between East Huntspill and Biddisham along the proposed 400kV overhead line and existing F route has been designated an unproductive aquifer. The Mercia Mudstone Group between Biddisham and the Mendip Hills at Webbington has been classified by the EA as a secondary B aquifer. There are three groundwater abstractions within 1km of the development route. All of the groundwater abstractions relate to general farming and domestic use at farms. No potable water abstractions are noted within 1km of the Proposed Development within this Section. Information available on the EA website indicates that the site does not lie within a currently designated groundwater Source Protection Zone (SPZ).	
Soil Type	Naturally wet loamy and clayey soils with low permeability
Superficial Geology	Tidal Flat Deposits throughout
Bedrock Geology	0 – 3.8km Langport Member, Blue Lias Formation and Charmouth Mudstone Formation consisting of undifferentiated mudstones and limestone. 3.8- 13km Charmouth Mudstone consisting of mudstone described as dark grey laminated shales, and dark, pale and bluish grey mudstones. 13 - 14.8km Undifferentiated Triassic Mercia Mudstones of relatively low permeability.

Route Section B – Somerset Levels and Moors South	
Main Rivers	Huntspill River, River Brue, Mark Yeo and River Axe
Flood Zone	Predominantly Flood Zone 3
Length in Flood Zone 3	14.2km
Land Use	Rural with isolated settlements
Environmental Designations	Huntspill River NNR
Development Description Summary	
Section B extends approximately 16km from Woolavington Road in the south to Webbington Road in the north, which forms the southern boundary of the Mendip Hills AONB. All but 1.3km of the route in this Section will be an overhead line on T-pylons. The proposed route would intersect the existing ZG 400kV overhead line east-west route at NGR 3344 1430 then pass across Mark causeway, cross the Mark Yeo River south of Rooks Bridge (NGR 3372 1524), the A38 at Tarnock, then cross the Old River Axe near Biddisham (NGR 3374 1535). Two construction compounds are proposed, to be accessed from the A38. A CSE compound (the transition point between overhead line and underground cables) would be constructed immediately east of the M5 south of the Mendip Hills (see South of Mendip Hills FRA **Volume 5.23.2**). The proposed route would then continue north-eastwards as an underground cable, crossing the River Axe near Crab Hole (NGR 3378 1549) either by bridge or beneath the river (via Horizontal Direct Drilling (HDD)), following to the east of the M5 before entering the Mendip Hills AONB.	
Permanent Works	
T-pylon D	24
T-pylon D10	5
T-pylon D30	11
Lattice Type	2
Goal post terminal pylon	2
Underground Cable (400kV)	1.5km
Dismantled Works	
Lattice Pylons	57

2.6 Route Section C – Mendip Hills AONB

Table 2.3 Overview of Route Section C

Route Section C - Mendip Hills AONB	
Southern Limit and Grid Reference	Webbington NGR 3380 1555
Northern Limit and Grid Reference	Towerhead Road NGR 3413 1595
Length (km)	5.8km
Local Authority	North Somerset Council
Internal Drainage Board	Not applicable
CFMP	North and Mid-Somerset Catchment Flood Management Plan
Topography	Ascends the gently sloping Lox Yeo Valley across the Mendip Hills to a maximum 62mAOD, then descends to 4mAOD. The Mendip Hills around the Lox Yeo valley ascend to above 120mAOD and is steeply inclined in places.
Hydrological and Hydrogeological Overview The Mendip Hills area of high ground is formed by a Limestone ridge. The permeable nature of the bedrock results in few surface watercourses. The main source of flooding in this Section is from surface water runoff and flooding from minor watercourses. Those draining the steeper and less permeable ground are prone to be flashy but produce small peak flows. The Mendip Hills comprise of Carboniferous Limestones, a principal karstic aquifer of local importance as a source of water supply. Infiltration occurs from enhanced rainfall on higher ground; water is stored and flows via fractures, potentially emerging at springs where in contact with the Triassic strata at the base of the ridge. Groundwater levels under average conditions are likely to be approximately 20m below surface elevations, and will vary with rainfall infiltration. The Alluvium located close to the Lox Yeo River, between Banwell Road and Max Mill Lane is designated as a secondary A aquifer. The Mercia Mudstone Group between the Mendip Hills has been classified by the EA as a secondary B aquifer. There are four recorded groundwater abstractions within 1km of the Proposed Development within Section C. Two of these are used for potable water use. The Mendip Hills and in particular the limestone bedrock has been designated by the EA as SPZ 2 (outer catchment).	
Soil Type	The Lox Yeo Valley has naturally wet, loamy and clayey floodplain soils. To the north, soils comprise a mix of slightly acid loamy and clayey soils with impeded drainage; and freely draining slightly acid and base rich soils.

Route Section C - Mendip Hills AONB	
Superficial Geology	In the Lox Yeo Valley south of Banwell Road - Tidal Flat Deposits (consolidated soft silty clay, with layers of sand, gravel and peat). In the Lox Yeo Valley north of North of Banwell Road – Alluvium. Upslope on either side of the valley - Head Deposits.
Bedrock Geology	The base of the Lox Yeo Valley is underlain by the Mercia Mudstone Group mudstone. The surrounding Mendip Hills comprise the older Clifton Down Limestone Formation, the Burrington Oolite Subgroup, the Black Rock Limestone Subgroup and the Avon Group (limestone with dolomite and interbedded mudstone).
Main Rivers	Lox Yeo River
Flood Zone	Predominantly Flood Zone 1
Length in Flood Zone 3	100m
Land Use	Rural agricultural
Environmental Designations	None adjoining route
Development Description Summary	
Section C extends for approximately 6km from the southern boundary of the AONB on Webbington Road to the northern boundary of the AONB on the A368, west of Sandford. The proposed route would pass between the M5 motorway and the western end of the Mendip Hills at Webbington then in a north-east direction along the valley of the Lox Yeo River towards Winscombe. The 400kV underground cables would cross the Lox Yeo river by HDD before turning northwards to cross the A368 road at Towerhead (NGR 3413 1595).	
Permanent Works	
Underground Cable (400kV)	Throughout
Dismantled Works	
Lattice Pylons	22

2.7 Route Section D – Somerset Levels and Moors North

Table 2.4 Overview of Route Section D

Route Section D – Somerset Levels and Moors North	
Southern Limit and Grid Reference	Towerhead Road NGR 3413 1595
Northern Limit and Grid Reference	Tickenham NGR 3464 1718
Length (km)	Approximately 15km
Local Authority	North Somerset Council
Internal Drainage Board	North Somerset Levels
CFMP	North and Mid-Somerset Catchment Flood Management Plan
Topography	Low lying at 6-8mAOD rising to approximately 25m at Tickenham Ridge
Hydrological and Hydrogeological Overview This area is low lying with numerous embanked watercourses passing through. The main flood risk in this area is from tidally influenced river flooding during tide-locked conditions and overtopping of flood embankments on the main river channels. Surface water run-off from the surrounding higher ground and as a result of tide-locked agricultural drainage networks also occurs locally. The Head Deposits close to the Mendip Hills at Sandford and around Yatton are designated a secondary undifferentiated aquifer. The Tidal Flat Deposits and peat deposits along the remaining Proposed Development are designated as unproductive. The Mercia Mudstone Group between the Mendip Hills at Sandford and Nailsea is also classified by the EA as a secondary B aquifer. The South Wales Middle and Lower Coal Measures Formations have been designated as secondary A aquifers. The Down End Limestone Formation on Tickenham Ridge has been designated a principal aquifer. There are four potable water abstractions within 1.5km of the Proposed Development and relate to: • 890m north east of Churchill Substation for use as bottled water; • 1,255m south west of Sandford for use as direct potable water; • 1,632m north west of Yatton for use as direct potable water; and • 1,662m south east of Yatton for use as direct potable water. Borehole M5 Avon to East Brent 153 shows low groundwater permeability. Information available on the EA website indicates that the majority of the Proposed Development does not lie within a currently designated groundwater SPZ, except for Tickenham Ridge. The Down End Limestone Member has been designated a SPZ 1 (inner zone).	
Soil Type	Naturally wet loamy and clayey soils of low permeability. Around Nailsea freely draining acid loamy soil. Slightly acid loamy and clayey soils with impeded drainage; and loamy and sandy soils with a peaty surface are also present to a lesser extent.

Route Section D – Somerset Levels and Moors North	
Superficial Geology	Tidal Flat Deposits are present between Sandford and Yatton and at Kenn Moor. Head Deposits are present at the northern edge of the Mendip Hills at Sandford and around North End, Yatton. Extensive areas of organic-rich clay containing narrow layers or lenses of buried peat are located on Kenn Moor, north east of Yatton, on Nailsea Moor and on Tickenham Moor, to the base of the Tickenham Ridge.
Bedrock Geology	Sandford to West End, Nailsea - Undifferentiated Triassic Mercia Mudstone Group mudstones and subordinate siltstones. At West End and Nailsea - Down End Member sandstone with some conglomerate and pebbly sandstone (part of the Upper Coal Measures). At the northern end of Nailsea, the bedrock comprises the South Wales Lower and Middle Coal Measures Formations (undifferentiated sedimentary bedrock with coal bearing seams). The area is generally heavily faulted with significant faults identified as the Tickenham Fault and Naish House Fault.
Main Rivers	Towerhead Brook (Ordinary Watercourse); Oldbridge River (Ordinary Watercourse); Congresbury Yeo; Little River (Ordinary Watercourse); Black Ditch Rhyne; River Kenn; Land Yeo River
Flood Zone	Predominantly Flood Zone 3
Length in Flood Zone 3	13.6km
Land Use	Rural agricultural and wildlife reserve
Environmental Designations	Biddle Street, Yatton SSSI; Tickenham, Nailsea and Kenn Moors SSSI; Puxton Moor SSSI
Development Description Summary	
Section D extends for approximately 15km from the AONB boundary on the A368 to Clevedon Road (near Stone-Edge Batch). The underground cables would continue out of the Mendip Hills for approximately 1km into the proposed 400/132kV substation north of Sandford, crossing Towerhead Brook north of Towerhead Road. It is proposed that Towerhead Brook would be crossed by a bridge (see **Volume 5.3.3, Figure 3.18)** which would convey the cables and a semi-permanent access road, for transformer delivery. This access road between A368 and Sandford Substation (approx. 1.3km) is included in the Sandford Substation FRA (see **Volume 5.23.3**). Construction compounds would be built on Towerhead Road and at Sandford Substation. Immediately north-west of Sandford substation it is proposed to construct a 2.3km 132kV overhead line link to the AT route, joining the existing AT route at Box Bush Farm (NGR 3403 1625) (see **Volume 5.3.3, Figure 3.1.9)**.	

Route Section D – Somerset Levels and Moors North	
A 132kV connection approximately 285m long is also required between the proposed Sandford substation and existing 132kV overhead lines (known as the 'N Route') (see **Volume 5.3.3, Figure 3.1.19**). This connection would be an overhead line using two lines of single circuit wood poles (ten in total). A new single circuit connection would also be required between each of the existing W and Y Route 132kV overhead lines and the existing 132/33kV Churchill substation (see **Volume 5.3.3, Figure 3.1.10**). North of Sandford substation the proposed 400kV overhead line would cross the Congresbury Yeo River and then pass west of Horsecastle to cross the River Kenn at NGR 3439 1694. From Kenn Road, the 400kV route continues in a northeasterly direction towards Nailsea, crossing the Tickenham, Nailsea and Kenn Moor SSSI. The proposed 400kV overhead line route would turn to the north as it passes the north of Nailsea and continues into Section E, at Stone-edge Batch, Tickenham. The existing 132kV 'W Route' from south of Nailsea (pylon W36R) would be removed and replaced by an underground cable route which would pass through Nailsea; once through Nailsea, the new underground W Route would broadly follow the alignment of the existing W Route overhead line (Section E), through Portbury Wharf Nature reserve to Portishead Substation (Section F).	
Permanent Works	
T-pylons D	30
T-pylons D10	4
T-pylons D30	8
Lattice Type	7
Cable sealing End Platform Pylon (132kV lattice type)	3
Goal post terminal pylon	2
Wooden Pole	10
Underground cable (400kV)	1.3km
Underground cable (132kV)	3.3km
Dismantled Works	
Lattice Pylons	65

2.8 Route Section E – Tickenham Ridge

Table 2.5 Overview of Route Section E

Route Section E - Tickenham Ridge	
Southern Limit and Grid Reference	Tickenham NGR 3464 1718
Northern Limit and Grid Reference	M5 Motorway NGR 3487 1747
Length (km)	4km
Local Authority	North Somerset Council
Internal Drainage Board	Not applicable
CFMP	North & Mid-Somerset Catchment Flood Management Plan
Topography	Rising to 133mAOD over Tickenham Ridge then descending to 29mAOD
Hydrological and Hydrogeological Overview This Section comprises a narrow band of Limestone forming a wedge like ridge into the coastal plain. The permeable bedrock is drained by a few minor watercourses only. The Ridge rises to approximately 120mAOD and is approximately 2km wide. Alluvium is absent, the solid geology is complex, but predominantly Carboniferous Limestone and Upper Devonian Rocks (undifferentiated) - Sandstone and Conglomerate. It is likely that on the Ridge the groundwater table will be approximately 10-20m below surface level and will vary with rainfall. Groundwater emergence may occur near the base of the ridge. Following an exceptionally wet period it is possible that fractures may be re-activated, but no evidence of springs are visible on the Ordnance Survey (OS) mapping. The Alluvium located in close proximity of the Land Yeo at Stone-edge Batch, is designated as a secondary A aquifer. The Mercia Mudstone Group has been classified by the EA as a secondary B aquifer. The Pennant Sandstone and Avon Group has been classified by the EA as a secondary A aquifer. The Black Rock Limestone on Tickenham Ridge has been classified by the EA as a principal aquifer. There are two recorded groundwater abstractions in the vicinity of the Proposed Development. However, there are no potable water abstractions within 1,500m of the Proposed Development. The Black Rock Limestone Formation on Tickenham Ridge has been designated by the EA as SPZ 1 (inner catchment). This inner catchment area provides groundwater for a potable water abstraction at Tickenham Road Well, Clevedon, located circa 3km west of the nearest component of the Proposed Development consisting of the proposed underground cable (W Route) at Tickenham Court, Stone-edge Batch. The potable water abstraction is operated by Bristol Water Plc.	
Soil Type	Section E is underlain, from south to north, by soils comprising slightly acid loamy and clayey soils with impeded drainage; freely draining slightly acid but base rich soils; and freely draining acid loamy soil.
Superficial Geology	Quaternary Alluvium locally otherwise absent. There are some Head deposits in the Bullocks Bottom valley through which the 132kV underground cable W Route would be routed 150m south-west of Caswell Hill Compound.

Route Section E - Tickenham Ridge	
Bedrock Geology	Carboniferous Limestone Series including limestone, dolomite and interbedded mudstones. Pennant Series sandstone and conglomerate close to Whitehouse Lane Compound. The Mercia Mudstone Group is found at the southern and northern-most extents of the ridge.
Main Rivers	None
Flood Zone	All Flood Zone 1
Length in Flood Zone 3	None
Land Use	Rural agricultural and woodland
Environmental Designations	None
Development Description Summary	
Section E extends for approximately 4km from Clevedon Road (near Stone-edge Batch) in the south across the ridge to the M5 motorway. In this Section, the 400kV overhead line route keeps to the south of the existing F Route, continuing to run northeast. Prior to crossing Cadbury Camp Lane, the route turns to the north and continues northeast, crossing the ridge obliquely on Caswell Hill, with Priors Wood SNCI to its west. The route turns and heads north at Prior’s Wood where it then crosses the M5 motorway. The W Route is described in Table 2.4, Section D. Two construction compounds (Caswell Hill Compound and Clevedon Road) are proposed immediately adjacent to the proposed 132kV Underground Cable route. Whitehouse Lane Compound is located close to the 400kV overhead line in the central extent of Section E.	
Permanent Works	
T-pylon D	7
T-pylon D10	1
T-pylon D30	4
Underground Cable (132kV)	4.6km
Dismantled Works	
Lattice Pylons	27

2.9 Route Section F – Portishead

Table 2.6 Overview of Route Section F

Route Section F - Portishead	
Southern Limit Grid Reference	M5 Motorway NGR 3487 1747
Northern Limit Grid Reference	Preferred Route (Option A) NGR 3501 1758 Alternative Route (Option B) NGR 3496 1767
Length (km)	Preferred Route (Option A) 1.8km, Alternative Route (Option B) 3.0km
Local Authority	North Somerset Council
Internal Drainage Board	North Somerset Levels
CFMP	North & Mid-Somerset Catchment Flood Management Plan
Topography	Low lying undulating topography between 6-12mAOD
Hydrological and Hydrogeological Overview This area (the Gordano Valley) is characterised by a small number of field drains and ditches although the Portbury Ditch drains the area to the south of Portishead along with two main rivers. Alluvium underlain by Triassic Rocks (undifferentiated) - Mudstone, Siltstone And Sandstone. Brackish groundwater, low permeability – low flow conditions. The Tidal Flat Deposits and Peat in the Gordano valley within Section F are designated as unproductive strata. The Head Deposits at the base of Tickenham Ridge are designated as a secondary undifferentiated aquifer. The River Terrace Deposits located beneath Sheepway are designated as a secondary A aquifer. The Mercia Mudstone Group has been classified by the EA as a secondary B aquifer. Information within the environmental database indicates that Section F is not located above a groundwater SPZ and there are no recorded groundwater abstractions within this Section There are no surface water abstractions within 500m of the Proposed Development within Section F.	
Soil Type	Naturally wet loamy and clayey soils of the coastal flats with low permeability with subordinate amounts of slightly acid loamy and clayey soils with impeded drainage.
Superficial Geology	Tidal Flat Deposits are located on the low-lying areas in the Gordano valley, west of Sheepway. River Terrace Deposits are found beneath Sheepway and may extend to beneath the Preferred Route Option A of the Proposed Development. Head Deposits are predominantly located along the northern side of Tickenham Ridge. Peat is restricted in extent to between The Portbury Hundred (A369) and the M5 motorway, beneath proposed pylon LD96 and LD97 along the preferred Route Option A.
Bedrock Geology	Undifferentiated Triassic Mercia Mudstone Group mudstones.

Route Section F - Portishead	
Main Rivers	Sandy Rhyne, Drove Rhyne
Flood Zone	Preferred Route (Option A) Predominantly Flood Zone 1 Alternative Route (Option B) Predominantly Flood Zone 3
Length in Flood Zone 3	Preferred Route (Option A) 0.3km Alternative Route (Option B) 2.2km
Land Use	Rural agricultural
Environmental Designations	None
Development Description Summary	
Section F extends for approximately 2km north from the M5 motorway to the existing Portishead 132kV electricity substation and east to the Portbury Docks complex. There are two potential routes for the proposed 400kV connection in this Section. These are described as the Preferred Route (Option A' and the Alternative Route (Option B). From its crossing of the M5, the Preferred Route (Option A) would run broadly parallel and to the north of the motorway. The Alternative Route (Option B) would largely follow the alignment for the existing W Route 132kV overhead line (to be removed) up to the drain 'Old Sea Bank' at which point it turns to the northeast. Between P-LD100 and P-LD101, the Alternative Route (Option B) would turn to the east and cross the existing BW Route; this would necessitate the 'undergrounding' of the BW Route, between Portishead substation and Pylon BW36R (NGR 3490 1768). The W Route is described in Table 2.4, Section D. The existing 132kV overhead line 'G Route' from Portishead to Seabank would be removed between Portishead and Avonmouth Substations.	

Permanent Works	Preferred Route (Option A)	Alternative Route (Option B)
T-pylon D	3	2
T-pylon D10	1	2
T-pylon D30	3	5
Underground Cable (132kV)	2.3km	2.9km
Lattice Pylons	0	1
Dismantled Works		
Lattice Pylons	25	28

2.10 Route Section G – Avonmouth

Table 2.7 Overview of Route Section G

Route Section G - Avonmouth	
Southern Limit Grid Reference	Preferred Route (Option A) NGR 3501 1758 Alternative Route (Option B) NGR 3496 1767
Northern Limit Grid Reference	Seabank Substation NGR 3538 1822
Length (km)	Preferred Route (Option A)10.0km Alternative Route (Option B)10.2km
Local Authority	North Somerset Council Bristol City Council and South Gloucestershire Council
Internal Drainage Board	Lower Severn Internal Drainage Board
CFMP	Severn Tidal Tributaries Catchment Flood Management Plan (Ref.2.6) and Severn River Basin Management Plan (Ref.2.7)
Topography	Low lying undulating topography between 6-8mAOD
Hydrological and Hydrogeological Overview The Avonmouth Section is essentially coastal floodplain much of which is below sea level and, therefore, susceptible to tidal/surge flooding from overtopping of the tidal defences. Numerous surface watercourses and several larger named rhynes are present, although these have only a small catchment area. The River Avon, draining a catchment of 2220km^2 passes through the Section. Flooding can occur from tide-locked rivers and from surface water. The River Terrace Deposits underlying a small area beneath Royal Portbury Docks are classified by the EA as a secondary A aquifer. The Head Deposits close to Portbury and Pill/Easton in Gordano are designated a secondary undifferentiated aquifer. The Tidal Flat Deposits underlying the majority of the Proposed Development within Section G - Avonmouth are classified as unproductive strata. The Mercia Mudstone Group bedrock underlying the majority of the Proposed Development within Section G - Avonmouth has been designated as a secondary B aquifer. There are six groundwater abstractions for industrial use within Section G. There are no potable water abstractions within this Section. Section G is not located within a groundwater SPZ.	
Soil Type	Naturally wet loamy and clayey soils of the coastal flats with low permeability. Subordinate amounts of slightly acid loamy and clayey soils with impeded drainage.
Superficial Geology	Tidal Flat Deposits beneath the majority of the Proposed Development. Small areas of Head Deposits, River Terrace Deposits and peat are also located along the Proposed Development within Route Section G.
Bedrock Geology	Undifferentiated Triassic Mercia Mudstone Group mudstones

<table>
<tr><th colspan="3">Route Section G - Avonmouth</th></tr>
<tr><td>Main Rivers</td><td colspan="2">Tidal River Avon</td></tr>
<tr><td>Flood Zone</td><td colspan="2">Predominantly Flood Zone 3</td></tr>
<tr><td>Length in Flood Zone 3</td><td colspan="2">Preferred Route (Option A) 6.5km
Alternative Route (Option B) 6.1km</td></tr>
<tr><td>Land Use</td><td colspan="2">Mixture of industrial, urban and rural</td></tr>
<tr><td>Environmental Designations</td><td colspan="2">Severn Estuary SSSI, SAC, SPA, Ramsar site.</td></tr>
<tr><td colspan="3">Development Description Summary</td></tr>
<tr><td colspan="3">Section G extends northeast from the Portbury Docks complex to Seabank substation. In this Section, the two possible routes described in Section F meet at a common point south of the Portbury coal stock yards. In this Section the proposed 400kV overhead line would be supported entirely by standard lattice pylons for preferred route (option A) and by standard lattice pylons from LD106 for alternative route (option B).
With preferred route (Option A), the 400kV overhead line would cross the 132kV overhead line ‘BW Route’ between LD105 and LD106; this would necessitate the ‘undergrounding’ of the BW Route at this point, from pylon BW 29A   to pylon BW28R , from where it would continue on its existing overhead line route to Avonmouth substation. As a result of two crossings of the existing 132kV overhead line ‘G route’ by the proposed 400kV overhead line, the G Route would be ‘undergrounded’ between Avonmouth substation to a new pylon, G31R, immediately east of the M49 at Moorhouse, from where it continues on its existing overhead line route to Seabank Substation.
There are five construction compounds proposed in Section G.</td></tr>
<tr><td>Permanent Works</td><td>Preferred Route (Option A)</td><td>Alternative Route (Option B)</td></tr>
<tr><td>T-pylon D</td><td>0</td><td>3</td></tr>
<tr><td>T-pylon D10</td><td>0</td><td>1</td></tr>
<tr><td>T-pylon D30</td><td>0</td><td>1</td></tr>
<tr><td>Lattice Type</td><td>38</td><td>32</td></tr>
<tr><td>Underground Cable (132kV)</td><td>170m (BW Route) + 2.4km (G Route)</td><td>2.4km (G Route)</td></tr>
<tr><td colspan="3">Dismantled Works</td></tr>
<tr><td>Lattice Pylons</td><td>26</td><td>26</td></tr>
</table>

2.11 Route Section H – Hinkley Line Entries

Table 2.8 Overview of Route Section H

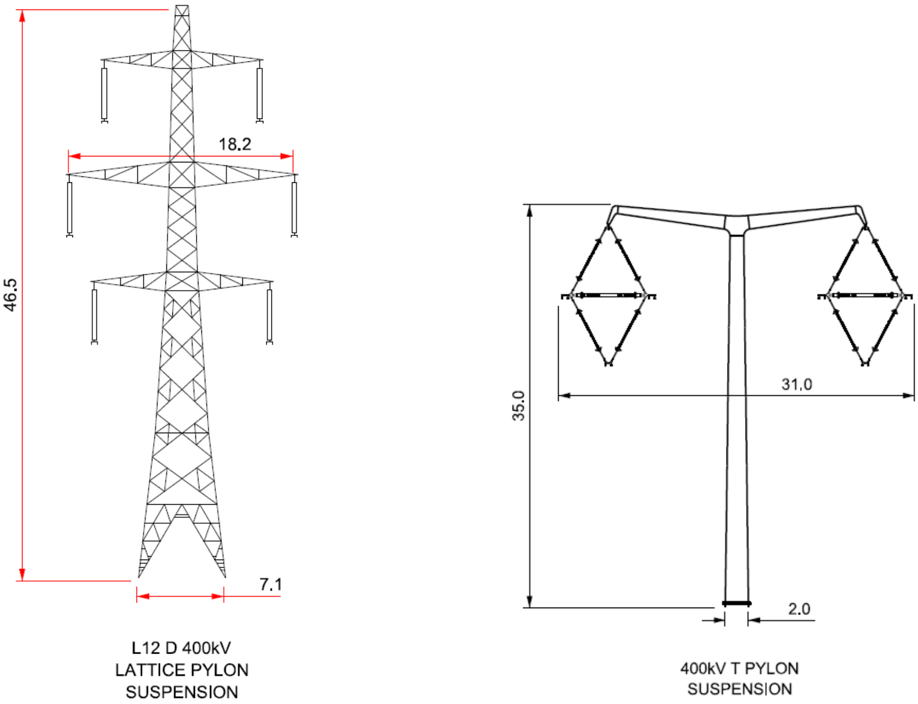
Route Section H – Hinkley Line Entries	
Southern Limit Grid Reference	Zipe Farm NGR 3221 1448
Northern Limit Grid Reference	Hinkley Point substation NGR 3213 1458
Length (km)	Approximately 3km
Local Authority	West Somerset District Council
Internal Drainage Board	River Parrett Internal Drainage Board
CFMP	West Somerset Catchment Flood Management Plan
Topography	Low lying undulating topography between 5-15mAOD with a high point of 25mAOD in the north-west corner.
Hydrological and Hydrogeological Overview Numerous interconnected surface watercourses cross the Proposed Development. The largest watercourse is East Brook (an arm of Stogursey Brook) which drains through Wick Moor. There are no recorded surface water abstractions on or within 1km of the Proposed Development within Section H. This Section is low lying coastal floodplain comprised of alluvium underlain by Triassic rocks (undifferentiated), mudstones, siltstone and Sandstone. Groundwater will be brackish and have low permeability. Groundwater levels are likely to be near the surface with possibly a tidal influence on the head. The Head Deposits and Tidal Flat Deposits underlying the Proposed Development are classified by the EA as secondary (undifferentiated) aquifers. The Alluvium and the Langport Member, Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated) are classified as secondary A aquifers. The Blue Anchor Formation, Mercia Mudstone Group, and the Westbury Formation and Cotham Member (undifferentiated) are classified as secondary B aquifers. There are no groundwater abstractions within 500m of the Proposed Development within Section H. Information available on the EA website indicates that the Proposed Development does not lie within a designated groundwater SPZ.	
Soil Type	Northern part of the Proposed Development area - Naturally wet loamy and clayey soils of the coastal flats, Southern part of the Proposed Development area - lime rich loams and clays with impeded drainage.
Superficial Geology	Head Deposits are located at the south eastern end of the Proposed Development. Alluvium is located at the south eastern end of the site and in a band across the centre of the western part of the Proposed Development. Tidal Flat Deposits are located in the central and northern part of the Proposed Development.

Route Section H – Hinkley Line Entries	
Bedrock Geology	Triassic Mudstones and Limestones The majority of the Proposed Development is underlain by the Langport Member, Blue Lias Formation and Charmouth Mudstone Formation (calcareous mudstones, limestones, siltstones and shales). The north western part of the Proposed Development is a fault-bounded block of Triassic age strata. The strata forming this block are the Blue Anchor Formation, Mercia Mudstone Group, and the Westbury Formation and Cotham Member comprising mudstone and siltstone with thin limestone and sandstone units. Made Ground deposits are present beneath the far north eastern part of the Proposed Development.
Main Rivers	(Stogursey Brook classified as Ordinary Watercourse)
Flood Zone	Approximately 50% in Flood Zone 3, 50% in Flood Zone 1
Length in Flood Zone 3	1.2km
Land Use	Rural but includes Hinkley Power Station.
Environmental Designations	Bridgwater Bay SSSI; Severn Estuary SAC, SPA, SSSI and Ramsar site.
Development Description Summary	
'Line entries' refer to how overhead lines approach and connect to substations on the high voltage transmission network. The Proposed Development is a 1.4 km diversion of the existing 400kV overhead line 'ZZ Route' and 275kV overhead line 'VQ Route' and a 1.2km connection from Shurton Substation to the existing 400kV Hinkley Point Substation (NGR 3213 1458).	
Permanent Works	
Lattice Pylons	13
Dismantled Works	
Lattice Pylons	6

2.12 Proposed Development Structures

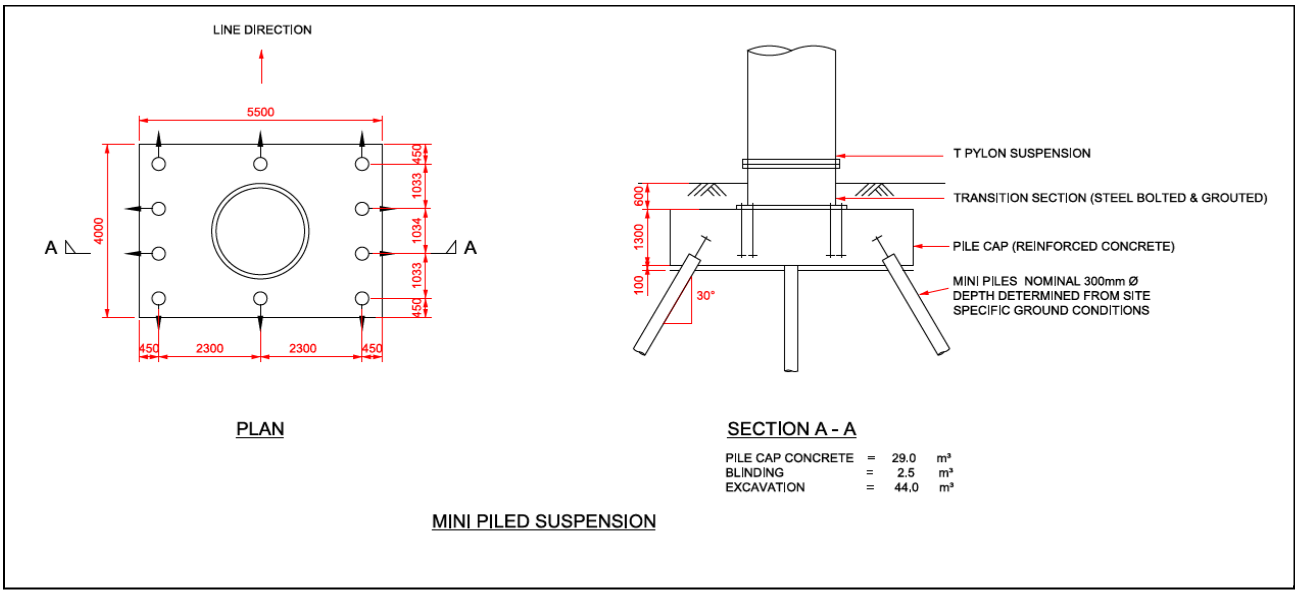
2.12.1 The Proposed Development comprises the placement of T pylons (three different types) and conventional Lattice pylons as shown in **Inset 2.1**.

Inset 2.1: Typical Pylon Types



2.12.2 T-pylons feature a single steel tubular upright pole bolted to a buried concrete footing set at 600mm below ground level and covered with topsoil (as indicated in **Inset 2.2**). The only change in impermeable ground surface arising from the presence of the T-pylons is from the area of the base of the circular pylon upright.

Inset 2.2: Detail of Typical T-pylon Foundation



2.12.3 **Table 2.9** shows the impermeable area for each of the three main T-pylon types.

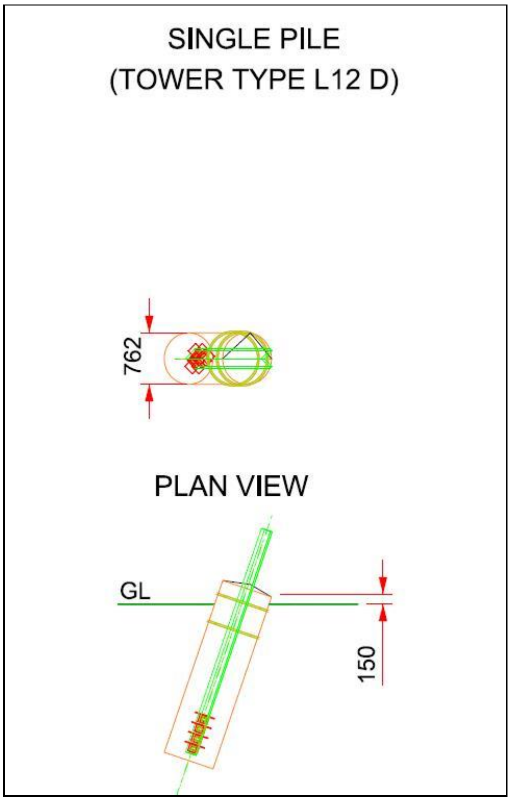
Table 2.9 Impermeable Areas for a T-pylon Installation

T-Pylon Type	Diameter	Impermeable Area
D	2.0m	3.14m^2
D10	2.0m	3.14m^2
D30	2.3m	4.15m^2

2.12.4 Lattice pylons are generally mounted on four piled footings, one for each leg. The general arrangement for a lattice pylon foundation is shown in **Inset 2.3** for a single pile cap. Larger pile caps involving two or more piles are provided where necessary, and full drawing details are available in **Volume 5.23.5.2, Appendix E**.

2.12.5 The lattice pylons above ground structures have a negligible impermeable area as each pylon base, irrespective of the piling detail, has a single 762mm diameter concrete casing around the leg of the pylon. The total impermeable area of each pylon (four corners) is, therefore, 1.8m^2.

Inset 2.3 Detail of Typical Lattice Pylon Foundation



2.13 Construction Phase General Details

2.13.1 The Proposed Development crosses large areas of agricultural land, in some places remote from existing road infrastructure. To facilitate the construction of the Proposed Development it would be necessary to install temporary roads and construction compounds. Where an underground cable section is proposed there would be a period when trench excavations are opened. The locations of the temporary structures associated with the construction phase are provided in **Volume 5.23.5.2, Appendix F**.

Haul Roads

2.13.2 It is proposed that the haul roads and compounds would be constructed at the start of the construction phase, and then used throughout the duration of the works. Therefore, all haul roads and compounds are assessed on the basis that they would be in place for the entire construction period.

2.13.3 To construct the haul roads, the topsoil would be stripped and stockpiled alongside the haul roads for the duration of the works.

2.13.4 For the topsoil stripping, the depth of the topsoil layer would vary by location; between 75mm – 300mm, as described in the Topsoil Stripping Method Statement, which is provided at **Volume 5.3.3, Appendix 3G**. For the purposes of this FRA, a worst case scenario that, in all cases, 300mm of top soil would be stripped and stockpiled has been assessed.

2.13.5 Generally, the haul road surface would be kept as close to existing ground level as possible (minimum 50mm above existing ground level). In accordance with Sustainable Drainage principles, (Ref.2.8) runoff would be managed locally by allowing it to infiltrate into adjacent vegetated ground (assuming the ground is not saturated). To account for the need to manage surface water drainage in a variety of conditions, including when the ground is saturated, a range of methods would be employed. These are outlined in the Construction Environmental Management Plan (see **Volume 5.26.1A**). The specific methods adopted would trap sediment and minimise the alteration of the natural flow paths. Where the haul road crosses peat, a floating road would be laid on the ground surface. This would exceed 300mm in depth and may require drainage pipes to maintain floodplain connectivity.

2.13.6 The impact on flood risk of temporary stockpiles arising from haul road construction has been assessed.

2.13.7 The construction phase would also include the use of temporary compounds. The proposed construction would require 22 compounds with a total area of 29ha. Typically a compound would comprise materials storage areas, offices, mess facilities and parking areas (see **Volume 5.3.3, Figure 3.16)** . Each compound would be drained using Sustainable Drainage (SuDS) principles to ensure runoff rates do not exceed the greenfield runoff rate. This approach is consistent with SuDS principles as required under the Flood and Water Management Act 2010 (Ref.2.9).

2.13.8 Greenfield runoff rates have been calculated using the Institute of Hydrology (IOH) 124 Method (Ref.2.10), for each of the proposed compound sites. Allowable discharges range from 7.00l/s/ha at Bridgwater Tee (Bath Road) to 9.7l/s/ha at Towerhead Road.

2.13.9 The impact on flood risk of temporary stockpiles arising from compounds has been assessed.

Watercourse Crossings

2.13.10 There are 304 temporary and two permanent watercourse crossings along the proposed route. These include crossings of Main Rivers, and several large Ordinary Watercourses as well as many other crossings of Internal Drainage Board (IDB) rhynes, smaller drainage channels and ditches. The Ordinary Watercourses mentioned in **Tables 2.10** and **2.11** represent key locations along the route and are termed within this study, along with the Main Rivers crossed, as 'Principal Watercourses'.

2.13.11 Watercourses would be crossed using temporary culverts for the most part, with some bridges and HDD, or options for bridges or HDD on other crossings. A Crossings Schedule is provided in **Volume 5.23.5.2, Appendix E**.

2.13.12 For the smaller watercourse crossings, the design of the culverts has been based, as far as possible, on the following criteria identified in consultation with the Environment Agency (EA), IDBs and Natural England (NE):

- site surveys of ditch dimensions;
- likely loading conditions; and
- the following specifications:
  - no multiple pipes;
  - minimal disturbance to the banks;
  - no excavation or concrete bedding where possible;
  - no concrete surround;
  - use of a batter for headwalls;
  - 450mm minimum diameter; and
  - optimised pipe sizes.

2.13.13 The culvert sizing would be checked at detailed design phase to ensure that the culverts can convey the existing channel capacity with an afflux of less than 100mm. This will ensure that there are minimal hydraulic losses due to the culvert.

2.13.14 Culvert length is based on the width of the haul road, plus 1m on either side. Thus, on the overhead line sections where haul roads are 4m wide the culverts would be 6m long and on the underground cables sections where haul roads are 7m wide culverts would be 9m long. The length of watercourse subject to temporary culverting is calculated on this basis.

2.13.15 Within Flood Zone 3 there are 166 culverts on the overhead line section (making a combined length of 996m), plus 31 culverts on the underground cables section (279m combined length). The total length of culvert is therefore estimated to be around 1275m in Flood Zone 3.

2.13.16 Where a watercourse crossing is considered too large for a culvert to provide sufficient conveyance, a temporary single span bridge would be installed.

2.13.17 The Main River crossings and larger non-main river crossings are detailed in **Table 2.10**. Most bridges will be of the temporary 'bailey bridge' type as shown in drawing 13/NG/0225 with a span of up to 40m. **Table 2.10** lists only Principal Rivers (includes Main and non-main rivers) where there is either a temporary or permanent river crossing proposed to be put in place. It is not a list of all Main

Rivers along the route. For example, King's Sedgemoor Drain, River Huntspill, River Brue, Drove Rhyne and the River Avon (all Main Rivers) would be over-sailed by the overhead line only; the haul road would not cross the watercourse and so no structure would be required.

2.13.18 At the River Axe two options are included within the DCO; via a permanent cable bridge or by Horizontal Direct Drilling (HDD) under the river. The final design is dependent upon detailed cable design following appointment of a contractor. Both options have been considered; however only the cable bridge presents any potential increase in flood risk. The proposed River Axe cable bridge is shown in drawing 13/NG/0244 with a span of 34m.

2.13.19 Cables will cross over the Towerhead Brook and not be drilled or ducted under it. However, it is not yet confirmed whether this cable crossing and the permanent road over Towerhead Brook will be by open span bridge (drawing 13/NG/0246) with a span of 8m, or by a 3000x1800mm box culvert (drawing 13/NG/0245).

2.13.20 The drawings referred to in the last two paragraphs are provided in **Volume 5.23.5.2, Appendix E**. All temporary and permanent crossings of these principal watercourses would have soffits at 600mm above the 'maximum flood level', to be defined as the 1 in 100 (1%) annual probability flood level. See the Crossings Schedule (also in **Volume 5.23.5.2, Appendix E**) for details of channel dimensions and section 7 of this FRA for mitigation details.

Table 2.10 Crossing Details for Principal Rivers

Route Section	River Name	Grid Reference	Proposed Development Component	Haul Road Crossing Reference	Type
B	Old River Axe (Ordinary Watercourse)	337402 153512	400kv Overhead line	400-UG-CR08	Bridge 13/NG/0225
B	River Axe (Cable Bridge)	337945 154906	400kV underground cable via HDD under river or Cable Bridge	400-UG-CR21.	Bridge 13/NG/0244
B	Mark Yeo River	337347 150900	400kV Overhead line	C-LD10-CR16 (temporary bridge)	Bridge 13/NG/0225
C	Lox Yeo River	339885 157822	400kV underground cables via HDD	400-UG-CR45	Bridge 13/NG/0225
D	Towerhead Brook (Ordinary Watercourse)	341168 159746	400kV underground cable via Cable Bridge	400-UG-CR56 and 400-UG-CR57 (temporary bridge)	13/NG/0246 for bridge span of 8m Or 13/NG/0245 for box culvert 3000x1800mm

Route Section	River Name	Grid Reference	Proposed Development Component	Haul Road Crossing Reference	Type
D	Congresbury Yeo River	341563 164837	400kV Overhead line	C-LD53-CR04	Bridge 13/NG/0225
D	Black Ditch Rhyne	343202 168798	400kV Overhead line	C-LD70-CR07	Bridge 13/NG/0225
D	Middle Yeo River (Tickenham Boundary Rhyne) (Ordinary Watercourse)	346186 171314	400kV Overhead line	C-LD78-CR02	Proposed dimensions of box culvert 1390mm x 990mm
D	Land Yeo River	345904 171731	400kV overhead line, 132kV W Route via HDD	W Route-CR07	Bridge 13/NG/0225
F	Sandy Rhyne	349518 175516	400kV overhead line	C-LD95-CR01	Bridge 13/NG/0225

Table 2.11 Fluvial Flood Modelling at Principal Watercourse Crossings

Route Section	River Name	Grid Reference	Model Node Reference	Fluvial Flood Level (mAOD)		
				1 in 10 annual probability (10%)	1 in 25 annual probability (4%)	1 in 100 annual probability (1%)
B	Old River Axe (Ordinary Watercourse)	337402 153512	Loop08	5.727	5.821	5.956
B	River Axe (Cable Bridge)	337945 154906	AXE034ds	5.745	5.843	5.984
C	Lox Yeo River	339885 157822	No fluvial modelling available			
D	Towerhead Brook (Ordinary Watercourse)	341168 159746	No fluvial modelling available			
D	Congresbury Yeo River	341563 164837	CY06132	Not available	7.112	7.148
D	Black Ditch Rhyne	343202 168798	No fluvial modelling available			

Route Section	River Name	Grid Reference	Model Node Reference	Fluvial Flood Level (mAOD)		
				1 in 10 annual probability (10%)	1 in 25 annual probability (4%)	1 in 100 annual probability (1%)
D	Middle Yeo River (Tickenham Boundary Rhyne) (Ordinary Watercourse)	346186 171314	TICK_3429-C	Not available	Not available	4.682
D	Land Yeo River	345904 171731	LAND_8105-B	Not available	Not available	10.034
F	Sandy Rhyne	349518 175516	No fluvial modelling available			

Underground Cable Trenching

2.13.21 It is proposed that the underground cables will be placed in four parallel trenches as indicated in drawing 13/NG/0204 (in **Volume 5.23.5.2, Appendix E**). These will be cut to at least 1.1m deep (to accommodate a protective tile above the cable). The underground cables will mostly be placed within sections of the route within Flood Zone 1, although there are exceptions near to the River Axe, west of Nailsea and within Route Sections F and G where areas within Flood Zone 3 are crossed.

Construction Overview

2.13.22 **Tables 2.12** to **2.20** provide an overview of the temporary works by Route Section. Within each table the location of the temporary works is shown in relation to the fluvial flood zones. Volumes of spoil are based on haul road length and an assumed width of 4m where overhead line and 7m where underground. Conservatively, it is assumed that 300mm depth is excavated.

Table 2.12 Overview of Route Section A Construction

Flood Zone	Flood Zone 3	Flood Zones 1 and 2
Length of haul road (km)	1.8	2.0
Area of haul road (m2)*	8,755	8,080
Number of Compounds	1	
Name of Compound	Bridgwater Tee (Bath Road)	
Area of Compounds (ha)	2.03	

Flood Zone	Flood Zone 3	Flood Zones 1 and 2
Number of Culverts	7	
Total length of culvert (m)	42	
Number of Bridges	0	
Volume of Spoil (Haul Roads) (m3)	2,626	2,424
Volume of Spoil (Compounds) (m3)	6,091	

*assuming overhead lines sections of haul road are 4m wide and underground cable sections of haul roads are 7m wide

Table 2.13 Overview of Route Section B Construction

Flood Zone	Flood Zone 3	Flood Zones 1 and 2
Length of haul road (km)	16.1	3.2
Area of haul road (m2)*	70,408	13,049
Number of Compounds	3	0
Name of Compound	South of the Mendip Hills (Hams Lane) A38 Bristol Road (Overhead Lines) A38 Bristol Road (Underground)	
Area of Compounds (ha)	6.66	0
Number of Culverts	82	1
Total length of culvert (m)	528	6
Number of Bridges	28	2
Volume of Spoil (Haul Roads) (m3)	21,122	3,915
Volume of Spoil (Compounds) (m3)	19,976	0

*assuming overhead lines sections of haul road are 4m wide and underground cable sections of haul roads are 7m wide

Table 2.14 Overview of Route Section C Mendip Hills AONB Construction

Flood Zone	Flood Zone 3	Flood Zones 1 and 2
Length of haul road (km)	0.1	6.2
Area of haul road (m2)*	743	43,106
Number of Compounds	0	2
Name of Compound		Barton Road Castle Hill
Area of Compounds (ha)		3.50
Number of Culverts	1	26
Total length of culvert (m)	9	234

Flood Zone	Flood Zone 3	Flood Zones 1 and 2
Number of Bridges	1	1
Volume of Spoil (Haul Roads) (m3)	223	12,932
Volume of Spoil (Compounds) (m3)	0	10,509

*assuming overhead lines sections of haul road are 4m wide and underground cable sections of haul roads are 7m wide

Table 2.15 Overview of Route Section D Somerset Levels and Moors North Construction

Flood Zone	Flood Zone 3	Flood Zones 1 and 2
Length of haul road (km)	18.1	4.8
Area of haul road (m2)*	76,012	31,902
Number of Compounds	2	4
Name of Compound	Sandford AT Route Overhead Lines Church Lane	Towerhead Road Sandford Substation Engine Lane Nailsea
Area of Compounds (ha)	1.93	7.33
Number of Culverts	85	4
Total length of culvert (m)	522	33
Number of Bridges	19	1
Volume of Spoil (Haul Roads) (m3)	22,804	9,571
Volume of Spoil (Compounds) (m3)	5,792	21,986

*assuming overhead lines sections of haul road are 4m wide and underground cable sections of haul roads are 7m wide

Table 2.16 Overview of Route Section E Tickenham Ridge Construction

Flood Zone	Flood Zone 3	Flood Zones 1 and 2
Length of haul road (km)	0	4.9
Area of haul road (m2)*	0	34,489
Number of Compounds	0	3
Name of Compound		Clevedon Road Caswell Hill Whitehouse Lane
Area of Compounds (ha)	0	1.94

Flood Zone	Flood Zone 3	Flood Zones 1 and 2
Number of Culverts	0	1
Total length of culvert (m)	0	9
Number of Bridges	0	0
Volume of Spoil (Haul Roads) (m3)	0	10,346
Volume of Spoil (Compounds) (m3)	0	5,805

*assuming overhead lines sections of haul road are 4m wide and underground cable sections of haul roads are 7m wide

Table 2.17 Overview of Route Section F Portishead (Preferred Route (Option A))Construction

Flood Zone	Flood Zone 3	Flood Zones 1 and 2
Length of haul road (km)	0.1	0.7
Area of haul road (m2)*	560	4,760
Number of Compounds	1	0
Name of Compound	Sheepway	
Area of Compounds (ha)	0.89	0
Number of Culverts	5	0
Total length of culvert (m)	45	0
Number of Bridges	2	1
Volume of Spoil (Haul Roads) (m3)	168	1,428
Volume of Spoil (Compounds) (m3)	2,670	0

*assuming overhead lines sections of haul road are 4m wide and underground cable sections of haul roads are 7m wide

Table 2.18 Overview of Route Section F Portishead (Alternative Route (Option B))Construction

Flood Zone	Flood Zone 3	Flood Zones 1 and 2
Length of haul road (km)	2.5	1.4
Area of haul road (m2)*	17,036	7,925
Number of Compounds	1	1
Name of Compound	Sheepway	BW Underground Route West
Area of Compounds (ha)	0.89	0.62
Number of Culverts	10	0
Total length of culvert (m)	75	0
Number of Bridges	2	0
Volume of Spoil (Haul Roads) (m3)	5,111	2,377
Volume of Spoil (Compounds) (m3)	2,670	1,867

*assuming overhead lines sections of haul road are 4m wide and underground cable sections of haul roads are 7m wide

Table 2.19 Overview of Route Section G Avonmouth Construction

Flood Zone	Flood Zone 3	Flood Zones 1 and 2
Length of haul road (km)	6.1	1.4
Area of haul road (m2)*	34,579	8,343
Number of Compounds	3	2
Name of Compound	Kings Weston Lane G Route Underground (East of M49) Seabank (Severn Road)	St Andrews Road (BW Underground Route East Option A only)
Area of Compounds (ha)	2.7	1.1
Number of Culverts	24	0
Total length of culvert (m)	177	0
Number of Bridges	5	0
Volume of Spoil (Haul Roads) (m3)	10,374	2,503
Volume of Spoil (Compounds) (m3)	8,260	3,312

*assuming overhead lines sections of haul road are 4m wide and underground cable sections of haul roads are 7m wide

Table 2.20 Overview of Route Section H Construction

Flood Zone	Flood Zone 3	Flood Zones 1 and 2
Length of haul road (km)	1.2	0.8
Area of haul road (m2)*	4,666	3,116
Number of Compounds	0	0
Name of Compound	N/A	N/A
Area of Compounds (ha)	0	0
Number of Culverts	1	1
Total length of culvert (m)	6	6

Flood Zone	Flood Zone 3	Flood Zones 1 and 2
Number of Bridges	0	0
Volume of Spoil (Haul Roads) (m3)	1,400	935
Volume of Spoil (Compounds) (m3)	0	0

*assuming overhead lines sections of haul road are 4m wide and underground cable sections of haul roads are 7m wide

2.14 National Policy Statements

2.14.1 The National Policy Statements on energy infrastructure (DECC, 2011) are the primary policy documents that Nationally Significant Infrastructure Projects (NSIP) must comply with. For the Proposed Development the relevant National Policy Statements are:

- Overarching National Policy Statement for Energy (Ref.2.11).
- National Policy Statement for Electricity Networks Infrastructure (Ref.2.12).

2.14.2 The main requirements related to flood risk are covered in EN-1 (Section 5.7, EN-1). Flood risk also needs to be considered within the context of the PPG on Flood Risk and Coastal Change which replaced PPS25.

2.14.3 In addition to the specific flood risk requirements there are additional requirements related to applying principles of “good design” (Section 4.5, EN-1) covering sustainable drainage and flood resilience and resistance.

2.14.4 EN-1 also makes reference to the need to consider climate change adaptation (Section 4.8, EN-1) with the following aspects specifically identified:

- resilience to changes in the hydrological cycle;
- sensitivity to extreme climate change scenarios;
- adaptive capacity; and
- consequential impacts of adaptive measures on flood risk elsewhere.

2.14.5 Within EN-5, resilience to climate change in the context of flood risk posed to a particular development (and impact from the development) is also a key consideration.

2.14.6 **Volume 5.23.5.2, Appendix B** includes a summary of the main requirements of EN-1 and EN-5 related to flood risk, along with a summary commentary of how these requirements have been considered within the full suite of FRAs.

2.15 Local Development Documents

2.15.1 The local development documents have been taken into account in this FRA and provide a local context for how flood risk is considered along the proposed route, although these do not form the final basis for decision making with regard to development consent for the Proposed Development.

2.15.2 Key policies related to consideration of flood risk for each Local Authority area along the proposed route are identified below. The local authorities are listed according to their administrative areas by Route Section from A to H.

Sedgemoor District Council

2.15.3 Within the Sedgemoor District Council's Core Strategy (Ref.2.13), Policy D1 sets out the requirements of the Sequential Test for applicants:

"to demonstrate that there are no reasonably available alternative sites at lower flood risk within a defined area of search where the proposed development could be sited. For the purposes of the Sequential Test the area of search will be the Sedgemoor District area unless:

- *It can be demonstrated that the development has a specific locational requirement based on functional requirements or to meet a demonstrable specific local need, in which case the area of search should reflect this…"*

North Somerset Council

2.15.4 North Somerset Council's Core Strategy adopted in April 2012 (Ref.2.14) sets out policy with regard to addressing flood risk and the associated impacts of climate change. The requirements set out within the Core Strategy follow the NPPF and associated Technical Guidance.

Bristol City Council

2.15.5 The Bristol Development Framework Core Strategy (Ref.2.15) identifies Flood Risk and Water Management as one of its key policies to deliver its strategic objectives. Policy BCS16 sets out the requirements of the Sequential Test for applicants:

"Development in Bristol will follow a sequential approach to flood risk management, giving priority to the development of sites with the lowest risk of flooding. The development of sites with a sequentially greater risk of flooding will be considered where essential for regeneration or where necessary to meet the development requirement of the city.

Development in areas at risk of flooding will be expected to:

- *be resilient to flooding through design and layout, and/or*
- *incorporate sensitively designed mitigation measures, which may take the form of on-site flood defence works and/or a contribution towards or a commitment to undertake such off-site measures as may be necessary,*

in order to ensure that the development remains safer from flooding over its lifetime.

All development will also be expected to incorporate water management measures to reduce surface water runoff and ensure that it does not increase flood risk elsewhere. This should include the use of sustainable drainage systems (SuDS)"

2.15.6 For the consideration of development sites outside of Flood Zone 1 the Core Strategy states:

"Where it does become necessary to consider development on land with a greater risk of flooding, development will… be expected pass the Exception Test, which assesses the development against other considerations such as its broader sustainability benefits, the use of previously developed land and the potential to make the development safe through mitigation".

South Gloucestershire Council

2.15.7 South Gloucestershire Local Plan: Core Strategy 2006 - 2027 (Ref.2.16) sets out policy addressing flood risk and the associated impacts of climate change.

2.15.8 Policy CS35 - Severnside - states that land at Severnside will be safeguarded and developed for distribution and other extensive employment uses, including energy generation. The council will continue to work with landowners, Bristol City Council, the local Enterprise Partnership (LEP) and statutory agencies to provide a strategic development approach which will help to deliver development while mitigating site constraints including flood risk, coastal protection, biodiversity, archaeology and transportation.

2.15.9 The council recognised that a strategic approach (including the necessary strategic flooding infrastructure) to managing flood risk at Severnside is required based on the completed SFRA. The strategy and funding for this infrastructure is being taken forward by the Councils and the LEP. Until this infrastructure is in place, the Council would strongly encourage that site specific FRA should be prepared and should take account of the likely cumulative impacts of further development in the area and the effect to third parties.

2.15.10 Policy CS36 relates to Proposals for Major Infrastructure Projects. In its role either as determining authority for associated development, or as consultee for applications to other bodies, the Council will seek to ensure that development makes a positive contribution to the implementation of its vision, strategic objectives and strategy for development. With regard to flood risk, the policy states that the Council would seek compliance with the following:

"The provision of flood protection measures to manage flood risk and, where feasible, deliver improvements in the locality. The provision of an assessment of anticipated impacts of the proposal on the surrounding marine and terrestrial environment and delivery of measures to manage and minimise any harm caused."

2.15.11 Within the context of Policy CS36, the National Grid Transmission Lines connecting Hinkley in Somerset with the Seabank Power Station at Avonmouth is identified as a Major Infrastructure project.

West Somerset Council

2.15.12 The West Somerset Local Plan to 2032: Revised Draft Preferred Strategy (Ref.2.17) sets out Policy EN1 - Mitigation of Impact of Hinkley Point New Nuclear Proposals. This policy states that the development of a new nuclear power station at Hinkley Point must demonstrate that adequate measures are taken to mitigate the adverse cultural, economic, environmental and social impact of the related development (both temporary and permanent and preparatory and ancillary) on the communities affected, both in the short and the longer term.

2.15.13 Policy CC2 - Flood Risk Management - states that development proposals should be located and designed so as to mitigate against, and to avoid increased flood risk to new and existing development, whilst helping to provide for the development needs of the community. Flood risk to new and existing development should be addressed through site specific FRAs, and include sustainable drainage systems design features. The Level 1 and Level 2 SFRAs provide a starting point for site specific FRAs.

2.16 Sequential Test

2.16.1 **Volume 5.2.1** describes the details of the need case and alternatives considered with regard to electricity transmission infrastructure development. This sets the wider context for the Sequential Test for the Proposed Development, which seeks to direct development towards areas of lowest flood risk.

2.16.2 As part of the application for development consent, The Sequential Test Report is provided in **Volume 5.23.5.2, Appendix A**. However, the need for the connection, the project development process, and the alternatives considered are summarised below.

Need for the Connection

2.16.3 National Grid operates the high voltage electricity transmission system in Great Britain and owns the system in England and Wales. The system operates at 400,000 and 275,000 volts, connecting the electricity generators to substations where the high voltages are transformed to lower voltages, enabling the power to be distributed to homes and businesses.

2.16.4 In September 2007, National Grid received an application for the connection of a new nuclear power station at Hinkley Point, Somerset (Hinkley Point C Power Station) to the high voltage electricity transmission system. This connection, in combination with others in the South West and South Wales and Gloucestershire, triggered the need for new transmission capacity in the region.

2.16.5 A detailed explanation of the need for the Proposed Development is contained in National Grid document 'Need Case for the South West and South Wales and Gloucestershire Regions' (National Grid 2014).

Project Development Process

2.16.6 Developing a scheme to connect Hinkley Point C Power Station to the National Grid high voltage transmission system has included the following steps:

- Strategic optioneering: to confirm the need and develop and assess strategic options that would meet the identified need, including assessment of alternative technologies, high level environmental constraints and costs and selection of the option to take forward;

- Route Corridor Study (RCS): to take account of environmental constraints and define potential areas of land or 'route corridors' for the new connection and identify the most appropriate option to meet the need;
- Initial consultation: to obtain the views of statutory bodies, other agencies and the general public on the potential route corridors;
- Back-check and review of options: to take the opportunity before corridor selection to verify whether the need case and review of strategic options remained valid in light of any changes in circumstances and consider representations received;
- Route corridor selection: to consider and evaluate which of the possible route corridors would be preferred and once identified announce the preferred corridor;
- Assessment of impact of infrastructure changes on the local electricity network and development of options to ensure electricity supplies are maintained (resulting from the proposed removal of existing 132kV overhead lines and where the Proposed Development interacts with the existing local electricity network);
- Development of draft route: develop the connection detail within the preferred route corridor and consult on this;
- Environmental Impact Assessment (EIA) Scoping Report: outline the approach and scope of the EIA for the project;
- Statutory pre-application consultation: consult statutory bodies, other non-statutory bodies and the general public on details of the proposed application, including the Preliminary Environmental Information and seeking views on specific design details;
- Consultation feedback report: review of representations received during the statutory pre-application consultation;
- Change control: Consideration of all suggestions to amend the Proposed Development following Stage 4 consultation; and
- Preparation of application and its submission for Development Consent.

Alternatives Considered

2.16.7 National Grid considered a range of options to connect the new Hinkley Point C Power Station to the transmission system and evaluated these options as part of the strategic optioneering process, which is detailed in a separate National Grid report 'Hinkley Point C Connection Strategic Optioneering Report' (Ref.2.18).

2.16.8 Options considered included the potential to upgrade the existing transmission system. However this would not meet the requirements set out in the need case and established that additional capacity would still be required.

2.16.9 Options that were compliant with the requirements of the National Electricity Transmission System Security and Quality of Supply Standard (SQSS) were assessed in more detail and two main route corridors with option Route Corridor 1 having two variants: Options 1A and 1B.

2.16.10 Route Corridor 1 Option 1A would follow the route and actually replace the existing 132kV overhead line with a 400kV overhead line so that the original line would be removed.

2.16.11 Route Corridor 1 Option 1B considered the construction of a new 400kV overhead line parallel to the existing Western Power Distribution (WPD) 132kV overhead line, either to the east or west of the existing overhead line. The existing WPD 132kV overhead line would not be removed.

2.16.12 Route Corridor 2 involved the construction of a new 400kV overhead line between Bridgwater and Seabank Substation. This route corridor aimed to avoid the paralleling of overhead lines, although this would not be possible in some locations due to environmental constraints and urban areas. The existing WPD 132kV overhead line would not be removed.

2.16.13 The RCS proposed that Route Corridor 1 Option 1A was the least environmentally constrained corridor as it would result in the replacement of an existing 132kV overhead line with a 400kV overhead line. The relatively wide corridor identified for much of the route would also allow an alignment to be identified to minimise the scale of change and impact on the environment.

Sequential Test for the Proposed Route

2.16.14 The context for the works associated with the proposed route is set within this wider context for the Proposed Development and the previously agreed strategic option to provide a connection from Bridgwater to Seabank, connecting into the existing National Grid main interconnected transmission system. Full details of the Sequential Test are contained in the Sequential Testing for the Proposed Hinkley Point C Connection Project Route Report (**Volume 5.23.5.2, Appendix A**)

2.16.15 The proposed route is located within Flood Zones 1, 2 and 3. **Table 2.21** shows the approximate length of the route within each of the Flood Zones, and the percentage of the total length that this represents.

Table 2.21 Approximate Route Length within Each Flood Zone

Flood Zone	Length in Flood Zone (km)	Percentage of Total Route Length in Flood Zone (%)
Flood Zone 1	17	29
Flood Zone 2	5	9
Flood Zone 3	35	62
Total	57	100

2.16.16 The PPG on Flood Risk and Coastal Change requires decision-makers to steer new development to areas at the lowest probability of flooding by applying a ‘Sequential Test’. Given that a significant length of the route is within Flood Zones 2 and 3 the Sequential Test must be passed. Flood Zone 2 and Flood Zone 3 in much of the area is virtually coincident so there is little or no opportunity to move from Flood Zone 3 to Flood Zone 2. To move from Flood Zones 2 or 3 to Flood Zone 1 could require major deviations and increased route length.

2.16.17 In developing an appropriate alignment within the route corridor, and in identifying locations for construction compounds, access routes and other associated works, wherever possible, locations have been chosen to minimise the flood risk. As the route is within Flood Zones 2 and 3 to reduce impacts to and from the Proposed Development, keeping the route as short as practicable reduces the risk. However, constraints, for example safety related matters with construction near overhead lines, or specific traffic management issues, necessitate locating some temporary works within Flood Zones 2 and 3.

2.16.18 In accordance with the PPG on Flood Risk and Coastal Change, only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required. As the need is for a connection between Bridgwater and Seabank there are no suitable routes that would avoid Flood Zones 2 and 3 completely, and therefore, locating most of the works within these Flood Zones is required.

2.16.19 With the proposed route crossing large areas of Flood Zone 3, including many watercourse crossings, the proposed works would be within both Flood Zone 3a and Flood Zone 3b. Flood Zone 3a is land assessed as having a 1 in 100 (1%) annual probability or greater of river flooding or 1 in 200 (0.5%) annual probability or greater of tidal flooding. Flood Zone 3b is referred to as the functional floodplain and has an annual probability of flooding of 1 in 20 (5%) or greater from either fluvial or tidal sources.

2.16.20 The Proposed Development is classified as “Essential Infrastructure” in accordance with Table 2 of PPG. Within the context of this FRA only the infrastructure specifically associated with the overhead lines and underground cables is considered. The following infrastructure, also defined as Essential Infrastructure is excluded from consideration within this FRA, but is addressed through four other FRAs (**Volumes 5.23.1 to 5.23.4**):

- two single circuit CSE compounds at Bridgwater Tee just north of Bridgwater;
- a double circuit CSE compound south of the Mendip Hills;
- a new substation at Sandford, North Somerset; and
- an extension and modifications to the existing Seabank 400kV substation 3km north of Avonmouth.

2.16.21 Table 3 of the PPG on Flood Risk and Coastal Change shows the Flood Zones and the appropriate uses within each Flood Zone. For Flood Zone 3a the requirements state:

“In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.”

2.16.22 For Flood Zone 3b the requirements state:

In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

- *remain operational and safe for users in times of flood;*
- *result in no net loss of floodplain storage;*
- *not impede water flows; and*
- *not increase flood risk elsewhere.*

2.16.23 The flood risk vulnerability classification given in Table 2 of the PPG indicates that the proposed overhead lines, underground cables and associated infrastructure would be classified as "Essential Infrastructure" defined as:

"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."

2.16.24 For those parts of the route that are within Flood Zone 1 the Sequential Test is passed. For those parts of the route that are within Flood Zones 2 and 3a there are no lower risk Flood Zones available within the preferred route corridor. Therefore, to pass the Sequential Test, it must be demonstrated that the development could remain operational and safe in times of flood.

2.16.25 For the specific lengths of the route that are within Flood Zone 3b there are the additional requirements related to: no net loss of floodplain storage; not impeding water flows; and not increasing flood risk elsewhere. Section 7.2 addresses specific mitigation measures in this regard, with section 7.4 demonstrating how mitigation measures result in there being a negligible loss of floodplain storage.

2.17 Exception Test

2.17.1 Table 3 of the PPG, reproduced here as **Table 2.22** demonstrates that the Proposed Development is appropriate within Flood Zones 1 and 2. However, where the Essential Infrastructure is proposed to be located In Flood Zones 3a or 3b an Exception Test needs to be passed.

2.17.2 The Sequential Test Report (**Volume 5.23.5.2, Appendix A**) shows how National Grid has taken a sequential approach to locating the infrastructure and how the requirements for the Exception Test have been met for the Proposed Development. Key parts of the Exception Test are summarised below to provide a context within this FRA.

Table 2.22 Flood Risk Vulnerability and Flood Zone Compatibility

Flood Risk Vulnerability Classification		**Essential Infra-structure**	**Highly Vulnerable**	**More Vulnerable**	**Less Vulnerable**	**Water Compatible**
Flood Zone	Zone 1	✓	✓	✓	✓	✓

Flood Risk Vulnerability Classification		Essential Infra-structure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
	Zone 2	✓	Exception Test Required	✓	✓	✓
	Zone 3a	Exception Test Required	×	Exception Test Required	✓	✓
	Zone 3b	Exception Test Required	×	×	×	✓

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

2.17.3 The National Planning Policy Framework, paragraph 102 (referenced from the PPG on Flood Risk and Coastal Change) describes the requirements of the Exception Test as follows:

"If, following application of the Sequential Test, 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 flood risk assessment 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.*

Both elements of the test will have to be passed for development to be allocated or permitted."

2.17.4 With regard to the first requirement, as noted above, the need for the Hinkley Point C Connection project has already been established through the *Need Case for the South West and South Wales and Gloucestershire Regions* (National Grid 2014) document that outlined the requirement for new transmission infrastructure in the region. This is as a result of the drive towards a low-carbon economy, of which Hinkley Point C forms a part. Without the new transmission infrastructure it is anticipated that by 2018 there would be insufficient transmission infrastructure for the new power generation plants to connect to. This would have a negative impact on the economy and would be detrimental to wider sustainability benefits if there is insufficient transmission infrastructure to enable new low-carbon power generation plants to connect to the transmission grid.

2.17.5 For the second requirement, this FRA considers flooding from all sources over the lifetime of the Proposed Development, taking account of the users and the impact of flooding elsewhere. The identification and assessment of flood risk is addressed in sections 4 and 5 considering construction and operational phases respectively, with climate change considerations and mitigation measures considered in sections 6 and 7 respectively.

2.17.6 EN-1 identifies the following requirements for the Exception Test:

- "*it must be demonstrated that the project provides wider sustainability benefits to the community that outweigh flood risk;*
- *the project should be on developable, previously developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously developed land subject to any exceptions set out in the technology-specific NPSs; and*
- *a FRA must demonstrate that the project will be safe, without increasing flood risk elsewhere subject to the exception below and, where possible, will reduce flood risk overall.*

Exceptionally, where an increase in flood risk elsewhere cannot be avoided or wholly mitigated, the IPC may grant consent if it is satisfied that the increase in present and future flood risk can be mitigated to an acceptable level and taking account of the benefits of, including the need for, nationally significant energy infrastructure… In any such case the IPC should make clear how, in reaching its decision, it has weighed up the increased flood risk against the benefits of the project, taking account of the nature and degree of the risk, the future impacts on climate change, and advice provided by the EA and other relevant bodies."

2.17.7 With regard to the first requirement above - providing wider sustainability benefits - this is covered by the first point of the Exception Test as set out in the NPPF.

2.17.8 With regard to the second requirement above, the proposed route closely follows where possible, other existing overhead line routes. However, the nature of the works associated with the overhead lines and underground cables, passing through rural areas, means by definition they are not on “previously developed land”. There are no routes between Bridgwater and Seabank that would enable the works to be undertaken on previously developed land other than by following the existing 132kV overhead cable route.

2.17.9 With regard to the third requirement - demonstrating that the "project" would be safe - this is covered by the second point of the Exception Test as set out in the NPPF. As noted above, the identification and assessment of flood risk is addressed in sections 4 and 5 of this FRA covering construction and operational phases, with climate change considerations and mitigation measures considered in sections 6 and 7 respectively.

2.17.10 Taking account of how the requirements of the Exception Test are expressed slightly differently within the NPPF and National Policy Statement EN-1, the remainder of this FRA seeks to address all of these requirements. However, the underlying reason for the difference in how the Exception Test requirements are expressed is due to revisions to planning policy with regard to flood risk as follows:

- **Planning Policy Statement 25: Development and Flood Risk** - Published in March 2010, this set out the Exception Test using the three main points of the Exception Test.
- **National Energy Policy Statement EN-1** - Published in July 2011, this references PPS25 with regard to many aspects of development and flood risk, and draws significantly from the Exception test as expressed in PPS25.
- **National Planning Policy Framework** - Published in March 2012 this supersedes PPS25 and removes the requirement relating to previously developed land. It is emphasised that the NPPF remains in place, but the Technical Guidance to the NPPF is now superseded by the PPG on Flood Risk and Coastal Change (March 2014).

2.17.11 Consideration of how the Sequential and Exception Tests are met is addressed specifically in section 7 of this FRA. Full details of the Sequential Test are provided in **Volume 5.23.15.2, Appendix A**.

3. FLOOD HAZARD AND RISK OVERVIEW

3.1 Introduction

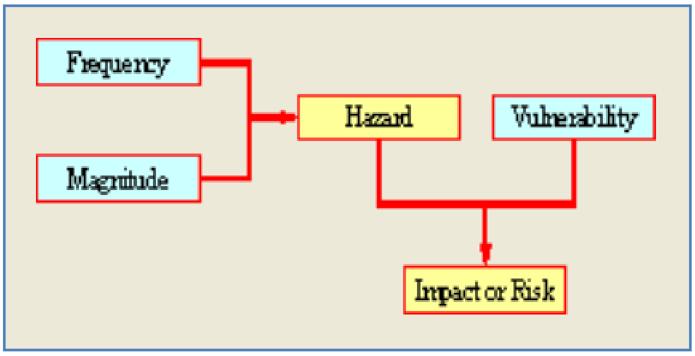
3.1.1 This section provides details of how flood hazard and risk has been assessed. It provides a high level summary of each flood risk source, the impact that each source has on the works, and the impact that the works would have on flood risk elsewhere (sections 3.2 to 3.5). Section 3.6 summarises the overview.

3.1.2 Sections 3.7 to 3.11 give further detail on how different flood sources could potentially impact the works, and the impact that the works could have on flooding elsewhere. A summary of historic flood events is also included (section 3.12).

3.1.3 Detailed assessments of the risks are provided in section 4 and section 5.

3.1.4 Flood risk is the product of the probability or likelihood of an event occurring multiplied by its consequence or severity. The hazard is usually defined as the source of the cause of damage or loss and, in this case may refer to the depth and velocity of flooding from fluvial, tidal, surface water and other sources. The realisation of damage or loss is a function of the vulnerability of the receptor i.e. the people or property being flooded. These concepts of hazard and risk are shown in **Inset 3.1**.

Inset 3.1: Flood Hazard and Risk Flow Chart



Source: European consortium ERA-NET CRUE (http://www.iiama.upv.es/roomfortheriver/home_archivos)

3.1.5 This FRA assesses the flood risks to the development and caused by the development both during the construction phase and the operational phase.

3.2 Sources of Flooding

3.2.1 The PPG on Flood Risk and Coastal Change requires that an assessment of all potential sources of flooding is undertaken. The following potential sources (hazards) have been considered:

- fluvial;
- tidal;
- surface water (pluvial);
- groundwater;
- water services (sewers and water mains); and
- reservoirs and other artificial sources.

3.2.2 For the proposed works associated with the overhead lines and underground cables, there is an important distinction to be made between construction risk and operational risk. To construct the 57km route would require construction compounds, haul roads, watercourse crossings and other elements, which, once the works are complete, would be removed. This is particularly important within the context of considerable lengths of the route being located within Flood Zone 3.

3.2.3 This section (section 3) provides an overview of the construction and operational risks related to each potential flood source (hazard) and likelihood, and for each Section (A to H) of the proposed route. The detail behind these summary findings is included in sections 4 and 5 for the operational phase and construction phase respectively.

3.3 Hazard and Risk Assessment

3.3.1 The exposure to the flood hazard and the impact on the receptors differs for the operational and construction phases. This can be exemplified by considering a pylon exposed to a fluvial flood (the hazard) in Flood Zone 3. During construction, there would be plant, excavations for foundations, equipment to be installed, and access roads, all exposed to the flood hazard. In the event of major fluvial flood the impact on these receptors could be significant, thus the risk is high. However, once the construction is completed, the pylon is completely resilient to inundation so the exposure to the same flood hazard would low. Therefore as the consequence of the impact on the receptor is low, the overall flood risk in the operational phase would be is low.

3.3.2 **Inset 3.2** shows the risk matrix used in assigning overall risk values with regard to the operational and construction phases based on the likelihood of flooding and the severity of the impact of the flooding. This matrix is used throughout the risk assessment process and is applied to both the operational and construction phases in sections 4 and 5 of this FRA.

Inset 3.2 Matrix for Assessing Risk for each Flood Source

Severity of Impact	Significant	**M**	**H**	**H**
	Moderate	**M**	**M**	**H**
	Low	**L**	**M**	**M**
	Very Low	**L**	**L**	**L**
		Low	Medium	High
		Likelihood of occurrence		

Where:

H is High Risk

M is Medium Risk

L is Low Risk

3.3.3 Whilst the hazard remains the same, the likelihood of flooding during a 5 year construction programme (or a 7 year construction programme as considered in the FRA Sensitivity Test, **Volume 5.29.2.3**) is considerably lower than the likelihood of flooding during a 40 year operational design life.

3.3.4 For example, the probability of there being a flood event greater than the 1 in 10 (10%) annual probability event during a 5 year period is 0.41 (a 41% chance), while over a 40 year operational timeframe the probability is 0.98 (a 98% chance). Taking the 1 in 100 (1%) annual probability event, the probability of an event of this magnitude occurring in a 5 year period is only 0.05 (5% chance) whereas over the 40 year timeframe the probability is 0.33 (a 33% chance). Hence the likelihood of occurrence of a 1 in 100 (1%) annual probability event is 6.6 times more likely over 40 years than it is over five (or seven) years.

3.3.5 Consideration is given to both the potential impact on the works, and the potential impact elsewhere as a result of the works. Comparing the impact between different Route Sections and for different potential flood sources, consideration is given to factors such as:

- total route length within the Section;
- total route length exposed to a particular flood hazard;
- number of watercourse crossings within the Section; and
- number and type of receptors within the Route Section - length of access roads, construction compounds etc.

3.3.6 For the severity of impact of an event, the assessment is based on the potential impact in the absence of mitigation measures. It is important to consider this potential impact prior to mitigation to ensure that appropriate mitigation measures are identified. Mitigation measures are considered in section 7 of this FRA.

3.4 Operational Phase Hazard and Risk

3.4.1 The flood hazard and flood risk during the operation phase is summarised for each Route Section in **Tables 3.1** to **3.3**.

3.4.2 **Table 3.1** shows the flood hazard that the Proposed Development is exposed to during the operational phase and **Table 3.2** the flood risk to the operational phase. **Table 3.3** shows the potential impact of the Proposed Development, when operational on other receptors, shown as the change in flood risk as a result of the operational phase.

Table 3.1 Flood Hazard to the Proposed Development - Operational Phase

Flood Source (Hazard)	**Route Section**							
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Fluvial	H	H	L	H	L	H	H	H
Tidal	H	H	N/A	H	N/A	H	H	H
Surface Water	M	M	M	M	M	M	M	M
Groundwater	L	L	L	L	L	L	L	L
Water Services	L	L	L	L	L	L	L	L
Reservoirs and other artificial sources	N/A	L	N/A	L	N/A	N/A	N/A	N/A

Table 3.2 Flood Risk to the Proposed Development - Operational Phase

Flood Source	**Route Section**							
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Fluvial	L	L	L	L	L	L	L	L
Tidal	L	L	N/A	L	N/A	L	L	L
Surface Water	L	L	L	L	L	L	L	L
Groundwater	L	L	L	L	L	L	L	L
Water Services	L	L	L	L	L	L	L	L
Reservoirs and other artificial sources	N/A	L	N/A	L	N/A	N/A	N/A	N/A

3.4.3 **Tables 3.1** and **3.2** indicate that for each Route Section there are some flood sources that present a high likelihood of exposure to the Proposed Development but that these present a low risk overall. An example would be in Section A which crosses Flood Zone 3. This presents a high likelihood of a flood event occurring over the operational life of the Proposed Development (**Table 3.1**) but a low risk (**Table 3.2**) because the pylons are resilient to inundation.

3.4.4 **Table 3.3** shows that the impact of the Proposed Development on flood risk elsewhere during the operational phase is Low because runoff from the pylons footprint is minimal.

Table 3.3 Impact from the Proposed Development - Operational Phase

Flood source	**Route Section**							
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Fluvial	L	L	L	L	L	L	L	L
Tidal	L	L	N/A	L	N/A	L	L	L
Surface Water	L	L	L	L	L	L	L	L
Groundwater	L	L	L	L	L	L	L	L
Water Services	L	L	L	L	L	L	L	L
Reservoirs and other artificial sources	N/A	L	N/A	L	N/A	L	N/A	N/A

3.5 Construction Phase Hazard and Risk

3.5.1 The flood hazard and flood risk during the construction phase is summarised for each Route Section in **Tables 3.4 to 3.6**.

3.5.2 **Table 3.4** shows the flood hazard that the temporary works are exposed to during the construction phase. **Table 3.5** shows the flood risk to the temporary works, while **Table 3.6** shows the potential impact of the temporary works on flood risk to other receptors.

Table 3.4 Flood Hazard to the Proposed Development – Construction Phase

Flood Source	**Route Section**							
	A	B	C	D	E	F	G	H
Fluvial	M	M	L	M	L	M	M	M
Tidal	M	M	N/A	M	N/A	M	M	M
Surface Water	M	M	M	M	M	M	M	M
Groundwater	L	L	M	L	M	L	L	L
Water Services	L	L	L	L	L	L	L	L
Reservoirs and other artificial sources	N/A	L	N/A	L	N/A	N/A	N/A	N/A

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3.5.3 Table 3.4 shows a lower flood hazard overall during the construction phase compared to the operational phase shown in **Table 3.1**. This is primarily due to the construction period being five years (seven years in the FRA Sensitivity Test, **Volume 5.29.2.3**) compared to the operational phase of 40 years, and hence the likelihood of an event occurring during the construction phase is considerably lower than the likelihood during its operation. For example, for Section A, the fluvial and tidal flood hazard is Medium in the construction phase compared to High during the operational phase (**Table 3.1**). This is because the probability of a 1 in 100 (1%) annual probability event occurring in a 40 year timeframe is 0.33 (a 33% chance), compared to only 0.05 (a 5% chance) during a five year construction period.

3.5.4 **Table 3.5** shows the flood risk to the proposed construction works. For example, overall in Route Section A there is a medium risk to the temporary works. Therefore, there is a need for mitigation measures to reduce the impact to the temporary works and the impact caused by the temporary works.

Table 3.5 Flood Risk to the Proposed Development – Construction Phase

Flood Source	**Route Section**							
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Fluvial	M	M	L	M	L	M	M	M
Tidal	M	M	N/A	M	N/A	M	M	M
Surface Water	M	M	M	M	M	M	M	M
Groundwater	L	L	M	L	M	L	L	L
Water Services	L	L	L	L	L	L	L	L
Reservoirs and other artificial sources	N/A	N/A	N/A	M	N/A	N/A	N/A	N/A

3.5.5 The proposed temporary works may increase the existing flood risk elsewhere by for example, increasing the impermeable areas, interrupting floodplain connectivity, or causing sediment to block drainage ditches. **Table 3.6** shows the severity of this additional flood risk from all sources on receptors elsewhere.

Table 3.6 Impact from the Proposed Development – Construction Phase

Route Section	**Fluvial**	**Tidal**	**Surface Water**	**Groundwater**	**Water Services**	**Reservoirs**
A	Low	None	Moderate	Very Low	None	None
B	Significant	None	Moderate	Very Low	None	None
C	Low	None	Moderate	Low	None	None
D	Significant	None	Moderate	Very Low	None	None
E	Very Low	None	Moderate	Low	None	None
F	Moderate	None	Moderate	Very Low	None	None
G	Moderate	None	Moderate	Very Low	None	None
H	Low	None	Moderate	Very Low	None	None

3.5.6 Where the severity of any increased risk is classed as Moderate or Significant, mitigation measures are required to reduce the impact. The impact of the hazard can be reduced by reducing the likelihood of an event occurring or by making the receptor resilient. In the case of the constructions works, the works will be made as resilient as possible. With increased flood risk elsewhere the approach is to reduce the likelihood of the hazard occurring by modifying the construction methods.

3.6 Summary of Flood Risk Overview

3.6.1 **Table 3.1** to **Table 3.6** are summarised as follows:

- The primary flood hazard to which both the operational and construction phase are exposed is fluvial and tidal flooding.
- The exposure to the fluvial and tidal flood hazards, and therefore the likelihood of an event occurring, is lower for the construction phase than for the operational phase due to the different timeframes for each phase: five years for construction (seven years in the FRA Sensitivity Test, **Volume 5.29.2.3**); 40 years for operation.
- The severity of the impact of a flood event (from any source) on the temporary works is considerably higher than the impact on the operational phase.
- The overall balance of risk between “higher likelihood, lower severity” events during the operational phase and “lower likelihood, higher severity” events during the construction phase is such that the overall flood risk is higher during the construction phase. This principle applies to both the impact on the Proposed Development and the impact resulting from the Proposed Development. This applies mainly to the access haul roads and site compounds.
- Whilst the primary exposure to flood hazard is from fluvial and tidal events, there are isolated locations within some Route Sections that are exposed to other sources of flood hazard, for which mitigation measures are required.

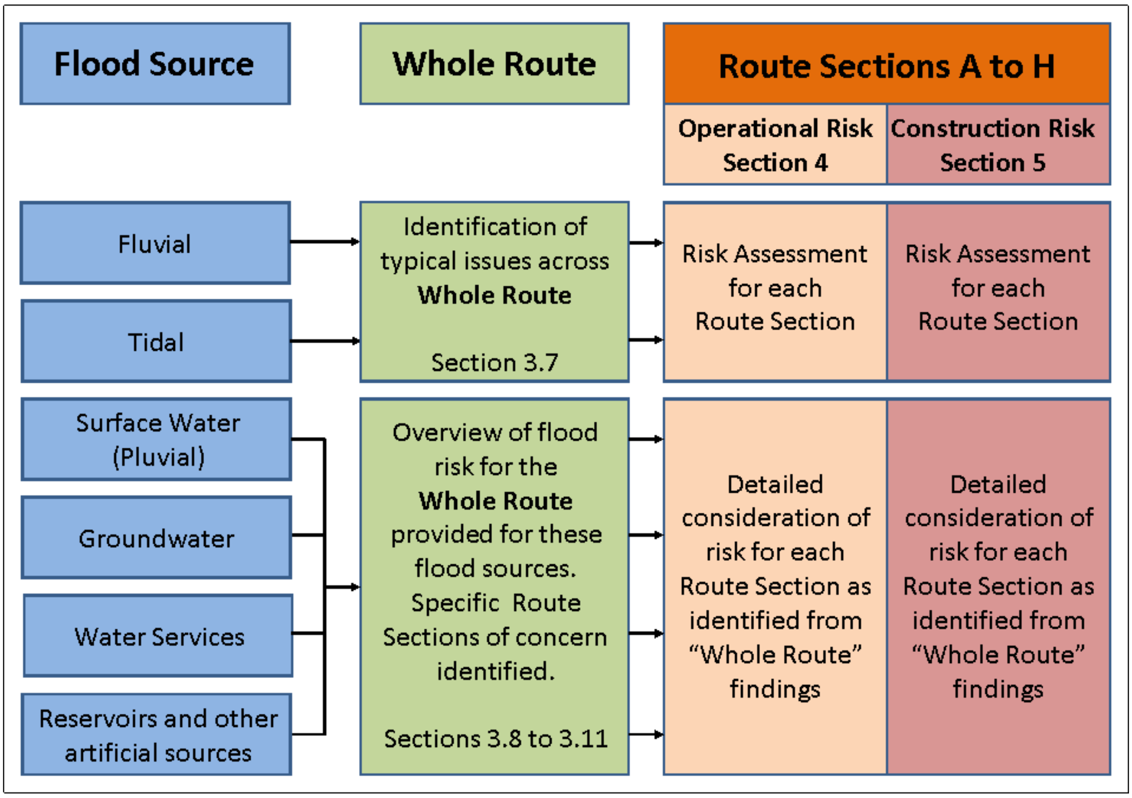
3.6.2 Given the above summary, the flood risks relating to the construction phase and operational phase are addressed separately. Section 4 addresses flood risks relating to the operational phase and section 5 addresses those relating to the construction phase.

3.6.3 Where the flood risk is broadly similar along most of the route, it is considered only once, with any exceptions noted within each Route Section.

3.6.4 This FRA applies to the 40 year life of the operational phase. Should the life of the Proposed Development be extended beyond this, the FRA should be reviewed and any necessary adaptations to the infrastructure made to accommodate the change in flood risk.

3.6.5 The structure of how flood risk is considered in detail along the route is shown in **Inset 3.3**

Inset 3.3: Consideration of Flood Risk along the Proposed Route



3.7 Fluvial and Tidal Flooding

<u>Potential Flood Risk to the Proposed Works</u>

3.7.1 The proposed route passes through all three fluvial Flood Zones with approximately 60% of the route falling within Flood Zone 3. Fluvial and tidal flood risk are considered here together as the two flood sources are closely linked. In many locations, fluvial flood risk is tidally influenced, and hence the two sources cannot be clearly separated and there is little to be gained by separating them. The EA Flood Maps show the combined tidal 1 in 200 (0.5%) annual probability and fluvial 1 in 100 (1%) annual probability flood extents. These are reproduced in **Volume 5.23.5.2, Appendix G**.

3.7.2 The topography of the route varies from the very flat and low lying areas of the Somerset Levels, through to more undulating Sections such as the route through the Mendip Hills AONB and Tickenham Ridge.

3.7.3 On the inland lower lying Sections, notably parts of Section A, all of Section B and most of Section D, the areas (largely the Somerset Levels and Moors) are exposed to both fluvial flood risk and a tidal flood risk.

3.7.4 On the higher parts of the proposed route, primarily Section A and Section E, there is no tidal flood risk, although there remains a fluvial flood risk in some locations.

3.7.5 On the Sections closer to the coast around the River Avon, the primary flood risk is from tidal flooding, although the tidal influence on fluvial flows may also be important.

3.7.6 There are three vulnerable stretches of coast which are susceptible to overtopping of the coastal defences. The Section from Weston-super-Mare south to Brean Cross Sluice (mouth of the River Axe system) could potentially affect the Proposed Development within Section D. From Portishead south westerly inland to the North East of Clevedon; along the coast from the Land Yeo, south to Congresbury Yeo; and at Weston super Mare south to Uphill Sluice.

3.7.7 The Avonmouth/Severnside SFRA (Ref.3.19) states that: 'The majority of the Avonmouth/Severnside SFRA study area is considered at high risk of flooding (Flood zone 3 – 1% AEP river flooding or 0.5% coastal flooding). If there were no tidal defences it is predicted that there would be extensive tidal flooding of the low lying land. The impact of the high tide storm condition (high tides and storms) dominates the flood zone 3 envelope in comparison to the fluvial dominated simulations.'

3.7.8 **Table 3.7** provides a summary of the key locations along the proposed route where a fluvial and/or tidal flood risk has been identified.

Table 3.7 Locations Potentially Vulnerable to Fluvial and Tidal Flooding

Route Section	Section Name	Location Description	Comment on Fluvial and Tidal Flood Risk
A	Puriton Ridge	Horsey Level, south of King's Sedgemoor Drain.	Combined fluvial and tidal flood risk. Water levels on King's Sedgemoor Drain influenced by tide levels on the River Parrett. Approximately 1km of the proposed route lies within Flood Zone 3.
B	Somerset Levels and Moors South	Somerset Levels, from just south of the Huntspill River in the south, to the River Axe in the north.	Combined fluvial and tidal flood risk. Water levels for large areas of this Route Section are influenced by tide levels and major hydraulic controls (tidal sluices) on the Huntspill River, the River Brue and the River Axe.
C	Mendip Hills AONB	Short section crossing the Lox Yeo, approximately 2km west of Winscombe.	Fluvial flood risk from the Lox Yeo River as the underground cable crosses Flood Zone 3 over a length of approximately 100m.
D	Somerset Levels and Moors North	Towerhead Brook in the south; extensive area across Somerset Levels covering almost the entire Route Section.	Combined fluvial and tidal flood risk. Water levels are influenced by tide levels and major hydraulic controls (tidal sluices) on the Oldbridge River, the River Yeo and the Blind Yeo.

Route Section	Section Name	Location Description	Comment on Fluvial and Tidal Flood Risk
E	Tickenham Ridge	Not applicable	Low fluvial and tidal flood risk
F	Portishead	East of Portishead.	Tidal flood risk across low lying areas to east of Portishead.
G	Avonmouth	Most of Section G, mainly north of River Avon.	Tidal flood risk across low lying areas located behind tidal defences. Tidal influence on River Avon.
H	Hinkley Line Entries	South and east of Hinkley Point 400kV Substation.	Combined fluvial and tidal flood risk along the East Brook and West Brook.

3.7.9 The locations described in **Table 3.7**, in many cases, cover extensive areas. The implications of the fluvial and tidal flood risk is given further consideration within the specific Route Section in sections 4 and 5 of this document for operation and construction phases respectively.

3.7.10 **The overall risk of tidal and fluvial flooding is high.** In many locations, the fluvial flood risk is tidally influenced.

Potential Impact of the Proposed Works on Flood Risk Elsewhere

3.7.11 The potential impact of the Proposed Development on fluvial flood risk elsewhere is discussed in greater detail within section 4 for the operational phase and section 5 for the construction phase. However, the main focus is on the construction phase, during which, the temporary works has the potential to increase the flood risk.

3.7.12 As an overview, the potential impacts on fluvial flood risk elsewhere are linked to the:

- loss of floodplain storage caused by the elevation of haul roads above the surrounding ground level and the stockpiling of the stripped topsoil;
- loss of floodplain connectivity caused by the compartmentalisation of the floodplain by construction haul roads and stockpiles that may create a barrier to floodplain flow; and
- reduced conveyance capacity of the drainage network caused by watercourse crossings creating a potential flow restriction.

3.7.13 There is no influence on tidal flood risk elsewhere as the presence of the works, either operational or construction phases cannot physically influence tide levels.

3.8 Surface Water Flooding

Potential Flood Risk to the Proposed Works

3.8.1 The proposed route would cross predominantly rural "greenfield" areas, pass several villages, the western edge of Nailsea, the eastern edge of Portishead and cross industrial areas of Avonmouth.

3.8.2 The low lying, flat areas of the proposed route are generally served by extensive land drainage networks. Surface water runoff from "greenfield" areas in the vicinity of the works would typically flow into the network of drainage ditches.

3.8.3 On steeper sections, there is the potential for surface water flooding to affect the works where access roads or site compounds cross natural surface water flow paths. In the event of an extreme rainfall event, flow depths or flow velocities could affect the temporary works.

3.8.4 The Flood Map for Surface Water (FMfSW) shows surface water flood mapping undertaken at a national level to provide an indication of those areas potentially vulnerable to surface water flooding based on the 1 in 30 (3.3%) and 1 in 100 (1%) annual probability rainfall events. Details from this mapping indicate that there are areas along the proposed route that may be vulnerable to surface water flooding. These are summarised in **Table 3.8**. Route Section maps showing surface water flooding are provided in **Volume 5.23.5.2, Appendix H**.

Table 3.8 Locations Vulnerable to Surface Water Flooding

Route Section	Section Name	Location Description	Comment on Flood Risk
A	Puriton Ridge	South of Puriton	Isolated areas largely confined to watercourses.
B	Somerset Levels and Moors South	Extensive areas to the east of Woolavington	Predominantly associated with field drain system
C	Mendip Hills AONB	Approximately 1km north west of Winscombe.	Proposed route is in the vicinity of a natural surface flow path in Flood Zone 1. In extreme rainfall events temporary works in this area (Castle Hill Compound) could be affected. There is potential impact downstream along this flow path if mitigation measures are not considered.
D	Somerset Levels and Moors North	Area on Nailsea Moor and Tickenham Moor approximately 1km west of Nailsea.	Proposed route crosses very low lying areas of Nailsea and Tickenham Moors with areas within the 1 in 30 (3.3%) annual probability surface water flood event extent. The area is also in Flood Zone 3.

Route Section	Section Name	Location Description	Comment on Flood Risk
E	Tickenham Ridge	North east of Stone Edge Batch.	Proposed route is in the vicinity of a natural surface water flow path in Flood Zone 1. In extreme rainfall events temporary works in this area could be affected. There is potential impact downstream along this flow path if mitigation measures are not considered.
F	Portishead	Approximately 1km east of Portishead close to the A369.	Proposed route crosses very low lying areas east of Portishead. The area is in Flood Zone 3.
F	Portishead	Portbury and Sheepway areas in the northern part of Section F, east of Portishead.	The area for the proposed route shows numerous small areas of localised surface water flooding predominantly with a 1 in 100 (1%) annual probability. The area is covered by Flood Zones 1, 2 and 3.
G	Avonmouth	All of Section G.	The area for the proposed route shows numerous small areas of localised surface water flooding some with a 1 in 30 (3%) annual probability. The area is covered by Flood Zones 2 and 3.
H	Hinkley Line Entries	Approximately 1km south east of Hinkley Point 400kV substation.	Proposed route crosses East Brook and West Brook watercourses with extensive areas nearby subject to surface water flooding. The area is in Flood Zone 3.

3.8.5 Each of the locations identified in **Table 3.8** is given further consideration within the specific Route Section in sections 4 and 5.

3.8.6 This analysis of data from the FMfSW provides a useful overview of surface water flood hazard along the entire route. In many of the flatter low lying areas the FMfSW shows small areas of ponding along the proposed route. It is possible that a localised short duration extreme rainfall event might lead to some localised flooding in these locations. However, this is unlikely to be to a very deep but there could be the possibility of 'nuisance' flooding and localised ponding to a shallow depth for short periods of time.

3.8.7 **In general, the overall risk of surface water flooding is low.** However, there are some locations where the risk is higher. These locations are specifically identified within sections 4 and 5, relating to operation and construction phases respectively.

Potential Impact of the Proposed Works on Flood Risk Elsewhere

3.8.8 The Proposed Development would include T-pylons in Sections A to F and lattice pylons in Sections G and H on the overhead line route. The T-pylons are formed of a single steel column of either 2m or 2.3m diameter, constructed on a concrete piled foundation. In addition, the Proposed Development includes the removal of the existing 132kV F route and portions of the 132kV W and G routes, including their lattice pylons and the concrete foundations for these pylons.

3.8.9 **Table 3.9** shows the calculated indicative change in impermeable area following completion of the Proposed Development. The net effect of the proposed removal of these routes and the replacement with the 400kV route would result in a small overall reduction in impermeable area as a result of the smaller total impermeable footprint of the T-pylon structures compared to the lattice pylons. The largest net reduction in impermeable area is in Flood Zone 3 as shown in **Table 3.9**.

3.8.10 Allowing for uncertainties in the exact dimensions of the lattice pylon bases along the route to be removed, it is considered that the Proposed Development when operational would have an insignificant impact on surface water runoff generation and is unlikely to have a measureable impact on flood risk.

Table 3.9 Indicative Change in Impermeable Areas

Route Section	**Indicative Change in Impermeable Area (m^2)**			
	Flood Zone 3	**Flood Zone 2**	**Flood Zone 1**	**Section Change**
A	-37	0	-22	-59
B	-74	-5	0	-79
C	0	0	-88	-88
D	-11	-4	-61	-76
E	0	0	-62	-62
F (Preferred Route (Option A))	-70	0	-17	-87
F (Alternative Route (Option B))	-58	0	-21	-79
G (Preferred Route (Option A))	+32	+12	+4	+48
G (Alternative Route (Option B))	+24	+11	0	+35
H	+8	+4	+1	+13
Net change (Preferred Route (Option A))	-152	+7	-245	
Net change (Alternative Route (Option B))	-148	+6	-253	

3.8.11 **Table 3.8** summarises the main locations along the proposed route that could be affected by surface water flooding, and therefore, there is the potential for some minor disruption at these locations, in the event that a pylon obstructs a surface water flow path. The disruption is likely to be highly localised and of little consequence.

3.8.12 Taking account of the pylon locations, the FMfSW mapping, and the design of the pylon foundations, there would at worst, be a localised (within a few metres) change in flow path, and would have no measurable impact on flood risk elsewhere.

3.8.13 Runoff from the compounds or haul roads during the construction phase does have the potential to impact on surface water flood risk elsewhere. This is particularly the case if the roads or compounds have a permeability that is lower than that of the surrounding ground and there are receptors downstream. However, measures such as constructing the haul roads with permeable materials, spacing of topsoil stock piles to minimise any disruption to natural flow paths and minimising disturbance to vegetation adjacent to haul roads would all act to mitigate the potential impact of the temporary works on flood risk elsewhere. Mitigation measures are discussed in detail in section 7.

3.9 Groundwater Flooding

Potential Flood Risk to the Proposed Works

3.9.1 A number of sources of information have been reviewed to assess the groundwater flood risk along the route. The following has been concluded:

- the SFRAs that cover the Proposed Route do not indicate that groundwater is a specific consideration along any part of the route. This includes the locations for the proposed CSE compounds and substations;
- National level, mapping has been prepared showing Areas Susceptible to Groundwater Flooding (AStGWF). Although this is high level mapping that cannot be used in isolation for the assessment of local groundwater flood risk, the absence of a clear identified groundwater flood risk is supported by the absence of any recorded groundwater flooding concerns in other related documents such as the SFRAs;
- the Defra (Ref.3.20) Groundwater Flooding Scoping Study did not reveal any records of flooding from aquifers in this area; and
- the general absence of Source Protection Zones (SPZ) along most of the Proposed Route indicates that groundwater resources in the area, often synonymous with groundwater flooding vulnerability, suggests that the risk of groundwater flooding is low.

3.9.2 Whilst the majority of the route has no SPZ, there are two locations where SPZ are identified close to the route. These are:

- Route Section C - North of the Mendip Hills where the route crosses between two SPZ (Inner Zone) to the south of the A368 just west of Sandford, although the route does not encroach on these zones.
- Route Section E – Approximately 1km north of Nailsea and north of the Land Yeo.

3.9.3 The superficial deposits along the entire route are designated as either "Secondary B" or "Secondary Undifferentiated" aquifers, or as "Unproductive Strata". "Secondary B" aquifers are predominantly lower permeability layers. The "Secondary Undifferentiated" designation is assigned where it has not been possible to attribute either category "Secondary A" or "Secondary B" to a rock type. In most cases, this is due to the variable characteristics of the rock type. The "Secondary B" and "Secondary Undifferentiated" designations apply to large parts of Sections A and B. The "Unproductive Strata" are rock layers or drift deposits with low permeability that has negligible significance for water supply or river base flow. The Unproductive Strata designation applies to large areas of Route Sections C to G.

3.9.4 The bedrock along the route largely comprises a mixture of Secondary A and Secondary B aquifer designations. "Secondary A" aquifers are permeable layers capable of supporting water supplies at a local scale, and in some cases forming an important source of baseflow to rivers. The exception to these designations is a very small area within Section E, north of Nailsea (at the same location as the SPZ Inner Zone) where the route passes over a "Principal" aquifer.

3.9.5 In the low lying, flatter parts of the proposed route, it is concluded that groundwater would not present a flood risk given the low permeability of the ground. Whilst there may be localised waterlogging issues, any flooding from groundwater emergence would be of minimal depth.

3.9.6 On the more undulating areas along the proposed route, particularly along the slopes of the Mendip Hills (Section C), and at Tickenham Ridge (Section E) where there is a greater presence of water-bearing strata the groundwater regime is different to that of the flatter low lying areas of the Somerset Levels and Moors (Sections B and D).

3.9.7 The Puriton Ridge is formed of the Lias Group stratum which is likely to have a groundwater at depth within perched sandy sub-layers. Groundwater movement is likely to be minimal given the low permeable properties of the aquifer and confined to the sandy sub layers.

3.9.8 Route Section C transects a ridge at the Mendip Hills, consisting of Carboniferous Limestones. Carboniferous limestone has high intergranular and/or fracture permeability and is classified as a Principal Aquifer. Groundwater will be restricted to fractures and may be expected to emerge at the surface as springs at the escarpment base, however, no evidence could be found of springs on the Ordnance Survey mapping. It is possible that enhanced groundwater flows may occur within the Triassic strata from the base of the ridge. This should be noted, and detailed design may be required to minimise the impact of local groundwater movement in the event that the exact line of installation intersected this type of hydrogeological regime. The underground cable design around the base of the ridge should be resistant to a rise in groundwater levels, and appropriate for saturated ground.

3.9.9 Overall, the risk from groundwater flooding is assessed as being low for the majority of the proposed route. There are isolated locations where there could be an increased risk of groundwater flooding although it is still not significant. These locations are given further consideration within the specific Route Section in sections 4 and 5 for operation and construction phases respectively.

Potential Impact of the Proposed Works on Flood Risk Elsewhere

3.9.10 Constructing any structure in the ground has the potential to disrupt groundwater flow. Thus, the impact of the pylon bases and underground cables needs to be considered.

3.9.11 Underground works can only affect flow paths in the event that:

- the water table is above the level of the underground works; and
- there is groundwater flow i.e. a hydraulic gradient across the obstruction in the ground.

3.9.12 In the low lying flat areas along the proposed route, groundwater flooding is not generally a concern. There are no records of groundwater flooding, and the areas are not identified as being important from a groundwater resource perspective.

3.9.13 The classification of soils along the proposed route, as listed in section 2 for each Route Section, indicate that the near-surface material has a relatively low permeability and groundwater flow within these strata is likely to be limited.

3.9.14 The hydraulic gradient across the pylon structures would be low as the ground is very flat and there is minimal difference in groundwater level over large distances.

3.9.15 Groundwater in the Alluvial deposits is anticipated to be 1-5m below the surface and rise following prolonged rainfall to the surface, contributing to the flooding from surface water (pluvial) and fluvial sources.

3.9.16 The foundations will disturb the top 1 - 2 metres of ground, below which the pile cap on which the pylon is bolted, is supported on piles which will be driven to a depth suitable for local ground conditions. The extent of the disruption to groundwater flow is likely to be minimal. With a typical pylon spacing of around 330m, and a maximum "obstruction" width of between 6.8m and 14.1m there would be a maximum obstruction to the flow path of between around 2% and 4% of the total flow path length. The obstruction width assumes groundwater flow perpendicular to the diagonal of the T-pylon foundation slab, for the smallest and largest slab respectively.

3.9.17 Pylon foundations are generally further than 200m from buildings. Only at four locations, Mark, Rooks Bridge, Kenn Moor (Manor Farm) and Stone-Edge Batch, are they within 140m, 80m, 130m and 110m respectively of properties. Of these, the pylons at Mark, Rooks Bridge and Kenn Moor all have the smaller foundations.

3.9.18 The impact on groundwater levels would be localised within the vicinity of the foundation base given the following conditions:

- low permeability of the near-surface soil and superficial geology;
- the spacing of the pylons relative to their foundations, and
- the shallow hydraulic gradients.

3.9.19 The potential impact of the piled foundations could manifest itself as a local rise in groundwater. However, along significant parts of the route there is an extensive land drainage network particularly across the Levels and Moors, which would control groundwater levels.

3.9.20 It is concluded that along the overhead lines route, the influence of the pylon foundations on groundwater flow and level would be minimal.

3.10 Sewer and Water Main Infrastructure Flooding

Potential Flood Risk to the Proposed Works

3.10.1 There are limited areas along the route that are served by a sewerage system. There would be, therefore, limited risk of flooding from sewers for most of the proposed route. Evidence of historic flooding from the sewerage system is limited as indicated in **Table 3.10**, although within Route Section G, sewer flooding has been reported around Avonmouth.

Table 3.10 Historic Evidence of Sewer Flooding

Route Section	Evidence	Source of Information
A	No instances of sewer flooding within 5km of the proposed route	Sedgemoor DC Level 1 SFRA (Ref.3.21)
B		
C	Sewer flooding with a flooding frequency of 1 in 10 years at Banwell, Winscombe and Sandford, all within 2km of the underground section.	North Somerset Level 1 SFRA (Ref.3.22)
D	Sewer flooding with flooding reported at Congresbury and Yatton, 2km to the east of the proposed route and an incidence with a flooding frequency of around 1 in 10 years west of Nailsea within 400m of the route.	
E	No reports identified.	
F	No reports identified.	
G	No reports identified. No reports identified Sewer flooding west of Avonmouth railway station at Gloucester Road, Meadow Street and Clayton Street. The 400kV overhead line passes directly over Gloucester Road.	South Gloucestershire Level 1 SFRA (Ref.3.23) Bristol City Council SFRA Avonmouth/Severnside SFRA
H	No reports identified.	Exmoor Park National Authority and West Somerset District Council Level 1 SFRA (Ref.3.24)

3.10.2 There are also limited locations where there is a large water main and, therefore, limited risk of flooding in the event of a major burst water main.

3.10.3 In the areas where the Proposed Development is located close to urban areas, notably Nailsea, Portishead and Avonmouth, there would be an increased risk of flooding from sewers or from a burst water main. As noted in **Table 3.10** there are specific incidents of flooding in Avonmouth close to the proposed route of the 400kV overhead line. The SFRAs that cover the proposed route do not indicate that there have been any other sewer flooding incidents in areas where works are proposed.

3.10.4 No services enquiries have been undertaken in the development of this FRA as these would be out of date by the time of construction. However, services searches have been undertaken to inform the design of the Proposed Development. During the detailed design stage, further water supply and sewerage utility details would need to be obtained to identify any critical sewers and water mains close to the working areas.

3.10.5 During operation, in the event that there is a flood from either of these sources, there would be minimal impact on the overhead lines or the underground cables due to the inherent resilience of this infrastructure.

3.10.6 During construction, in the unlikely event of flood from either of these sources, there could be a minor local impact. However, the low lying flat areas of the proposed routes are served by extensive land drainage networks so the water would drain from the location with possibly localised shallow ponding. On the areas where there are steeper slopes, in the event of a localised flood event, the water would dissipate along natural flow paths dictated by the local topography.

3.10.7 Any flooding that could result from a burst water main or from a surface water sewer overflowing would be limited in both duration and extent. The impact of flooding would also be considerably less than the exposure to fluvial and tidal flooding in those areas located within Flood Zones 2 and 3. Therefore, measures taken to mitigate flooding from fluvial and tidal sources would be adequate to address the impact of flooding from water services.

3.10.8 The risk from sewer flooding or from burst water mains along the proposed route is low.

Potential Impact of the Proposed Works on Flood Risk Elsewhere

3.10.9 There is no intention to discharge water to surface water sewers during the operational or construction phase of the Proposed Development. Therefore, there is no anticipated increased risk to sewers or water infrastructure.

3.10.10 No further consideration is given to flooding from sewers or from water mains within this FRA because:

- no sewerage is being constructed as part of the operational phase works. During construction the site sewerage is self-contained. The works would have no impact on flooding elsewhere related to sewer flooding as there

- would be no discharge into the surface water or sub-surface highway drainage systems; and
- the works would have no impact on flood risk elsewhere from a burst water main occurring elsewhere.

3.11 Flooding from Reservoirs and Other Artificial Sources

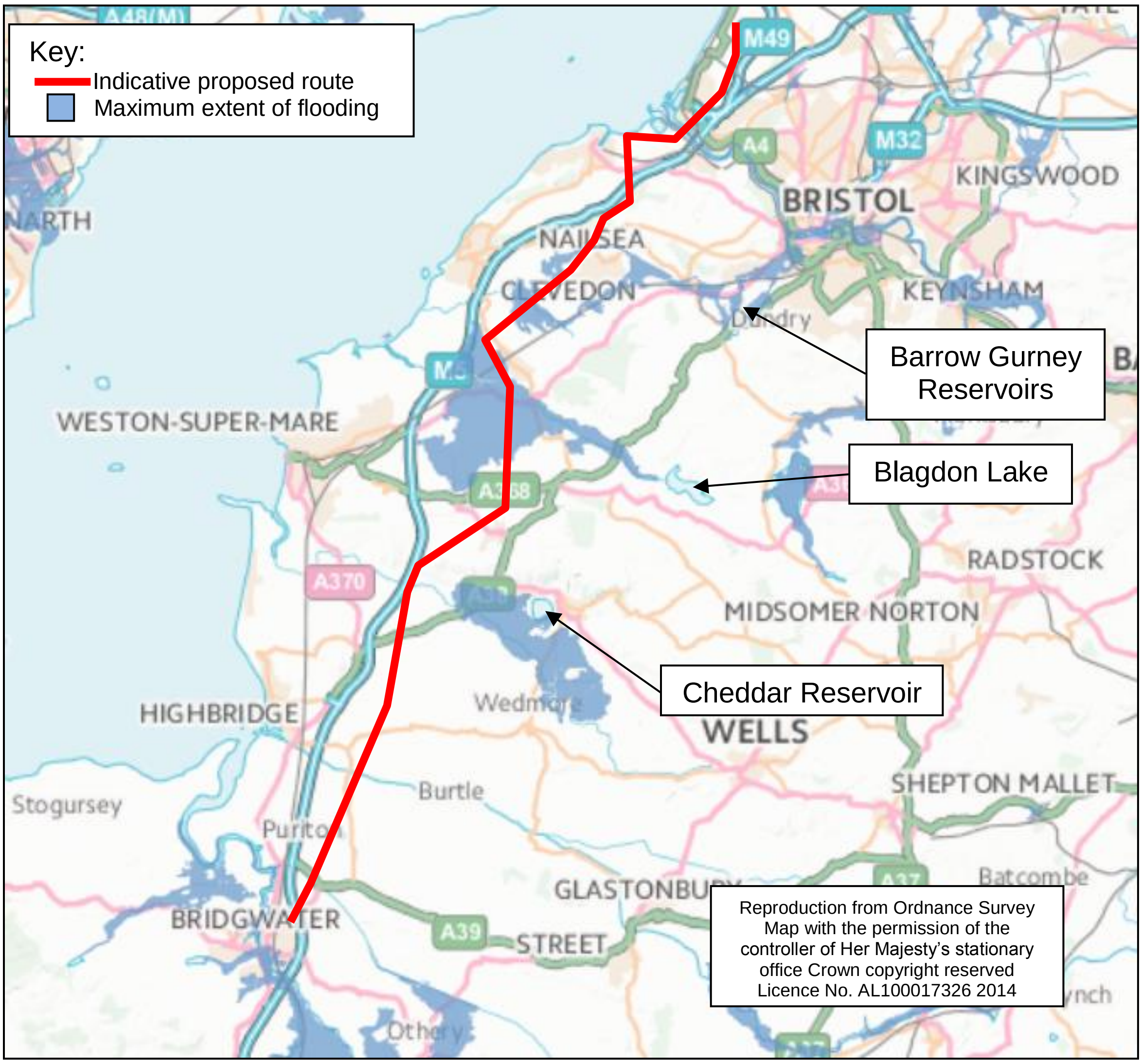
Potential Flood Risk to the Proposed Works

3.11.1 Flooding from artificial sources includes reservoirs, canals and lakes where water is retained above the natural ground level. Along the proposed route there are three reservoirs that pose a potential flood risk to the works, both during construction and during operation. These are:

- **Cheddar Reservoir** – east of the proposed route close to the northern part of Route Section B.
- **Blagdon Lake** – east of the proposed route close to the southern part of Route Section D.
- **Barrow Gurney Reservoirs** – east of the proposed route, approximately 6km south east of Nailsea, and east of Route Section D.

3.11.2 An overview of these reservoirs is shown **Inset 3.4**, along with the maximum extent of flooding based on inundation modelling following the failure of the water retaining structures.

Inset 3.4: Overview of Reservoirs along Proposed Route



3.11.3 There are no canals along the proposed route. The northern end of the Taunton to Bridgwater canal is located in Bridgwater, approximately 3km to the west and southwest of Section A, and on the west bank of the River Parrett. A breach of the canal would not impact on the Proposed Development.

3.11.4 The risk of flooding from reservoirs, canals and other artificial sources is low. However, parts of the route pass through areas anticipated to be flooded in the unlikely event of a failure of the Blagdon and Barrow Gurney Reservoirs. The flood risk from these reservoirs is considered within each specific Route Section in sections 4 and 5 for operation and construction respectively. The flood extent from the modelling of the Cheddar Reservoir does not affect the area of the proposed route.

Potential Impact of the Proposed Works on Flood Risk Elsewhere

3.11.5 The works associated with the overhead lines and underground cable route would not change the existing flood risk from reservoirs. There are no works within the vicinity of these structures and the proposed works would not influence flood levels resulting from a reservoir breach.

3.12 Historic Records of Flooding

3.12.1 The Strategic Flood Risk Assessments for the local authorities along the proposed route have been reviewed to identify major historic flood records affecting areas of the proposed route. The major flood events identified along the proposed route are listed in **Table 3.11**.

Table 3.11 Major Historic Flood Events along Proposed Route

Date	Location	Details	Source of Flooding	Source of Information
30th Jan 1607	Somerset	Known as the 'Great Flood', estimated tidal level at Kingston Seymour was 8.9mAOD. The flood covered approximately 520km^2 of land.	Tidal	North Somerset Council Level 1 SFRA
Oct/Nov 1960	Levels and Moors	Prolonged rainfall caused widespread flooding across the Levels and Moors. Floodwaters remained for approximately 86 days.	Rainfall	Sedgemoor Level 1 SFRA
1st July 1968	South West	Severe flooding caused by 5 inches of rain falling within 24 hours, including a major storm over the Mendip Hills	Rainfall	North Somerset Council Level 1 SFRA
Dec 1981	Levels and Moors	Tidal levels were the highest in the 20th century and overtopping of the sea defences took place at Pawlett, Combwich, Burnham-on-Sea. Approximately 3,570 hectares were inundated with 1,072 dwellings and commercial properties flooded (in the then 'Somerset Land Drainage District').	Tidal	Sedgemoor Level 1 SFRA
August 1997	Levels and Moors	Dramatic summer flooding not seen in Somerset since July 1968. Curry Moor, West Moor and Hay Moor suffered damage to grassland. Trapped floodwater caused vegetation to rot causing serious pollution.	Rainfall	Sedgemoor Level 1 SFRA
April 1998	Bridgwater	Tidal and fluvial flooding affecting properties, buildings and land. Number and location of properties affected unknown.	Tidal/Fluvial	Sedgemoor Level 1 SFRA

Date	Location	Details	Source of Flooding	Source of Information
2005	Congresbury	Subject to surface water flooding during heavy rain. Flooding of properties in Weetwood Road up to 18 inches deep	Surface Water	North Somerset Council Level 1 SFRA

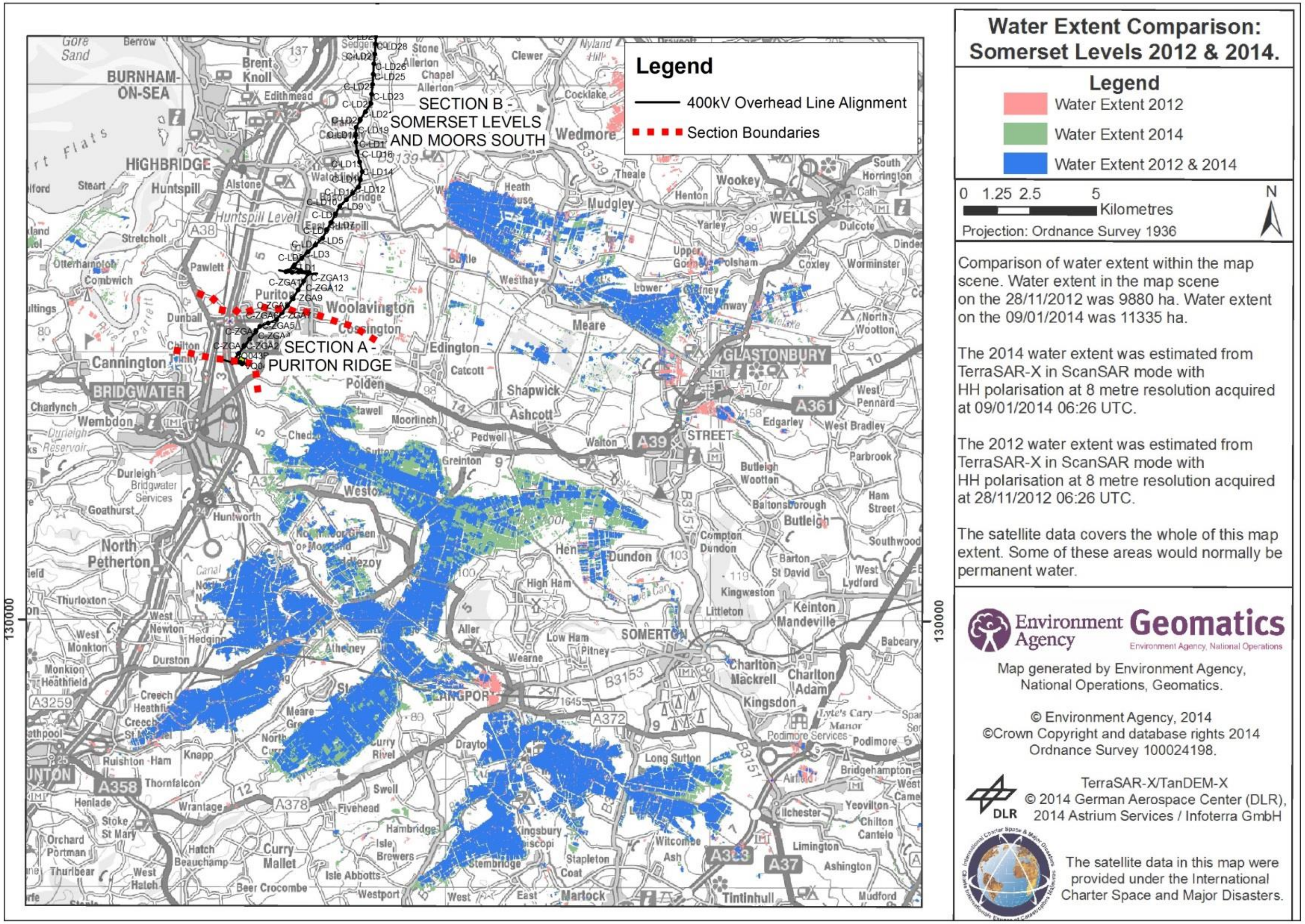
3.12.2 Fluvial and surface water flooding events during 2012 (July, August, November and December) affected large sections of Somerset following heavy rainfall across the county and surrounding areas. Flooding was most severe in the Somerset Levels between Bridgwater, Taunton, Yeovil and Glastonbury. Other areas affected by the flooding in 2012 included parts of Mid and North Somerset in close proximity to the Proposed Development, with Congresbury, Hewish, Churchill, Winscombe, Portbury and Nailsea experiencing surface water and fluvial flooding.

3.12.3 Further extensive flooding was experienced across the southern Somerset Levels and Moors and in the River Parrett catchment in January and February 2014. **Inset 3.5** (downloaded from http://www.disasterscharter.org/image/journal/article.jpg) shows recorded flood extents in both the 2012 and 2014 flood events and has been overlain with the Proposed Development route. This indicates that the Proposed Development route was not affected by flooding during either the 2012 or 2014 flood events, except a small part of the eastern edge of Route Section A, south of Kings Sedgemoor Drain.

3.12.4 The Environment Agency has confirmed that they do not have digitised historic flood extent maps that cover the area of the proposed route (due to incomplete digitising).

3.12.5 The North Somerset Levels Internal Drainage Board and Somerset Drainage Board Consortium do not have historic flood extent data or mapping. However, they did note that within rural areas managed by the IDBs it is expected that surface water in the form of shallow ponding is likely to cover the ground for some periods in most years. Therefore, there is a high likelihood of surface water flooding on an annual basis.

Inset 3.5: Historic Flood Extents with Proposed Development Route Overlaid



4. FLOOD HAZARD AND PROBABILITY – OPERATIONAL PHASE

4.1 Introduction

4.1.1 This section provides a detailed FRA of the proposed operational phase. Following the Overview (section 4.2) which provides a summary of flood risk to the proposed works and caused by the proposed works, each Section of the route from Section A to H is assessed in detail (sections 4.3 to 4.10).

4.2 Overview

Potential Flood Risk to the Proposed Operational Phase

4.2.1 The principal flood risk to the development is the combined Tidal and Fluvial flooding and Surface Water flooding. The fluvial flood zones are indicated on the appropriate flood maps in **Volume 5.23.5.2, Appendix G**.

4.2.2 The completed transmission line will only present the pylon bases within the flood zone. The pylon bases and structures are resilient to flooding being fabricated in concrete and steel for the purpose.

4.2.3 The key points to note are as follows:

- once the works are complete there is minimal flood risk because the structures are resilient to inundation and therefore the severity of the impact is low;
- the fluvial flood hazard is high in some places (FZ3);
- as noted in sections 3.7 to 3.10 Groundwater, Sewer/Water Mains, Surface water (pluvial) and Reservoir sources, both hazard and risk are low;
- within each section that follows (for each Route Section), the primary focus is on fluvial and tidal flood risk. The hazards from other sources are identified by exception where they apply e.g. Reservoirs for Section D.
- underground cables are resilient to flooding – there is no impact upon these assets as cables, jointing bays and all associated elements are resilient to flooding for prolonged periods without any negative impact on their operation;
- overhead lines and pylons are resilient to prolonged periods of inundation – there will be no impact of flooding on these assets;
- the proposed pylons are designed so that the 400kV overhead lines are suspended a minimum of 8.1m from the ground surface and 7.0m from the ground for 132kV overhead lines. Although there are a number of pylons proposed to be situated within Flood Zone 3 the minimum cable height in all cases is above the maximum flood depth and allowing for a safe clearance distance for electrical flashover including when undertaking watercourse maintenance. Where overhead lines cross Main Rivers and Ordinary watercourses, the agreed clearance is 10.9m and 8.1m respectively above the mean top of bank, based on the bank crest level in the area local to the overhead line crossing;

- the tide has significant influence on flooding across the Proposed Development area particularly influencing the fluvial risk environment due to tide-locking the watercourses. The EA Flood Maps show the combined tidal (1 in 200 (0.5%) annual probability) and fluvial (1 in 100 (1%) annual probability); and
- there are three reservoirs situated in the vicinity of the route. The Cheddar Reservoir flood inundation extent does not reach the proposed transmission line and has no impact on the route. The Blagdon and Barrow Gurney Reservoir inundation extents cross the proposed route with water depths exceeding 0.5m.

Potential Impact of the Proposed Operational Phase on Flood Risk Elsewhere

4.2.4 **Table 4.1** summarises the details contained in sections 3.7 to 3.10 with regard to the potential impact that the operational phase could have on flooding elsewhere.

Table 4.1 Potential Impact of the Proposed Works on Flood Risk

Hazard	Impact	Mitigation	Comment
Fluvial	Negligible localised	Required	Considered by specific Route Section
Tidal	No impact	None required	
Surface water	Negligible localised	None required	See section 4.2, sub-section on **Surface Water**
Groundwater	Negligible localised	Some local mitigation may be required	Considered by specific Route Section
Water utilities	No impact	None required	
Reservoirs	No impact	None required	

4.2.5 The operational phase works may give rise to an increased flood risk elsewhere as a result of the structures installed in the floodplain. The footprint of the structures is small but risk is considered for each Route Section, as detailed in sections 4.3 to 4.10 of this document.

4.2.6 The assessment of potential impacts from each flood source that could potentially be affected by the operational phase works needs to either:

(a) demonstrate that the scale or quantitative risk is minimal; or

(b) identify that it could have an impact and therefore requires mitigation.

4.2.7 This applies to surface water and groundwater as detailed below.

Surface Water

4.2.8 The steel pylon columns protruding above ground could modify surface water flow paths and lead to a slight increase in runoff volumes, however, this is likely to be a negligible change.

4.2.9 Various aspects of the design and wider considerations for the Proposed Development further minimise this risk:

- The pylons create a very small impermeable area. With no piped drainage at the base, the runoff will be dispersed and accommodated locally.
- The impermeable area is very dispersed as the typical pylon spacing is around 360m for 400kV overhead line and 275m for 132kV overhead lines.
- The impermeable area of the foundation to which the pylon base is anchored is 600mm below ground level. Therefore rainfall on to the foundation area is able to infiltrate into the top 600mm of topsoil. This applies to both T-pylon and lattice pylon foundations.
- The operational phase has fewer pylons. The net impact of this is likely to be a reduction in impermeable area. However the change in impermeable area on reducing flood risk is likely to be insignificant.

4.2.10 It is, therefore, concluded that the operational phase would have a negligible impact on surface water flood risk elsewhere.

Groundwater

4.2.11 In the low lying areas, groundwater levels in the alluvium are likely to be close to the surface or able to rise to the surface in wet winters. Groundwater levels are controlled by the network of ditches and drains that feed excess water towards the arterial river system. Where there is sufficient head, the pylon foundations may create a short term and localised increase in groundwater levels. This would soon be dissipated by the drainage system and is not considered likely to create an increased flood risk.

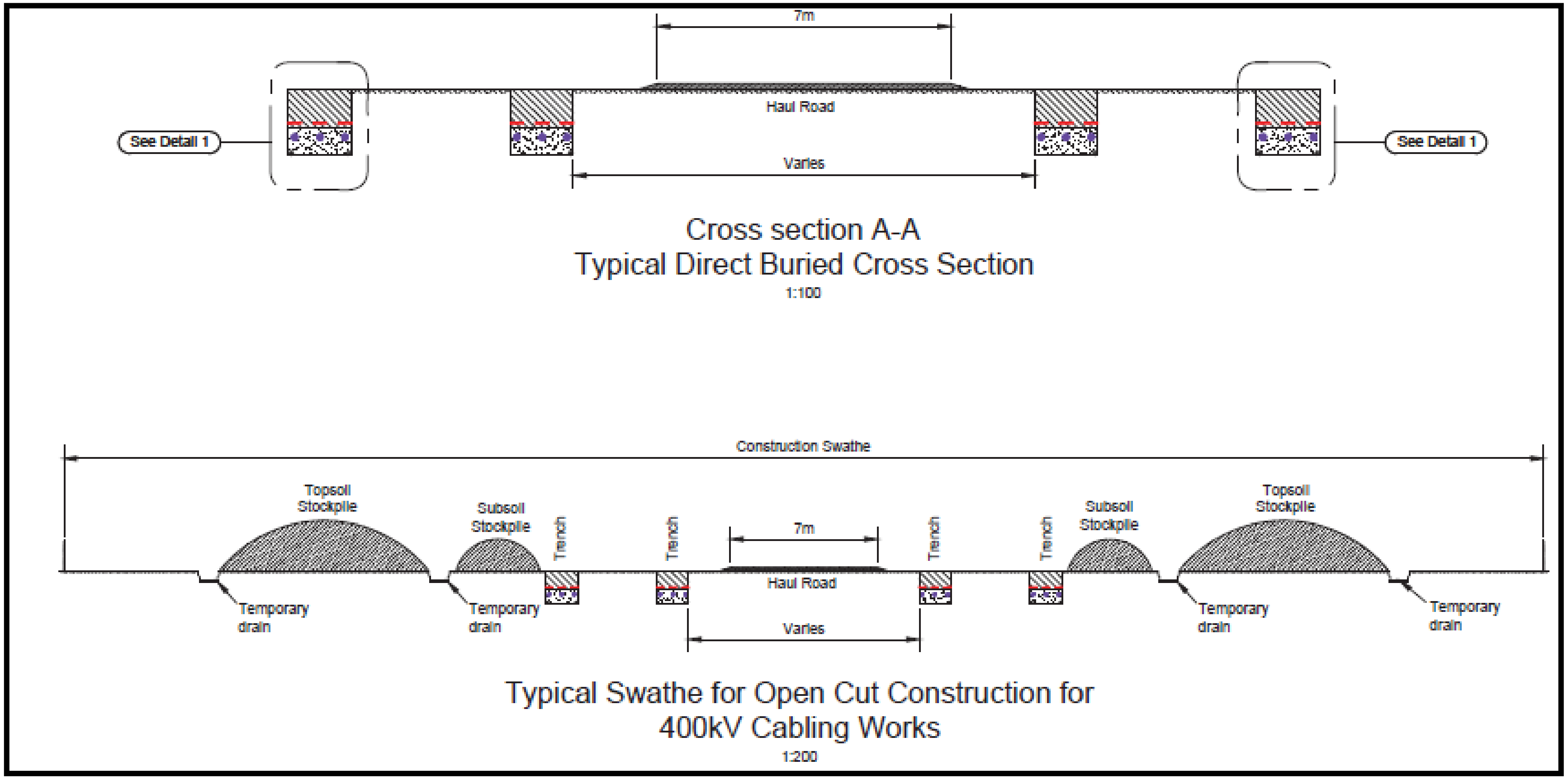
4.2.12 The impact of the underground cable sections on groundwater movement is more difficult to predict as the groundwater levels are not monitored. No impact is anticipated if the cable remains in the unsaturated zone. Where cabling is anticipated to be subject to ephemeral rises in groundwater head, the design will need to avoid major changes in permeability. This may occur in Section C and E where ridgelines are present and springs could form. In the unlikely event that they do, mitigation will be required.

4.2.13 Indicative design drawings of the underground cable trenching and ditch crossing general arrangement are available in **Volume 5.23.5.2, Appendix E**.

4.2.14 **Inset 4.1** shows a typical buried cable section. Cable trenches will usually be less than 1.8m deep. As this is similar to the depth of the drainage ditches and rhynes in the locality, there will be minimal impact on groundwater levels.

4.2.15 Throughout the majority of the route the impact of the proposed operational phase would not increase the flood risk elsewhere caused by groundwater. Exceptions to this are considered in the following sections.

Inset 4.1: Underground Cable Trenching General Arrangement



4.3 Route Section A – Puriton Ridge

4.3.1 Permanent works: installation of 10 T-pylons and removal of 24 lattice pylons

4.3.2 **Table 4.2** provides an overview of the flood hazard in Route Section A.

Table 4.2 Flood Hazard Overview of Route Section A

Flood Source	Comment
Fluvial	Flood Zone 3 south of King Sedgemoor Drain and Flood Zone 1 to the north.
Tidal	
Surface Water	Mapping shows that surface water flood extents are highly localised.
Groundwater	Low permeability and localised
Water Services	Predominantly rural area likely to have minimal infrastructure
Reservoir risk	No reservoirs identified locally

Impact of Flooding on the Operational Phase

Table 4.3 Impact of Flooding on the Operational Phase – Route Section A

Flood Source	Impact on the Development
Fluvial	No impact - Resilient structures
Tidal	No impact - Resilient structures
Surface Water	No impact - Resilient structures
Groundwater	No impact - Resilient structures
Water Services	No impact - Resilient structures
Reservoir risk	Not applicable – sites are outside modelled flood zones.

Risk Assessment to the Operational Phase

4.3.3 The assessment of flood risk from different sources potentially impacting on the operational phase for the overhead lines and underground cables is shown in **Inset 4.2**.

Inset 4.2: Flood Risk to the Operational Phase – Route Section A

Severity	Significant			
	Moderate			
	Low			
	Very Low	Groundwater Water Services	Surface Water	Fluvial/Tidal
		Low	Medium	High
		Likelihood		

4.3.4 There is variation in the likelihood of the various sources of flooding occurring, but in all cases the severity is Very Low due to the designed resilience of the Proposed Development.

4.3.5 Reservoirs are excluded from the matrix because there are no reservoirs that could impact on this Route Section in the event of a reservoir failure.

4.3.6 Therefore, overall, the risk of flooding on the operational phase related to the overhead lines and underground cables is Low.

Impact of the Operational Phase on Flood Risk Elsewhere

4.3.7 Receptors: Settlement of Puriton and agricultural land

4.3.8 **Table 4.4** identifies the impact that the proposed operational phase could have on flood risk to receptors elsewhere.

Table 4.4 Potential Impact of the Operational Phase on Flood Risk Elsewhere – Route Section A

Flood Source	**Impact from the Development**	**Comment**	**Flood Risk Mitigation**
Fluvial	No measureable change	Minimal change in floodplain volume due to space taken up by 2m diameter T-pylon columns on the floodplain (and removal of lattice pylons). No measureable impact given the extent of the floodplain.	None required
Tidal	No change	Works cannot physically influence tidal flood levels.	None required
Surface Water	No measureable change	Minimal change in impermeable area due to presence of T-pylons. Runoff from the impermeable pylon will infiltration into surrounding ground. No measureable effect on flood risk.	None required
Groundwater	Local increase in groundwater levels	Minor localised increase in groundwater levels around pylons however, the spacing between pylons would allow groundwater passage between pylons. Any minor local increase in groundwater levels would be regulated by the drainage ditches across the low lying areas of the route.	None required
Water Services	No change	No impact of works on any water services.	None required
Reservoirs	Not applicable	Not applicable –reservoir flood inundation mapping shows none affects this Route Section.	None required

4.3.9 The assessment in **Table 4.4** of the impact of the Proposed Development on flood risk elsewhere indicates that the risk is almost unchanged and highly localised to the pylon bases. This increased risk would occur from displacement by the pylon footings. If the soils arising from the construction of the pylon foundations are left on site this would be a small increase in risk. If the soils arising are removed there would only be the displacement of the pylons column itself. No Mitigation is required.

4.4 Route Section B – Somerset Levels and Moors South

4.4.1 Permanent works: installation of 40 T-pylons and 2 lattice pylons and underground cable; installation of a cable bridge over the River Axe and removal of 57 lattice pylons.

4.4.2 **Table 4.5** provides an overview of the flood hazard in Route Section B.

Table 4.5 Flood Hazard Overview of Route Section B

Flood Source	Comment
Fluvial	This Section includes areas in all three fluvial flood zones.
Tidal	
Surface Water	National mapping of surface water flooding shows apart from in the Woolavington district, it is largely confined to close proximity to the field boundary rhynes
Groundwater	Groundwater likely to be close to the surface
Water Services	Other than Mark and Rooks Bridge, the area is predominantly rural with minimal infrastructure
Reservoir risk	Mapping shows that failure of Cheddar Reservoir would not impact on Section B.

Impact of Flooding on the Operational Phase

4.4.3 **Table 4.6** provides an overview of the impact of flooding on the permanent works in Route Section B.

Table 4.6 Impact of Flooding on the Operational Phase – Route Section B

Flood Source	Impact on the Development
Fluvial	No impact - Resilient structures
Tidal	No impact - Resilient structures
Surface Water	No impact - Resilient structures
Groundwater	No impact - Resilient structures
Water Services	No impact - Resilient structures
Reservoir risk	No impact - Resilient structures. The proposed construction of Cheddar Reservoir Two may result in an increase in the modelled flood extents but there is not anticipated to be an increase in the risk to the Proposed Development.

Risk Assessment to the Operational Phase

4.4.4 The assessment of flood risk from different sources potentially impacting on the permanent works for the overhead lines and underground cables is shown in **Inset 4.3**.

Inset 4.3: Flood Risk to the Operational Phase – Route Section B

Severity	Significant			
	Moderate			
	Low			
	Very Low	Groundwater Reservoir Water Services	Surface Water	Fluvial/Tidal
		Low	Medium	High
		Likelihood		

4.4.5 There is variation in the likelihood of the various sources of flooding occurring, but in all cases the severity is very low due to the designed resilience of the Proposed Development.

4.4.6 Environment Agency mapping of the impact of a failure of the Cheddar Reservoir shows that flood water does not reach the transmission line and has no impact on the route. Therefore, overall, the impact of flooding on the permanent works related to the overhead lines and underground cables is Low.

Impact of the Operational Phase on Flood Risk Elsewhere

4.4.7 Receptors: Settlements of Mark and Rooks Bridge plus agricultural land and dispersed properties.

4.4.8 **Table 4.7** shows how the Proposed Development could potentially impact flood risk elsewhere.

Table 4.7 Potential Impact of the Operational Phase on Flood Risk Elsewhere – Route Section B

Flood Source	**Impact from the Development**	**Comment**	**Flood Risk Mitigation**
Fluvial	No measureable change	Small reduction in floodplain volume due to space taken up by T-pylon columns on the floodplain, but no measureable impact given the extent of the floodplain. At the River Axe crossing the underground cable will be brought to the surface and carried over the watercourse on a cable bridge. Elsewhere the underground cable will be buried under any watercourses which are intersected.	None required
Tidal	No change	Works cannot physically influence tidal flood levels.	None required
Surface Water	No measureable change –	Minimal change in impermeable area due to presence of T-pylons. No measureable effect. Runoff from the pylons will infiltrate around the pylon base.	None required
Groundwater	Local increase in groundwater levels	Minor localised increase in groundwater levels around pylons, however, the spacing between pylons would allow groundwater passage between pylons. Any minor local increase in groundwater levels would be regulated by the drainage ditches across the low lying areas of the route.	None required
Water Services	No change	No impact of works on any water services.	None required
Reservoirs	Not applicable	No reservoirs	None required

4.4.9 The above assessment of the impact of the Proposed Development on flood risk elsewhere indicates that the risk is almost unchanged and highly localised to the base of the pylons. No mitigation is necessary.

4.5 Route Section C – Mendip Hills AONB

4.5.1 Permanent works: installation of underground cable and removal of 22 lattice pylons.

4.5.2 **Table 4.8** provides an overview of the flood hazard in Route Section C.

Table 4.8 Flood Hazard Overview in Route Section C

Flood Source	Comment
Fluvial	Predominately Flood Zone 1 with a short section within Flood Zone 3 of the Lox Yeo River floodplain.
Tidal	Not applicable.
Surface Water	Surface water flood mapping shows extensive areas of surface water flooding close to the Lox Yeo watercourse and tributary.
Groundwater	Groundwater anticipated to be approximately 20m below the surface but may be responsive to rainfall.
Water Services	Predominantly rural area likely to have minimal infrastructure.
Reservoir risk	No reservoirs identified locally.

<u>Impact of Flooding on the Operational Phase</u>

4.5.3 **Table 4.9** provides an overview of the impact of flooding on the permanent works within Route Section C.

Table 4.9 Impact of Flooding on the Operational Phase – Route Section C

Flood Source	Impact on the Development
Fluvial	No impact – resilient underground cable
Tidal	No impact – resilient underground cable
Surface Water	No impact – resilient underground cable
Groundwater	No impact – resilient underground cable
Water Services	No impact – resilient underground cable
Reservoir risk	Not applicable – sites are outside modelled flood zones.

Risk Assessment to the Operational Phase

4.5.4 The assessment of flood risk from different sources potentially impacting on the permanent works for the underground cables is shown in **Inset 4.4.**

Inset 4.4: Flood Risk to the Operational Phase – Route Section C

Severity	Significant			
	Moderate			
	Low			
	Very Low	Groundwater Water Services Fluvial	Surface Water	
		Low	Medium	High
		Likelihood		

4.5.5 There is variation in the likelihood of the various sources of flooding occurring, but in all cases the severity is very low due to the designed resilience of the Proposed Development.

4.5.6 Therefore, overall, the impact of flooding on the permanent works related to the underground cables is low.

Impact of the Operational Phase on Flood Risk Elsewhere

4.5.7 Receptors: Agricultural land and dispersed properties.

4.5.8 **Table 4.10** provides an assessment of the impact of the permanent works on flood risk elsewhere.

Table 4.10 Potential Impact of the Operational Phase on Flood Risk Elsewhere – Route Section C

Flood Source	Impact from the Development	Comment	Flood Risk Mitigation
Fluvial	None	The underground cable will be buried under any watercourses which are intersected (e.g. Lox Yeo River).	None required
Tidal	None	Works cannot physically influence tidal flood levels.	None required
Surface Water	No measureable change	Cable will be buried with topsoil replaced. Infiltration effectively unchanged (with placement of cable and removal of pylons).	None required
Groundwater	Local increase in groundwater levels	Minor localised increase in groundwater levels up gradient of cable. However, groundwater is likely to be below cable level. Any minor local increase in groundwater levels would be regulated by the steep gradients.	None required
Water Services	No change	No impact of works on any water services.	None required
Reservoirs	Not applicable - no change	Not applicable – no reservoir flood inundation mapping affecting this Route Section.	None required

4.5.9 The assessment in **Table 4.10** of the impact of the Proposed Development on flood risk elsewhere indicates that the risk is almost unchanged. No Mitigation is required.

4.6 Route Section D – Somerset Levels and Moors North

4.6.1 Permanent works: installation of 42 T-pylons, 10 lattice pylons, 10 wooden pole supports, cable bridge over Towerhead Brook and underground cable and removal of 65 lattice pylons.

4.6.2 **Table 4.11** provides an overview of the flood hazard in Route Section D.

Table 4.11 Flood Hazard Overview in Route Section D

Flood Source	Comment
Fluvial	Tidally influenced river flooding during tide-locked conditions and overtopping of flood embankments on the main river channels.
Tidal	
Surface Water	Surface water run-off from the surrounding higher level land and as a result of tide-locked agricultural drainage networks occurs locally. Surface water mapping shows an area west of Nailsea with extensive areas flooded in a 1%-0.1% event.
Groundwater	Minor unexploited aquifer, groundwater levels not known but assume near to surface.
Water Services	Predominantly rural area likely to have minimal infrastructure
Reservoir risk	Section D lies within the flood extent of Blagdon Lake and Barrow Gurney Reservoirs

Impact of Flooding on the Operational Phase

4.6.3 **Table 4.12** shows an assessment of the impact of the flood hazards on the proposed works within Route Section D.

Table 4.12 Impact of Flooding on the Operational Phase – Route Section D

Flood Source	Impact on the Development
Fluvial	No impact – resilient structures
Tidal	No impact – resilient structures
Surface Water	No impact – resilient structures
Groundwater	No impact – resilient structures
Water Services	No impact – resilient structures
Reservoir risk	Resilient structures

Risk Assessment to the Operational Phase

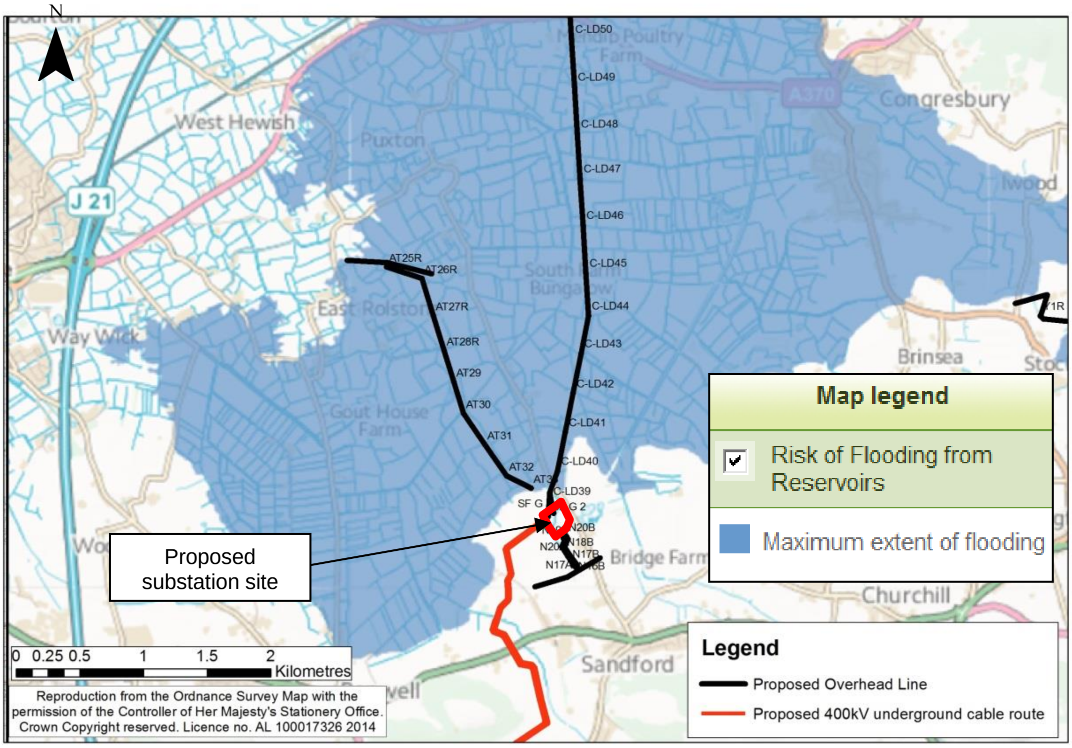
4.6.4 The assessment of flood risk from different sources potentially impacting on the permanent works within Route Section D is shown in **Inset 4.5**.

Inset 4.5: Flood Risk to the Operational Phase – Route Section D

Severity				
	Significant			
	Moderate			
	Low			
	Very Low	Groundwater Reservoirs Water Services	Surface Water	Fluvial/Tidal
		Low	Medium	High
		Likelihood		

4.6.5 Inundation modelling for the Blagdon and Barrow Gurney reservoirs undertaken by the Environment Agency shows that the route of the Proposed Development will be affected (**Inset 4.6**). The mapping shows that flood depths will be between 0.3m and 2m in the vicinity of the Proposed Development with velocities below 0.5m/s. The Environment Agency state that reservoir flooding is extremely unlikely with no loss of life recorded in the UK from reservoir flooding since 1925.

Inset 4.6: Reservoir Inundation Flood Mapping – Blagdon Lake Reservoir



4.6.6 There is variation in the likelihood of the various sources of flooding occurring, but in all cases the severity is low or very low due to the designed resilience of the Proposed Development.

4.6.7 Therefore, overall, the risk of flooding to the permanent works related to the underground cables is low.

Impact of the Operational Phase on Flood Risk Elsewhere

4.6.8 Receptors: Settlement of Tickenham, agricultural land and dispersed properties.

4.6.9 **Table 4.13** identifies the potential for the Proposed Development to increase flood risk elsewhere.

Table 4.13 Potential Impact of the Operational Phase on Flood Risk Elsewhere – Route Section D

Flood Source	Impact from the Development	Comment	Flood Risk Mitigation
Fluvial	Towerhead Bridge may impede flow. Otherwise no measureable change	At Towerhead Brook the underground cable will be brought to the surface and carried over the watercourse on a cable bridge or culvert. Elsewhere the underground cable will be buried under any watercourses which are intersected (e.g. Land Yeo River).	Mitigation required
Tidal	None	Works cannot physically influence tidal flood levels.	None required
Surface Water	No measureable change –	Cable will be buried with topsoil replaced. Infiltration effectively unchanged (with placement of cable and removal of pylons).	None required
Groundwater	Local increase in groundwater levels	Minor localised increase in groundwater levels up gradient of cable. However, groundwater is likely to be below cable level. Any minor local increase in groundwater levels would be regulated by the steep gradients. Minor localised increase in groundwater levels around pylons however, the spacing between pylons would allow groundwater passage between pylons. Any minor local increase in groundwater levels would be regulated by the drainage ditches across the low lying areas of the route.	None required
Water Services	No change	No impact of works on any water services.	None required
Reservoirs	No change	Reservoir flood inundation mapping affecting this Route Section.	None required

4.6.10 The assessment in **Table 4.13** of the impact of the Proposed Development on flood risk elsewhere indicates that the risk is almost unchanged and highly localised to the works. Mitigation is required to ensure that the Towerhead Brook crossing does not impede flows.

4.7 Route Section E – Tickenham Ridge

4.7.1 Permanent works: installation of 12 T-pylons; installation of underground cable and removal of 27 lattice pylons.

4.7.2 **Table 4.14** provides an overview of the flood hazard in Route Section E.

Table 4.14 Flood Hazard Overview for Route Section E

Flood Source	Comment
Fluvial	Flood Zone 1
Tidal	Not applicable
Surface Water	Surface water flood mapping shows minimal areas at risk.
Groundwater	Aquifer responsive to rainfall but groundwater levels anticipated to be 20m below surface.
Water Services	Predominantly rural area likely to have minimal infrastructure
Reservoir risk	No reservoirs identified locally

Impact of Flooding on the Operational Phase

Table 4.15 Impact of Flooding on the Operational Phase – Route Section E

Flood Source	Impact on the Development
Fluvial	No impact – resilient structures
Tidal	Not applicable
Surface Water	No impact – resilient structures
Groundwater	No impact – resilient structures
Water Services	No impact – resilient structures
Reservoir risk	Not applicable

Risk Assessment to the Operational Phase

4.7.3 The assessment of flood risk from different sources potentially impacting on the permanent works for the underground cables is shown in **Inset 4.7**.

Inset 4.7: Flood Risk to the Operational Phase – Route Section E

Severity	Significant			
	Moderate			
	Low			
	Very Low	Groundwater Fluvial Water Services	Surface Water	
		Low	Medium	High
		Likelihood		

4.7.4 There is variation in the likelihood of the various sources of flooding occurring, but in all cases the severity is Very Low due to the designed resilience of the Proposed Development.

4.7.5 Therefore, overall, the risk of flooding to the permanent works is Low.

Impact of the Operational Phase on Flood Risk Elsewhere

4.7.6 Receptors: Dispersed properties and agricultural land.

4.7.7 **Table 4.16** identifies how the Proposed Development impacts on flood risk elsewhere.

Table 4.16 Potential Impact of the Operational Phase on Flood Risk Elsewhere – Section E

Flood Source	**Impact from the Development**	**Comment**	**Flood Risk Mitigation**
Fluvial	None	The overhead line and underground cable are entirely in Flood Zone 1.	None required
Tidal	None	Works cannot physically influence tidal flood levels.	None required
Surface Water	No measureable change –	The route crosses an area of surface water flooding. Whilst the impact will be minimal, there is a reduction in impermeable area in this Section.	None required
Groundwater	Local increase in groundwater levels	Any minor local increase in groundwater levels would be regulated by the local ditch system.	None required
Water Services	No change	No impact of works on any water services.	None required
Reservoirs	No change	No reservoirs identified locally	None required

4.7.8 The assessment in **Table 4.16** of the impact of the Proposed Development on flood risk elsewhere indicates that the risk is effectively unchanged. No Mitigation is required.

4.8 Route Section F – Portishead

4.8.1 Permanent works: installation of 7-9 T-pylons, 0-1 lattice pylons and removal of 25-28 lattice pylons depending on route option.

4.8.2 There are two potential routes for the proposed 400kV connection in this Section. These are described as the 'Preferred Route (Option A)' and 'the Alternative Route (Option B)'. **Table 4.17** shows the flood hazards along the two routes.

Table 4.17 Flood Hazard Overview of Route Section F

Flood Source	Comment
Fluvial	Flood Zone 1 or 3 depending on route.
Tidal	
Surface Water	Mapping shows localised areas at risk from surface water flooding.
Groundwater	Low permeability alluvium.
Water Services	Heavily urban area likely to have complex arrangements of sewers and water mains.
Reservoir risk	No reservoirs identified locally.

<u>Impact of Flooding on the Operational Phase (Route Options A and B)</u>

4.8.3 The assessment of flood risk from different sources potentially impacting on the permanent works for the underground cables is shown in **Table 4.18**.

Table 4.18 Impact of Flooding on the Operational Phase – Route Section F

Flood Source	Impact on the Development
Fluvial	No impact – resilient structures
Tidal	No impact – resilient structures
Surface Water	No impact – resilient structures
Groundwater	No impact – resilient structures
Water Services	No impact – resilient structures
Reservoir risk	Not applicable

Risk Assessment to the Operational Phase (Routes A and B)

4.8.4 The assessment of flood risk from different sources potentially impacting on the permanent works for the pylons is shown in **Inset 4.8**.

Inset 4.8: Flood Risk to the Operational Phase – Route Section F

Severity	Significant			
	Moderate			
	Low			
4.8.5	Very Low	Groundwater Water Services	Surface Water	Fluvial/Tidal
		Low	Medium	High
		Likelihood		

4.8.6 There is variation in the likelihood of the various sources of flooding occurring, but in all cases the severity is Very Low due to the designed resilience of the Proposed Development.

4.8.7 Therefore, overall, the risk of flooding to the permanent works is Low.

Impact of the Operational Phase on Flood Risk Elsewhere

4.8.8 Receptors: Settlement of Portishead, agricultural land and dispersed properties.

4.8.9 **Table 4.19** identifies how the Proposed Development impacts on flood risk elsewhere.

Table 4.19 Potential Impact of the Operational Phase on Flood Risk Elsewhere – Route Section F

Flood Source	Impact from the Development	Comment	Flood Risk Mitigation
Fluvial	None	Small increase in floodplain volume due to reduction of pylons in the floodplain, but no measureable impact given the extent of the floodplain. The underground cable will be buried underneath any watercourses which are intersected (e.g. Sandy Rhyne).	None required
Tidal	None	Works cannot physically influence tidal flood levels.	None required
Surface Water	No measureable change	Route crosses area of surface water flooding. There will be a (minimal) reduction in impermeable area due to removal of pylons. However, this will have no measureable effect on flood risk.	None required
Groundwater	Local increase in groundwater levels	Any minor local increase in groundwater levels would be regulated by the local ditch system.	None required
Water Services	No change	No impact of works on any water services.	None required
Reservoirs	No change	No reservoirs identified locally	None required

4.8.10 The above assessment of the impact of the Proposed Development on flood risk elsewhere indicates that the risk is almost unchanged and highly localised to the works (the pylons). No Mitigation is required.

4.9 Route Section G – Avonmouth

4.9.1 Permanent works: installation of 38 lattice pylons (or 32 lattice pylons and 5 T-pylons); installation of underground cable and removal of 26 lattice pylons.

4.9.2 **Table 4.20** shows the flood hazards along the two routes.

Table 4.20 Flood Hazard Overview of Route Section G

Flood Source	Comment
Fluvial	Flood Zone 3
Tidal	
Surface Water	Surface water mapping shows numerous areas at risk of surface water flooding in a 30 year event.
Groundwater	Low permeability alluvium
Water Services	Heavily urban area likely to have complex arrangements of sewers and water mains
Reservoir risk	No reservoirs identified locally

<u>Impact of Flooding on the Operational Phase (Route Options A and B)</u>

4.9.3 **Table 4.21** shows the impact of flooding on the permanent works and applies to both routes.

Table 4.21 Impact of Flooding on the Permanent Works – Route Section G

Flood Source	Impact on the Development
Fluvial	No impact – resilient structures
Tidal	
Surface Water	No impact – resilient structures
Groundwater	No impact – resilient structures
Water Services	No impact – resilient structures
Reservoir risk	Not applicable

Risk Assessment to the Operational Phase (Route Options A and B)

4.9.4 The assessment of flood risk from different sources potentially impacting on the permanent works for the underground cables is shown in **Inset 4.9**.

Inset 4.9: Flood Risk to the Operational Phase – Route Section G.

Severity	Significant			
	Moderate			
	Low			
	Very Low	Groundwater Water Services	Surface Water	Fluvial/Tidal
		Low	Medium	High
		Likelihood		

4.9.5 Ground elevation on both the Preferred Route (Option A) and the Alternative Route (Option B) (apart from the crossing of the Drove Rhyne) is approximately equivalent to the 1 in 200 (0.5%) annual probability modelled tidal flood level (and confidence interval) for Node FID 48 in the River Severn 2km off Avonmouth. Therefore in the event of a 1 in 200 annual probability tidal water depths around the pylons will be minimal. However, in the combined part of Section G, apart from local high points, the proposed route is generally between 2.0m and 4.0m below the 1 in 200 (0.5%) annual probability modelled tidal flood level (and confidence interval) for Node FID 48. With the low likelihood and resilience of the pylons, the risk is still considered to be low.

4.9.6 There is variation in the likelihood of the various sources of flooding occurring, but in all cases the severity is very low due to the designed resilience of the Proposed Development.

4.9.7 Therefore, overall, the flood risk to the Proposed Development permanent works is low.

Impact of the Operational Phase on Flood Risk Elsewhere

4.9.8 Receptors: Avonmouth urban area and transport infrastructure

4.9.9 **Table 4.22** provides an assessment of the impact of the permanent works on flood risk elsewhere.

Table 4.22 Potential Impact of the Operational Phase on Flood Risk Elsewhere – Route Section G

Flood Source	Impact from the Development	Comment	Flood Risk Mitigation
Fluvial	None	Small increase in floodplain volume from a reduction of pylons in the floodplain, but no measureable impact given the extent of the floodplain. The underground cable will be buried under any watercourses which are intersected.	None required
Tidal	None	Works cannot physically influence tidal flood levels.	None required
Surface Water	No measureable change	Route crosses area of surface water flooding. Small reduction in impermeable area as a result of removal of pylons but unlikely to be a measureable reduction in flood risk.	None required
Groundwater	Local increase in groundwater levels	Any minor local increase in groundwater levels would be regulated by the local ditch system.	None required
Water Services	No change	No impact of works on any water services.	None required
Reservoirs	No change	No reservoirs identified locally	None required

4.9.10 The above assessment of the impact of the Proposed Development on flood risk elsewhere indicates that the risk is almost unchanged and highly localised to the works (the pylons). No Mitigation is required.

4.10 Route Section H – Hinkley Line Entries

4.10.1 Permanent works: installation of 13 lattice pylons and removal of 6 lattice pylons.

4.10.2 **Table 4.23** shows the flood hazards along the route.

Table 4.23 Flood Hazard Overview of Route Section H

Flood Source	Comment
Fluvial	Approximately 50% of the proposed new route is situated within Flood Zone 3, where the cables cross the East and West Brooks and Wick Moor.
Tidal	
Surface Water	Extensive areas at risk from the 1 in 30 year surface water flood
Groundwater	Secondary aquifers with no identified history of groundwater flooding
Water Services	Minimal water infrastructure as within existing Hinkley Point C Power Station.
Reservoir risk	No reservoirs identified locally

<u>Impact of Flooding on the Operational Phase</u>

4.10.3 **Table 4.24** shows the impact of flooding on the permanent works.

Table 4.24 Impact of Flooding on the Operational Phase – Route Section H

Flood Source	Impact on the Development
Fluvial	No impact – resilient structures
Tidal	
Surface Water	No impact – resilient structures
Groundwater	No impact – resilient structures
Water Services	No impact – resilient structures
Reservoir risk	Not applicable

Risk Assessment to the Operational Phase

4.10.4 The assessment of flood risk from different sources potentially impacting on the permanent works is shown in **Inset 4.10**.

Inset 4.10: Flood Risk to the Operational Phase – Route Section H.

Severity	Significant			
	Moderate			
	Low			
	Very Low	Groundwater Water Services	Surface Water	Fluvial/Tidal
		Low	Medium	High
		Likelihood		

4.10.5 The proposed route does not cross any reservoir flood extents in this Section.

4.10.6 There is variation in the likelihood of the different sources of flooding occurring, but in all cases the severity is very low due to the designed resilience of the Proposed Development.

4.10.7 Therefore, the overall impact of flooding on the permanent works related to the Proposed Development is low.

Impact of the Operational Phase on Flood Risk Elsewhere

4.10.8 **Table 4.25** assesses the flood risk caused by the Proposed Development.

Table 4.25 Potential Impact of the Operational Phase on Flood Risk Elsewhere – Route Section H

Flood Source	Impact from the Development	Comment	Flood Risk Mitigation
Fluvial	None	Small increase in floodplain volume due to reduction of pylons in the floodplain, but no measureable impact given the extent of the floodplain.	None required
Tidal	None	Works cannot physically influence tidal flood levels.	None required
Surface Water	No measureable change – reduction in impermeable area.	Route crosses area of surface water flooding. Minimal reduction in impermeable area due to reduction in pylons. No measureable effect.	None required
Groundwater	Local increase in groundwater levels	Any minor local increase in groundwater levels would be regulated by the local ditch system.	None required
Water Services	No change	No impact of works on any water services.	None required
Reservoirs	No change	No reservoirs locally	None required

4.10.9 The above assessment of the impact of the Proposed Development on flood risk elsewhere indicates that the risk is almost unchanged and highly localised to the works (the pylons). No Mitigation is required.

5. FLOOD HAZARD AND PROBABILITY – CONSTRUCTION PHASE

5.1 Introduction

5.1.1 This section provides a detailed FRA of the construction phase of the Proposed Development. Following the Overview (section 5.2) which provides a summary of flood risk to the construction phase works and resulting from the construction phase works, each Section of the route from Section A to H is assessed in detail (sections 5.3 to 5.10).

5.1.2 The division of the assessment of flood risk into individual Route Sections allows readers to identify the Route Sections that they are most interested in. This may be particularly of use to Local Authorities and the IDBs.

5.2 Overview

5.2.1 The construction phase requires installation of access haul roads, temporary watercourse crossings and site compounds to enable positioning of plant and materials for construction. The roads and compounds will require topsoil to be stripped and the temporary stockpiling of arising soils. All temporary works are assumed to be in place for the duration of the construction phase. Initially, this was assessed at five years; the revised construction programme, assessed in the FRA Sensitivity Test **(Volume 5.29.2.3)** assesses the implications of the construction phase lasting up to seven years.. The stockpiles have the potential to displace floodplain storage and impede surface water and fluvial floodplain flows.

5.2.2 It can be seen from the maps in **Volume 5.23.5.2, Appendix G** that the Flood Zone 2 and 3 cover extensive areas and that there are many watercourses throughout the route.

Potential Flood Risk to the Temporary Works

5.2.3 The key points to note are as follows:

- the highest risks to the Proposed Development occur during the construction works associated with both the overhead lines and underground cables;
- the likelihood of a flood occurring during either a 5 year or 7 year construction phase is lower than during the 40 year operational phase;
- the fluvial flood hazard is high in some locations as the route crosses fluvial Flood Zone 3;
- within each section that follows (for each Route Section), the primary focus is on fluvial and tidal flood risk. The hazard from other sources is identified by exception wherever it applies, e.g. Reservoirs for Sections B and D; and
- during the temporary works for both overhead lines and underground cables there is the potential risk of flooding.

5.2.4 When assessing the flood risk to the temporary works consideration needs to be given to the duration of the construction phase. The Institute of Hydrology (IoH) Report Number 49 (Ref.5.25) provides a means of estimating the risk of a specified return period event occurring over a short period of time, in this case the 5 year construction phase. This is calculated as:

$r = 1 - (1 - 1/T)^L$ where: r is the risk

L is the design life of the project in years

T is the return period in years

5.2.5 **Table 5.1** extracted from the IoH (Ref.5.25) Report is used to assess the probability of a chosen design flood being equalled or exceeded during the construction phase.

Table 5.1 Probability of a Design Event Occurring in a Defined Timeframe

Design Flood Event Annual Probability	**Design Life (years)**					
	2	**5**	**10**	**20**	**50**	**100**
1 in 5 (20%)	0.36	0.67	0.89	0.99	1.00	1.00
1 in 10 (10%)	0.19	0.41	0.65	0.88	0.99	1.00
1 in 20 (5%)	0.10	0.23	0.40	0.64	0.92	0.99
1 in 25 (4%)	0.08	0.18	0.34	0.56	0.87	0.98
1 in 50 (2%)	0.04	0.10	0.18	0.33	0.64	0.87
1 in 100 (1%)	0.02	0.05	0.10	0.18	0.39	0.63
1 in 200 (0.5%)	0.01	0.02	0.05	0.10	0.22	0.39
1 in 500 (0.2%)	0.00	0.01	0.02	0.04	0.10	0.18

5.2.6 The operational life of the Proposed Development is 40 years although it is recognised that overhead lines and underground cables may well be in operation beyond this timeframe. **Table 5.1** indicates that the probability of a 1 in 100 (1%) annual probability event occurring over a 50 to 100 year timeframe is 0.39 to 0.63. i.e. there is 39% and 63% chance of the 1 in 100 (1%) annual probability event occurring during a 50 year and 100 year design life respectively. This is indicated by the orange boxes in **Table 5.1**. As the temporary works will be in place for five years (seven years' results presented in the FRA Sensitivity Test **Volume 5.29.3**), to obtain a similar risk (0.39 to 0.63) a design flood event of the 1 in 5 (20%) to 1 in 10 (10%) annual probability gives a similar level of overall risk (0.41 to 0.67) as shown in the blue boxes in **Table 5.1**).

5.2.7 The design flood for which temporary works are assessed is, therefore, the 1 in 10 (10%) annual probability event. As the 1 in 10 year (10%) annual probability flood event data was not readily available, the 1 in 30 annual probability event National Flood Risk Assessment (NaFRA) outline has been adopted. This, therefore, provides a conservative approach.

5.2.8 The risk table used for each Route Section, which summarises all flood risks, takes account of this shorter period over which the risk is being assessed. As a result, the likelihood of flooding is lower compared to the same flood source during the operational phase.

5.2.9 **Fluvial and tidal** flood risk is based on the NaFRA (Ref.5.26) 1 in 30 (3%) annual probability flood extent used to define area at High risk of flooding. This shows flooding from the rivers and sea taking into account the flood defences. This is a conservative approach as the 1 in 30 annual probability flood extents are larger than the 1 in 10 annual probability flood extents. Flood levels for the 1 in 30 annual probability flood event have been estimated locally using LiDAR and are shown for each Section of the route within the fluvial floodplain.

5.2.10 **Surface water** flood risk has been assessed using the Environment Agency Flood Map for Surface Water (Ref.5.27).

5.2.11 **Groundwater** flood risk has been assessed using qualitative considerations of superficial and bedrock geology, source protection zones, borehole records (where available), soil type, Areas Susceptible to Groundwater Flooding (AStGWF) ground water emergence mapping and flood history.

5.2.12 **Reservoir** flood risk is based on the Environment Agency reservoir inundation mapping.

5.2.13 The "severity" of the impact from a particular flood source to the proposed construction works has been assessed based on the broad definitions given in **Table 5.2**.

Table 5.2 Severity of Impacts on Temporary Works

Severity	Typical Characteristics
Significant	Cessation of works, evacuation, risk to life, extensive areas affected for longer than 1 week.
Moderate	Cessation of work within parts of a Route Section, evacuation, risk to programme of less than 1 week, extensive areas affected.
Low	Some disruption to work programme, localised disruption.
Very Low	Inconvenience at a local level within a specific Route Section.

5.2.14 The assessment of "likelihood" of the event occurring is based on the following:

- High – more than 50% chance of occurring during a 5 year (seven years in FRA Sensitivity Test **Volume 5.29.2.3**) period;
- Medium – between 50% and 1% chance of occurring during a 5 year period (seven years in FRA Sensitivity Test **Volume 5.29.2.3**); and
- Low – Less than 1% chance of occurring during a 5 year period(seven years in FRA Sensitivity Test **Volume 5.29.2.3**) .

5.2.15 Where possible the allocation of a hazard to the likelihood band is determined from modelled data. However, for some hazards, the categorisation to these bands is somewhat subjective and is reliant on experienced judgement. In all cases, consideration is given to the scale of the impact. For example, taking into account the proportion of the Route Section affected.

5.2.16 The flood risk to the construction phase works, and the impacts arising from the construction phase works, are considered within the analysis for each Route Section, in sections 5.2 to 5.9.

Potential Impact of the Construction Phase Works on Flood Risk Elsewhere

5.2.17 When assessing the flood risk potentially caused by the construction phase of the Proposed Development, a number of generic impacts have been identified; these are detailed in **Table 5.3**. These are considered in detail in the detailed route sections to follow.

Table 5.3 Potential Impact of the Construction Phase Works on Flood Risk Elsewhere

Flood Source	Potential Impact of the Construction Phase Works	Comment
Fluvial	Loss of floodplain storage Compartmentalisation of the floodplain Watercourse conveyance capacity reduced by culverts or sediment	Mitigation required
Tidal	None	Works cannot physically influence tidal flood levels. No mitigation required.
Surface Water	Increased impermeable area leading to increased runoff rates and volumes Disruption of existing flow paths	Mitigation required
Groundwater	Dewatering of excavations leading to local lowering, or temporary works for excavations requiring cut-off leading to barrier to groundwater flow. Local disruption to groundwater flow paths due to piling	No mitigation required as short term and highly localised. De-watering of excavations and related design of temporary works to be addressed by contractor as part of wider environmental management during construction.
Water Services	None	No impact of works on any Sewers/water mains. No mitigation required.

Flood Source	Potential Impact of the Construction Phase Works	Comment
Reservoirs	No impact in general. Marginal loss of floodplain storage or compartmentalisation of floodplain due to temporary works	No mitigation required in general. Loss of floodplain storage is minimal. Other mitigation similar in principle to fluvial.

5.2.18 **Table 5.4** shows the definitions of the terms used to describe the severity of risks to receptors from the Proposed Development prior to mitigation.

Table 5.4 Definitions of Terms Used to Describe the Severity of Impacts to Receptors

Severity	Definition
Significant	Risk to life, evacuation required, extensive areas affected.
Moderate	Disruption to communities, possible local evacuation may be necessary.
Low	Some local disruption (for example minor road flooded, field flooded).
Very Low	Inconvenience e.g. local ponding.

5.3 Route Section A – Puriton Ridge

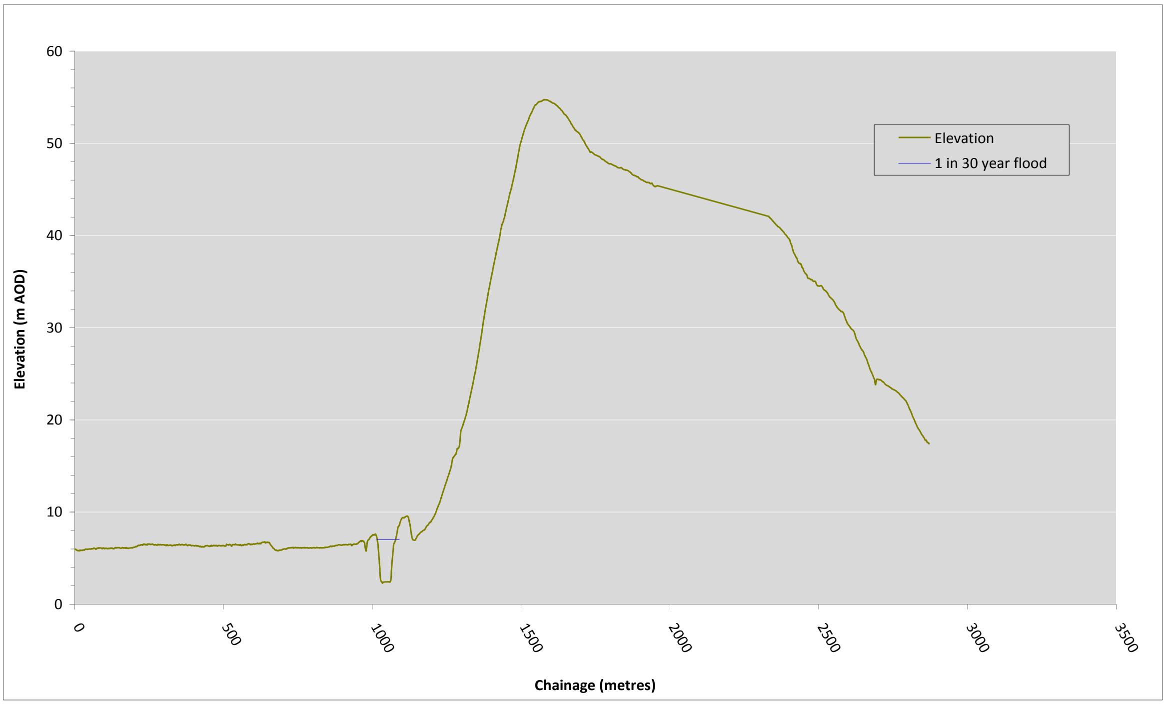
Table 5.5 Summary of Construction Phase Works – Route Section A

Works	Details
Compounds:	Bridgwater Tee (Bath Road) Compound
Haul Roads	3.8km
Temporary Pylons	2 lattice type
Culverts	7
Bridges	0

Risk Assessment to the Construction Phase Works

5.3.1 A longitudinal section along the route of the proposed overhead line is shown in **Inset 5.1** along with the 1 in 30 (3.3%) annual probability NaFRA flood level. This demonstrates that the 1 in 30 (3.3%) annual probability flood extent is largely in bank. Limited out of bank flooding close to the King's Sedgemoor Drain would be expected in such an extreme event.

Inset 5.1: Route Section A Topographic Profile and NaFRA 1 in 30 Annual Probability Flood Extent



5.3.2 **Inset 5.2** shows the likelihood and severity of the effects of various sources of flood risk on the construction phase works. Tidal and fluvial flood risk are grouped together as the impacts are essentially the same, and the fluvial impact for the most part is tidally influenced due to potential tide-locking of outfalls watercourses such as the King's Sedgemoor Drain discharges into the tidal reach of the River Parrett.

5.3.3 Modelled surface water flooding suggests that it is largely localised to the Kings Sedgemoor Drain and of small extent in this Route Section. There are no reservoirs within this Route Section.

Inset 5.2: Flood Risk to the Proposed Construction Phase Works – Section A

Severity	Significant			
	Moderate			
	Low	Groundwater	Fluvial/Tidal Surface Water	
	Very Low	Water Services		
		Low	Medium	High
		Likelihood		

5.3.4 There is variation in the likelihood of the different sources of flooding occurring however in all instances the severity is low or very low. Overall, there is a Medium risk of flooding to the construction phase works.

5.3.5 There is, therefore, a need to implement flood risk mitigation measures within this Route Section to limit the flood risk to the construction phase works.

Impact of the Construction Phase Works on Flood Risk Elsewhere

5.3.6 The assessment of the impact of the construction phase works on flood risk elsewhere is summarised in **Table 5.6**. The impacts are identified as potential impacts, in the absence of any mitigation measures. This provides the baseline against which mitigation measures are subsequently identified, where appropriate.

5.3.7 The assessment of the impact of the Proposed Development on flood risk elsewhere indicates that the proposed construction phase works could increase flood risk elsewhere. Without mitigation, the construction phase has the potential to impact on local receptors with moderate severity (**Inset 5.3**). Flood risk mitigation measures are required to mitigate the effect of the construction phase on flooding from surface water and fluvial sources.

Table 5.6 Potential Impact of the Construction Phase Works on Flood Risk Elsewhere – Route Section A

Flood Source	**Potential Impact of the Temporary Works during Construction Phase**	**Comment**
Fluvial	Loss of floodplain storage Compartmentalisation of floodplain Watercourse conveyance capacity reduced	Mitigation required as a precautionary measure
Tidal	None	Works cannot physically influence tidal flood levels. No mitigation required.
Surface Water	Increased impermeable area leading to increased runoff rates and volumes Disruption of existing flow paths	Mitigation required
Groundwater	Dewatering of excavations leading to local groundwater lowering, or temporary works for excavations requiring cut-off leading to barrier to groundwater flow. Local disruption to groundwater flow paths due to piling.	No mitigation required as short term and highly localised. De-watering of excavations and related design of temporary works to be addressed by contractor as part of wider environmental management during construction.
Water Services	None	No impact of works on any water services. No mitigation required.
Reservoirs	None	Not applicable – no reservoir flood inundation mapping affecting this Route Section.

Inset 5.3: Potential Impact of the Construction Phase Works on Flood Risk Elsewhere – Route Section A

Hazard	Severity	Action
Fluvial	Low	Mitigation required
Tidal	None	None required
Surface Water	Moderate	Mitigation required
Groundwater	Very Low	None required
Water Services	Very Low	None required
Reservoirs	Not applicable	Not applicable

5.4 Route Section B – Somerset Levels and Moors South

Table 5.7 Summary of Construction Phase Works – Route Section B

Works	Details
Compounds:	A38 Bristol Road (Overhead Line) A38 Bristol Road (Underground Cables) South of the Mendip Hills (Hams Lane)
Haul Roads	19.4km
Temporary Pylons	0
Culverts	83
Bridges	29
Excavation for underground cable	1.8km

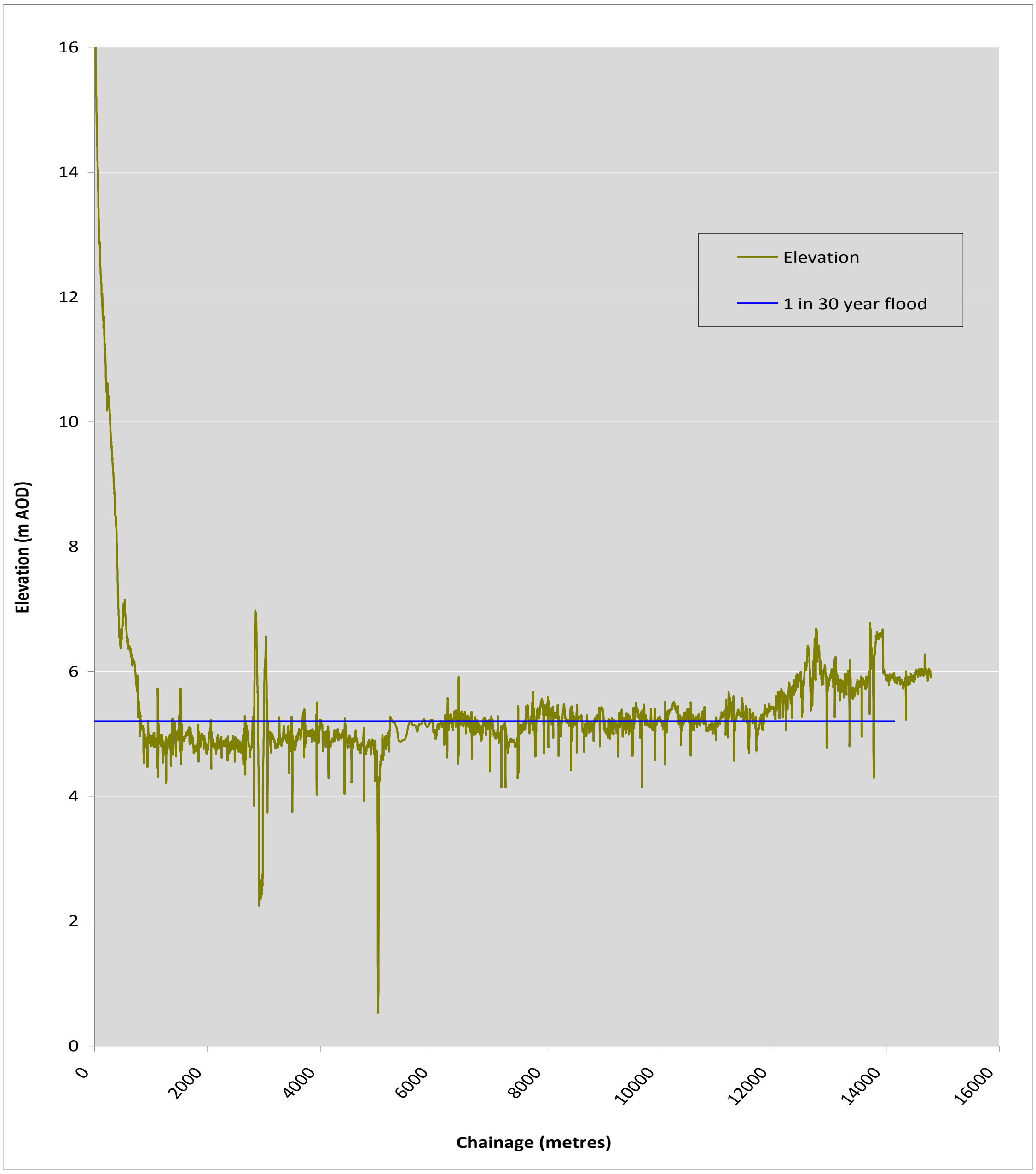
Risk Assessment to the Construction Phase Works

5.4.1 A longitudinal section along the route of the proposed overhead line is shown in **Inset 5.4** along with the 1 in 30 (3.3%) annual probability NaFRA flood level. This indicates that some sections of the construction area and route are likely to be inundated in a 1 in 30 (3.3%) annual probability flood event. In some locations along the Route Section, in a 1 in 30 (3.3%) annual probability event the flood water may be 0.5m deep. Trench sections for the underground cable may be inundated from fluvial flooding or groundwater emergence and will require pumped drainage.

5.4.2 **Inset 5.5** shows the likelihood and severity of the effects of various sources of flood risk on the proposed construction works. Tidal and fluvial flood risk are grouped together as the impacts are essentially the same, and the fluvial impact for the most part is tidally influenced due to potential tide-locking of outfalls from watercourses such as the Huntspill River, River Brue, Mark Yeo and River Axe.

5.4.3 Within the Route Section, the stretch of coast from Weston-super-Mare south to Brean Cross Sluice (mouth of the River Axe system) is susceptible to overtopping of the coastal defences. This could potentially affect the Proposed Development within Section B.

Inset 5.4: Route Section B Topographic Profile and NaFRA 1 in 30 Annual Probability Flood Extent



5.4.4 The North Somerset SFRA (Ref.3.22) Identifies a coastal flood defence covering the 9.6km north from Brean Cross Sluice (at NGR 330890 156242) past Weston-super-Mare to Clevedon. This is rated as providing between a 1 in 50 (2%) annual probability and 1 in 100 (1%) annual probabilities Standard of Protection, with only a 1 in 50 (2%) annual probability standard (5.84mAOD) at Uphill. This would indicate that, for tidal events greater than a 1 in 50 (2%) annual probability magnitude, there is a risk of tidal flooding via the River Axe valley and cross-connections to the River Brue. However, the likelihood of this occurring in the 5year construction phase is low.

5.4.5 There is a medium likelihood that tidal flooding may affect the A38 Bristol Road Compound and the South of the Mendip Hills (Hams Lane) Compound and a short section of haul road.

5.4.6 Modelled surface water flood extents in this Route Section are extensive in the southern area (near Woolavington). However, throughout the rest of the route section it is largely associated with field boundaries.

5.4.7 There is variation in the likelihood of the various sources of flooding occurring, and also in the severity of the impact leading to potential disruption to the construction programme, and damage to the construction phase works.

5.4.8 Overall, there is a Medium risk of flooding to the construction phase works. There is therefore a need to implement flood risk mitigation measures within this Route Section to limit the flood risk to the construction phase works.

5.4.9 There are no reservoirs within this Route Section.

Inset 5.5: Flood Risk to the Proposed Construction Phase Works – Section B

Severity	Significant			
	Moderate		Fluvial/Tidal	
	Low	Groundwater	Surface Water	
	Very Low	Water Services		
		Low	Medium	High
		Likelihood		

Impact of the Construction Phase Works on Flood Risk Elsewhere

5.4.10 The assessment of the impact of the construction phase works on flood risk elsewhere is summarised in **Table 5.8**. The impacts are identified as potential impacts, in the absence of any mitigation measures. This provides the baseline against which mitigation measures are subsequently identified, where appropriate.

Table 5.8 Potential Impact of the Construction Phase Works on Flood Risk Elsewhere – Route Section B

Flood Source	Potential Impact of the Temporary Works during Construction Phase	Comment
Fluvial	Loss of floodplain storage Compartmentalisation of floodplain Watercourse conveyance capacity reduced	Mitigation required
Tidal	None	Works cannot physically influence tidal flood levels. No mitigation required.
Surface Water	Increased impermeable area leading to increased runoff rates and volumes Disruption of existing flow paths	Mitigation required
Groundwater	Dewatering of excavations leading to local lowering, or temporary works for excavations requiring cut off leading to barrier to groundwater flow. Local disruption to groundwater flow paths due to piling	No mitigation required as short term and highly localised. De-watering of excavations and related design of temporary works to be addressed by contractor as part of wider environmental management during construction.
Water Services	None	No impact of works on any water services. No mitigation required.
Reservoirs	None	Not applicable – no reservoir flood inundation mapping affecting this Route Section.

5.4.11 The above assessment of the impact of the Proposed Development on flood risk elsewhere indicates that the proposed construction phase works could increase the flood risk. Without mitigation, the construction phase has the potential to impact on local receptors with significant severity. Flood risk mitigation measures are required to mitigate the effect of the construction phase on flooding from fluvial and surface water sources (**Inset 5.6**).

Inset 5.6: Potential Impact of the Construction Phase Works on Flood Risk Elsewhere – Route Section B

Hazard	Severity	Action
Fluvial	Significant	Mitigation required
Tidal	None	None required
Surface Water	Moderate	Mitigation required
Groundwater	Very Low	None required
Water Services	Very Low	None required
Reservoirs	Not applicable	Not applicable

5.5 Route Section C – Mendip Hills AONB

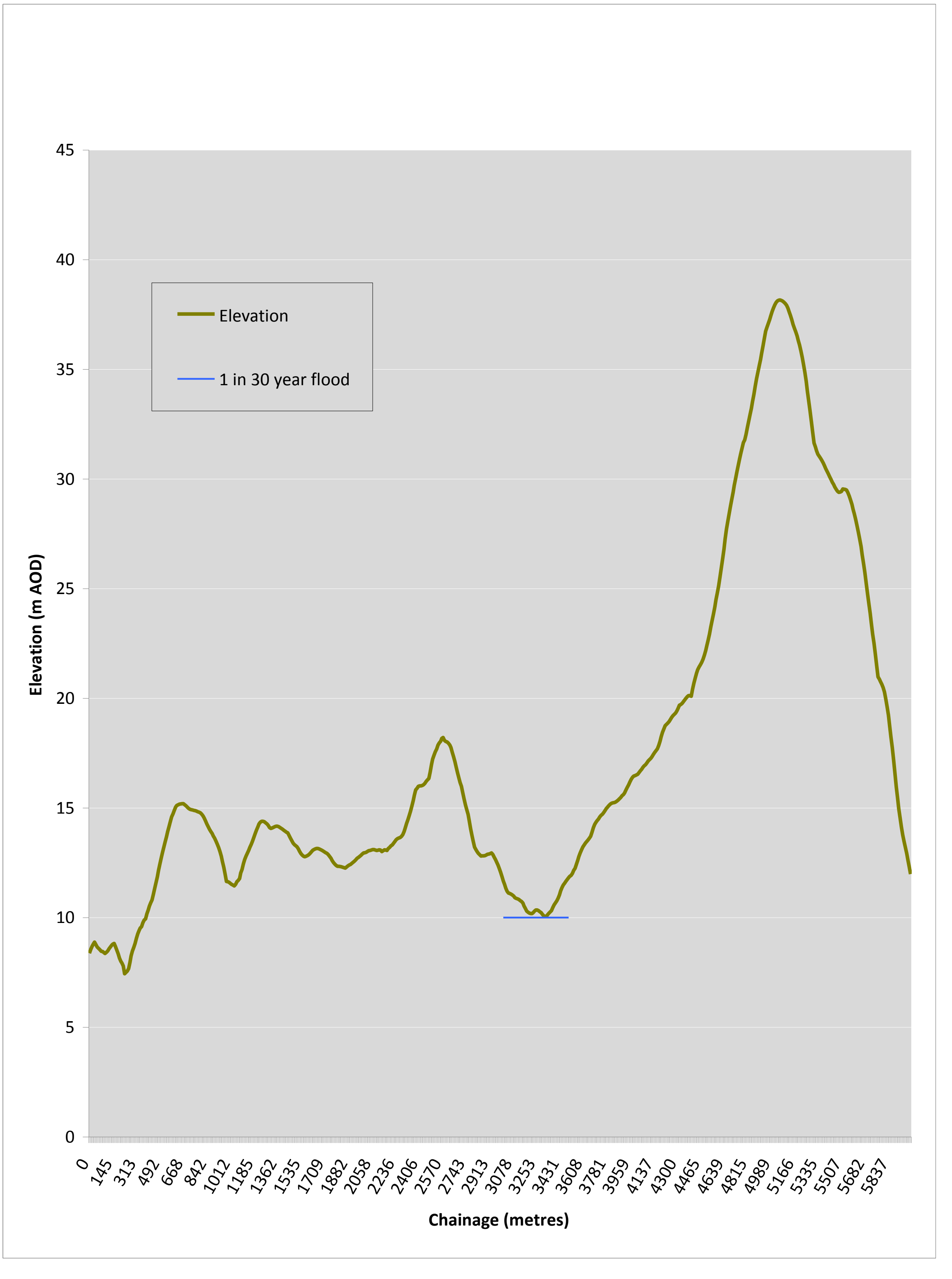
Table 5.9 Summary of Construction Phase Works – Route Section C

Works	Details
Compounds:	Barton Road Castle Hill
Haul Roads	6.3km
Temporary Pylons	0
Culverts	27
Bridges	3
Excavation for underground cable	5.8km

Risk Assessment to the Construction Phase Works

5.5.1 Section C lies mostly within Flood Zone 1 and is therefore unlikely to be subject to a fluvial flood risk. Only a small area near Winscombe lies within Flood Zone 3. **Inset 5.7** shows the indicative long section derived from SAR data (no LiDAR available) and using the NaFRA 1 in 30 (3.3%) annual probability flood extent.

Inset 5.7: Route Section C Topographic Profile and NaFRA 1 in 30 Annual Probability Flood Extent.



5.5.2 Modelled surface water flood extents shows large areas flooded in a 30 annual probability event, mostly associated with the Lox Yeo watercourse. The Castle Hill compound is located within an area identified as having a surface water flood risk with the eastern edge of the compound bordering the 1 in 30 (3.3%) annual probability surface water flood extent.

5.5.3 The proposed works in this Route Section involve topsoil stripping and digging cable trenches in an area of permeable bedrock. Therefore, there is an elevated risk of groundwater emergence impacting on the works.

5.5.4 Tidal and reservoir flooding is not a risk within this Route Section.

5.5.5 **Inset 5.8** identifies that the surface water flooding has the highest risk to the proposed construction phase in this Section.

Inset 5.8: Flood Risk to the Proposed Construction Phase Works – Section C

Severity	Significant			
	Moderate		Surface Water	
	Low		Groundwater	
	Very Low	Water Services	Fluvial	
		Low	Medium	High
		Likelihood		

5.5.6 There is variation in the likelihood of the various sources of flooding occurring, and also in the severity of the impact leading to potential disruption to the construction programme, and damage to the temporary works.

5.5.7 Overall, there is a Medium risk of flooding to the construction phase works. There is therefore a need to implement flood risk mitigation measures within this Route Section to limit the flood risk to the construction phase works.

<u>Impact of the Construction Phase Works on Flood Risk Elsewhere</u>

5.5.8 The assessment of the impact of the construction phase works on flood risk elsewhere is summarised in **Table 5.10**. The impacts are identified as potential impacts, in the absence of any mitigation measures. This provides the baseline against which mitigation measures are subsequently identified, where appropriate.

5.5.9 The assessment of the impact of the Proposed Development on flood risk elsewhere indicates that the proposed construction phase works could increase the flood risk. Without mitigation, the construction phase has the potential to impact on local receptors with moderate severity. Flood risk mitigation measures are required to mitigate the effect of the construction phase on flooding from surface water sources (**Inset 5.9**).

Table 5.10 Potential Impact of the Construction Phase Works on Flood Risk Elsewhere – Route Section C

Flood Source	**Potential Impact of the Temporary Works during Construction Phase**	**Comment**
Fluvial	None	None required
Tidal	None	Works cannot physically influence tidal flood levels. No mitigation required.
Surface Water	Increased impermeable area leading to increased runoff rates and volumes Disruption of existing flow paths	Mitigation required
Groundwater	Dewatering of excavations leading to local lowering, or temporary works for excavations requiring cut-off leading to barrier to groundwater flow. Local disruption to groundwater flow paths due to piling.	No mitigation required as short term and highly localised. De-watering of excavations and related design of temporary works to be addressed by contractor as part of wider environmental management during construction.
Water Services	None	No impact of works on any water services. No mitigation required.
Reservoirs	None	Not applicable – no reservoir flood inundation mapping affecting this Route Section.

Inset 5.9: Potential Impact of the Construction Phase Works on Flood Risk Elsewhere – Route Section C

Hazard	**Severity**	**Action**
Fluvial	Low	None required
Tidal	None	None required
Surface Water	Moderate	Mitigation required
Groundwater	Low	None required
Water Services	Very Low	None required
Reservoirs	Not applicable	Not applicable

5.5.10 Flood risk mitigation measures are required to mitigate the effect of the construction phase on flooding from minor watercourses and from surface water sources.

5.6 Route Section D – Somerset Levels and Moors North

Table 5.11 Summary of Construction Phase Works – Route Section D

Works	Details
Compounds:	Sandford AT Route Overhead Lines Church Lane Towerhead Road Sandford Substation Engine Lane Nailsea
Haul Roads	22.9km
Temporary Pylons	0
Culverts	89
Bridges	21
Excavation for underground cable	6.5km

Risk Assessment to the Construction Phase Works

5.6.1 A longitudinal section along the route of the proposed overhead line within Route Section D is shown in **Inset 5.10** along with the 1 in 30 (3.3%) annual probability NaFRA flood level. This indicates that the majority of the Section will be inundated in a 1 in 30 (3.3%) annual probability flood event. This has an approximately 15% likelihood of occurring during the 5 year construction phase. If it does occur, some parts of the Section would have flood depths of up to 2m, and many areas having depths of at least 1m. Trench sections for the underground cable may be inundated from fluvial flooding or groundwater emergence and will require pumped drainage.

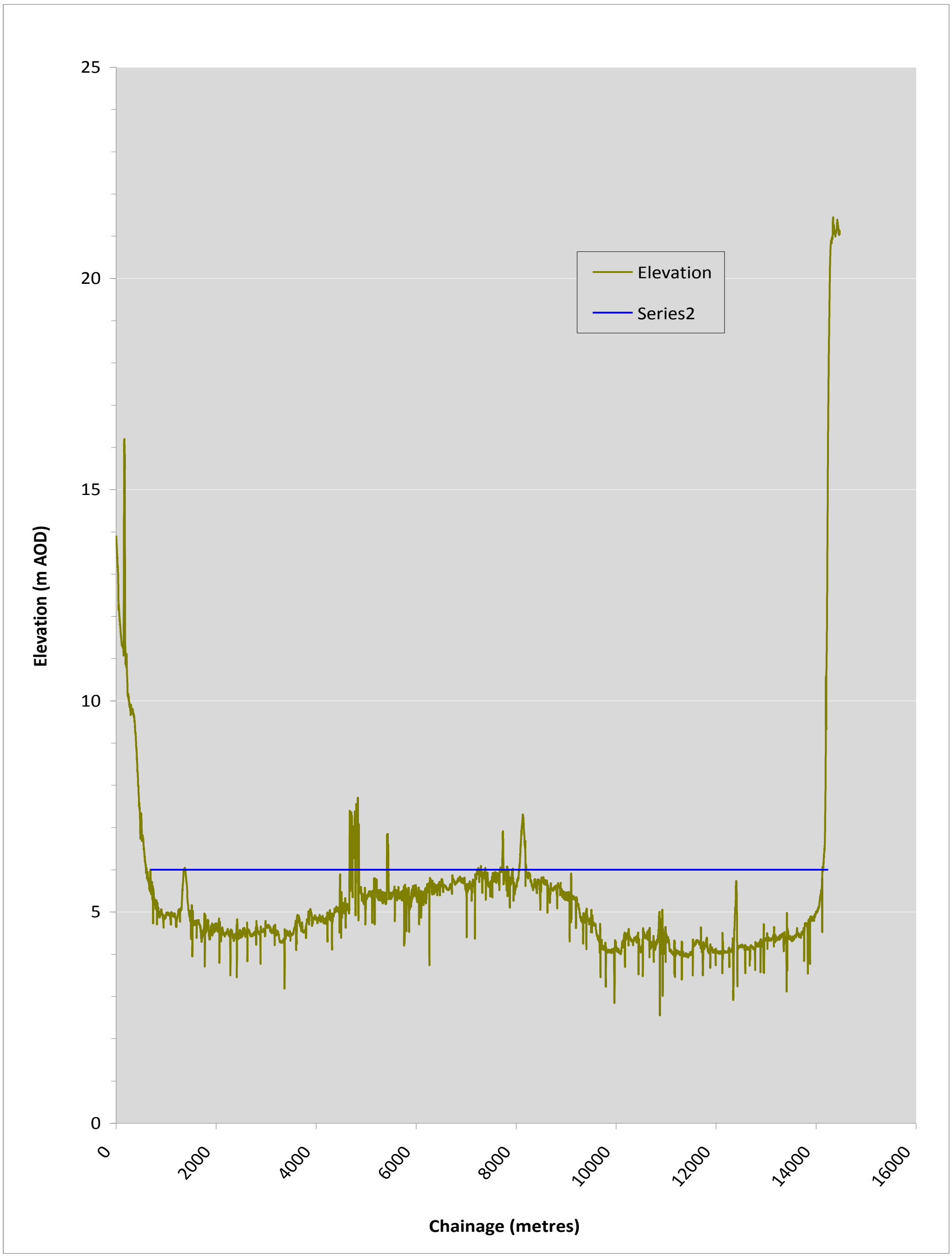
5.6.2 Within this Route Section, the Land Yeo is perched above the surrounding area and passes close to the Church Lane Compound. In the unlikely event of a breach of the embankments, the construction area would be inundated.

5.6.3 The raised banks along the Congresbury Yeo and its major tributaries are maintained to between a 1 in 5 (20%) annual probability and 1 in 100 (1%) annual probability Standard of Protection.

5.6.4 A 3km section of haul road crossing Nailsea Moor, north of the Congresbury Yeo, has a ground elevation below the crest level at Tutsbury Sluice indicating the potential for inundation in the event of overtopping.

Modelled surface water flood extents cover large areas at the southern and northern ends of the Route Section. Throughout the rest of the Route Section, surface water flood extents appear to be confined to field boundaries. Notable Church Lane compound is located on a 1 in 30 (3.3%) annual probability flow path close to the settlement of Tickenham Court and close to, the Nailsea Compound is located across a 1 in 100 (1%) annual probability surface water flow path draining the urban area of Nailsea.

Inset 5.10: Route Section D Topographic Profile and NaFRA 1 in 30 Annual Probability Flood Extent



5.6.5 In the unlikely event of a reservoir failure, the works would be inundated to a depth of at least 0.5m. As the likelihood of this occurring is low but the severity is moderate, the risk from reservoirs in this Route Section is medium.

5.6.6 **Inset 5.11** shows the likelihood and severity of the effects of various sources of flood risk on the proposed construction works. Tidal and fluvial flood risk are grouped together as the impacts are essentially the same, and the fluvial impact for the most part is tidally influenced due to potential tide-locking of outfalls

Inset 5.11: Flood Risk to the Proposed Construction Phase Works – Section D

Severity				
	Significant			
	Moderate	Reservoirs	Fluvial/Tidal	
	Low	Groundwater	Surface Water	
	Very Low	Water Services		
		Low	Medium	High
		Likelihood		

5.6.7 There is variation in the likelihood of the various sources of flooding occurring, and also in the severity of the impact leading to potential disruption to the construction programme, and damage to the construction phase works.

5.6.8 Overall, there is a Medium risk of flooding to the construction phase works. There is therefore a need to implement flood risk mitigation measures within this Route Section to limit the flood risk to the construction phase works.

Impact of the Construction Phase Works on Flood Risk Elsewhere

5.6.9 The assessment of the impact of the construction phase works on flood risk elsewhere is summarised in **Table 5.12**. The impacts are identified as potential impacts, in the absence of any mitigation measures. This provides the baseline against which mitigation measures are subsequently identified, where appropriate.

Table 5.12 Potential Impact of the Construction Phase Works on Flood Risk Elsewhere – Route Section D

Flood Source	Potential Impact of the Temporary Works during Construction Phase	Comment
Fluvial	Loss of floodplain storage Compartmentalisation of floodplain Watercourse conveyance capacity reduced	Mitigation required
Tidal	None	Works cannot physically influence tidal flood levels. No mitigation required.
Surface Water	Increased impermeable area leading to increased runoff rates and volumes Disruption of existing flow paths	Mitigation required

Flood Source	Potential Impact of the Temporary Works during Construction Phase	Comment
Groundwater	Dewatering of excavations leading to local lowering, or temporary works for excavations requiring cut-off leading to barrier to groundwater flow. Local disruption to groundwater flow paths due to piling	No mitigation required as short term and highly localised. De-watering of excavations and related design of temporary works to be addressed by contractor as part of wider environmental management during construction.
Water Services	None	No impact of works on any water services. No mitigation required.
Reservoirs	None	No mitigation required as no increase in flood risk from reservoirs.

5.6.10 The above assessment of the impact of the Proposed Development on flood risk elsewhere indicates that the proposed construction phase works could increase the flood risk. Without mitigation, the construction phase has the potential to impact on local receptors with significant severity. Flood risk mitigation measures are required to mitigate the effect of the construction phase on flooding from fluvial and surface water sources (**Inset 5.12**).

Inset 5.12: Potential Impact of the Construction Phase on Flood Risk Elsewhere – Route Section D

Hazard	Severity	Action
Fluvial	Significant	Mitigation required
Tidal	None	None required
Surface Water	Moderate	Mitigation required
Groundwater	Very Low	None required
Water Services	Very Low	None required
Reservoirs	Not applicable	Not applicable

5.7 Route Section E – Tickenham Ridge

Table 5.13 Summary of Construction Phase Works – Route Section E

Works	Details
Compounds:	Clevedon Road Whitehouse Lane and Caswell Hill
Haul Roads	4.9km
Temporary Pylons	0
Culverts	1
Bridges	0
Excavation for underground cable	5.1km

Risk Assessment to the Construction Phase Works

5.7.1 This Route Section of route lies within Flood Zone 1 and so there is a very low risk of fluvial flooding (the 1 in 30 (3.3%) annual probability NaFRA flood extent does not impact on this Route Section and therefore no topographic profile is shown).

5.7.2 Modelled surface water flood extents are largely confined to filed boundaries, however, Clevedon Road compound is in a location at risk from a 1 in 30 (3.3%) annual probability surface water flood event.

5.7.3 Trench sections for the underground cable may be inundated from surface water or groundwater emergence and will require pumped drainage.

5.7.4 There is no risk from tidal or reservoir flooding in this Route Section.

5.7.5 **Inset 5.13** shows the likelihood and severity of the effects of various sources of flood risk on the construction phase works.

Inset 5.13: Flood Risk to the Proposed Construction Phase Works – Section E

Severity				
	Significant			
	Moderate			
	Low		Surface Water Groundwater	
	Very Low	Fluvial Water Services		
		Low	Medium	High
		Likelihood		

5.7.6 There is variation in the likelihood of the various sources of flooding occurring with the overall risk to the temporary works classified as medium. The main hazard in this Section is from surface water and groundwater.

5.7.7 There is a need to implement flood risk mitigation measures within this Route Section to limit the flood risk from surface water runoff to the construction phase works. Some groundwater management measures may be required if the cable excavations intercept groundwater.

Impact of the Construction Phase Works on Flood Risk Elsewhere

5.7.8 The assessment of the impact of the construction phase works on flood risk elsewhere is summarised in **Table 5.14**. The impacts are identified as potential impacts, in the absence of any mitigation measures. This provides the baseline against which mitigation measures are subsequently identified, where appropriate.

Table 5.14 Potential Impact of the Construction Phase Works on Flood Risk Elsewhere – Route Section E

Flood Source	Potential Impact of the Temporary Works during Construction Phase	Comment
Fluvial	None	No surface water features (no proposed compounds or sections of haul road within Flood Zone 3 in this Section and no temporary culverting of watercourses)
Tidal	None	Works cannot physically influence tidal flood levels. No mitigation required.
Surface Water	Increased impermeable area leading to increased runoff rates and volumes Disruption of existing flow paths	Mitigation required
Groundwater	Dewatering of excavations leading to local lowering, or temporary works for excavations requiring cut-off leading to barrier to groundwater flow. Local disruption to groundwater flow paths due to piling	No mitigation required as short term and highly localised. De-watering of excavations and related design of temporary works to be addressed by contractor as part of wider environmental management during construction.
Water Services	None	No impact of works on any water services. No mitigation required.
Reservoirs	None	Not applicable – no reservoir flood inundation mapping affecting this Route Section.

5.7.9 The above assessment of the impact of the Proposed Development on flood risk elsewhere indicates that the proposed construction phase works could increase the flood risk. Without mitigation, the construction phase has the potential to impact on local receptors with moderate severity. Flood risk mitigation measures are required to mitigate the effect of the construction phase on flooding from surface water sources (**Inset 5.14**).

Inset 5.14: Potential Impact of the Construction Phase Works on Flood Risk Elsewhere – Route Section E

Hazard	Severity	Action
Fluvial	Very Low	None required
Tidal	None	None required
Surface Water	Moderate	Mitigation required
Groundwater	Low	None required
Water Services	Very Low	None required
Reservoirs	Not applicable	Not applicable

5.8 Route Section F – Portishead

Table 5.15 Summary of Construction Phase Works – Route Section F

Works	Details
Compounds:	BW Underground Route West (Alternative Route (Option B) only) Sheepway
Haul Roads	0.8km (Preferred Route (Option A)), 4.0km (Alternative Route (Option B))
Temporary Pylons	2 lattice type
Culverts	5-10
Bridges	3-2
Excavation for underground cable	4.2km

Risk Assessment to the Construction Phase Works

5.8.1 A longitudinal section along the route of the proposed overhead line is shown in **Inset 5.15** along with the 1 in 30 (3.3%) annual probability NaFRA flood level. This indicates that some sections of the construction area and route are likely to be inundated in a 1 in 30 (3.3%) annual probability flood event. Fluvial flood risk is greater in Alternative Route (Option B) due to the more extensive areas within the floodplain. Trench sections for the underground cable may be inundated from fluvial flooding or groundwater emergence and would require pumped drainage.

5.8.2 The North Somerset Level 1 SFRA (Ref.3.22) Indicates the presence of man-made coastal defences between Sugar Loaf Beach and Avonmouth Docks with a minimum elevation of 5.48m AOD at Portbury Wharf. The SFRA does not indicate what Standard of Protection this represents. However, it is likely to be well in excess of the 1 in 30 (3.3%) annual probability tidal floods.

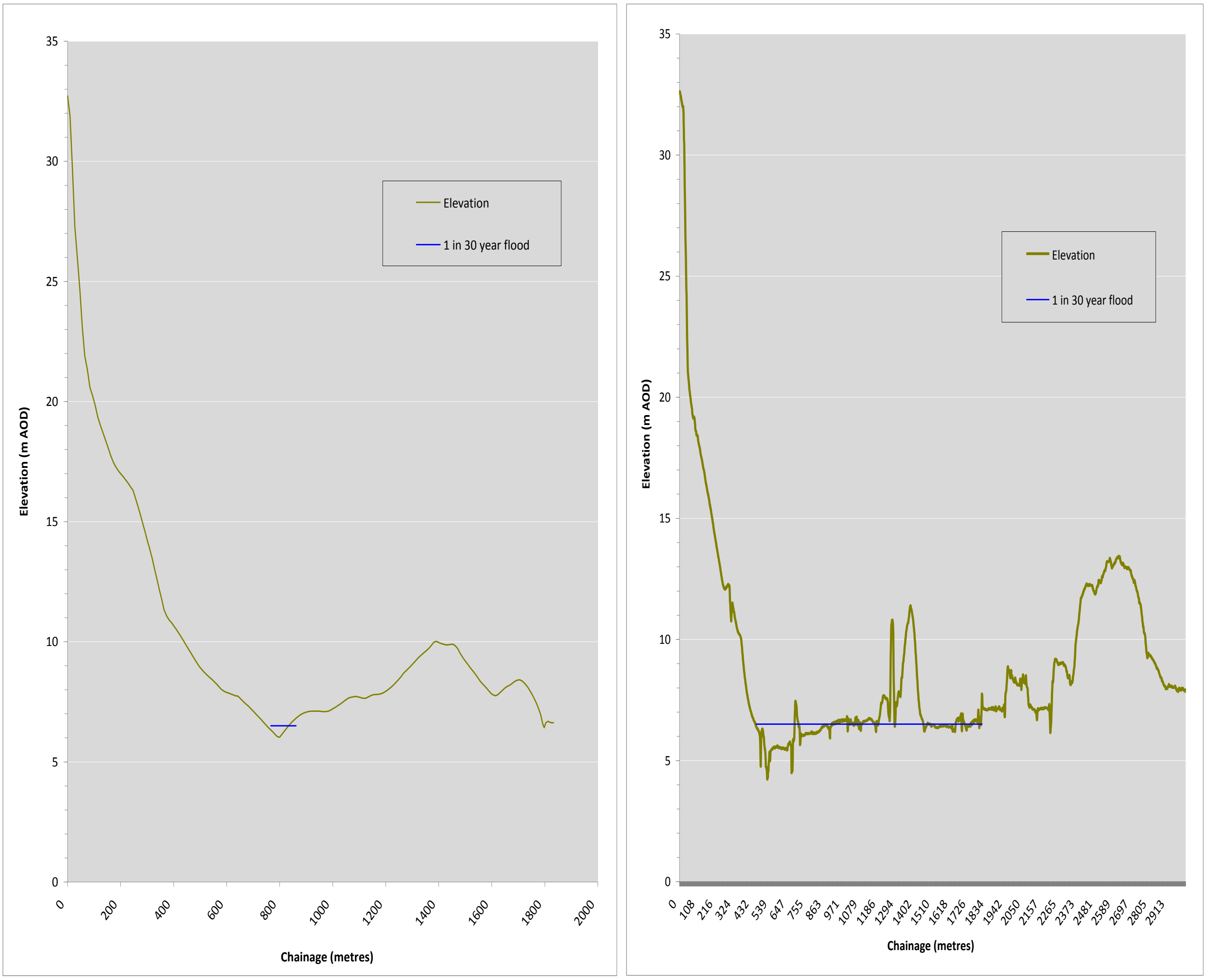
5.8.3 Modelled surface water flood extents show only very localised flooding in a 1 in 30 (3.3%) annual probability event. Sheepway compound lies close to but not in a surface water modelled flow path and BW Underground Route West Compound is remote from any surface water flooding. Therefore the risk to the compounds is considered low (**Inset 5.16**).

5.8.4 The proposed route (both options) in this Section passes close to urban areas where, as a result of the water services infrastructure associated with it, there is a slightly elevated risk of inundation from an infrastructure failure. The flood history in this area includes some flooding from water services.

5.8.5 There is no risk of flooding from reservoirs in this Route Section.

5.8.6 **Inset 5.16** shows the likelihood and severity of the effects of various sources of flood risk on the proposed construction works. Tidal and fluvial flood risk are grouped together as the impacts are essentially the same, and the fluvial impact for the most part is tidally influenced due to potential tidelocking of outfalls watercourses such as the Sandy Rhyne and Drove Rhyne.

Inset 5.15: Route Section F Topographic profile and NaFRA 1 in 30 Annual Probability Flood Extent for Preferred Route (Option A) (left) and Alternative Route (Option B) (right)



Inset 5.16 Flood Risk to the Proposed Construction Phase Works – Section F

Severity	Significant			
	Moderate		Fluvial/Tidal	
	Low	Groundwater	Surface Water	
	Very Low		Water Services	
		Low	Medium	High
		Likelihood		

5.8.7 There is variation in the likelihood of the various sources of flooding occurring, and also in the severity of the impact leading to potential disruption to the construction programme, and damage to the construction phase works.

5.8.8 Overall, there is a Medium risk of flooding to the construction phase works. There is a need to implement flood risk mitigation measures within this Route Section to limit the flood risk.

Impact of the Construction Phase Works on Flood Risk Elsewhere

5.8.9 The assessment of the impact of the construction phase works on flood risk elsewhere is summarised in **Table 5.16**. The impacts are identified, in the absence of any mitigation measures. This provides the baseline against which mitigation measures are subsequently identified, where appropriate.

Table 5.16 Potential Impact of the Construction Phase Works on Flood Risk Elsewhere – Route Section F

Flood Source	**Potential Impact of the Temporary Works during Construction Phase**	**Comment**
Fluvial	Loss of floodplain storage Compartmentalisation of floodplain Watercourse conveyance capacity reduced	Mitigation required for Alternative Route (Option B), as necessary for Preferred Route (Option A).
Tidal	None	Works cannot physically influence tidal flood levels. No mitigation required.
Surface Water	Increased impermeable area leading to increased runoff rates and volumes Disruption of existing flow paths	Mitigation required.
Groundwater	Dewatering of excavations leading to local lowering, or temporary works for excavations requiring cut-off leading to barrier to groundwater flow. Local disruption to groundwater flow paths due to piling	No mitigation required as short term and highly localised. De-watering of excavations and related design of temporary works to be addressed by contractor as part of wider environmental management during construction.
Water Services	None	No impact of works on any water services. No mitigation required.
Reservoirs	None	Not applicable – no reservoir flood inundation mapping affecting this Route Section.

5.8.10 The above assessment of the impact of the Proposed Development on flood risk elsewhere indicates that the proposed construction phase works could increase the flood risk. Without mitigation, the construction phase has the potential to impact on local receptors with moderate severity. Flood risk mitigation measures are required to mitigate the effect of the construction phase on flooding from fluvial and surface water sources (**Inset 5.17**).

Inset 5.17: Potential Impact of the Construction Phase Works on Flood Risk Elsewhere – Route Section F

Hazard	Severity	Action
Fluvial	Moderate	Mitigation required
Tidal	None	None required
Surface Water	Moderate	Mitigation required
Groundwater	Very Low	None required
Water Services	Very Low	None required
Reservoirs	Not applicable	Not applicable

5.9 Route Section G – Avonmouth

Table 5.17 Summary of Construction Phase Works – Route Section G

Works	Details
Compounds:	BW Underground Route East (Preferred Route (Option A) only) Kings Western Lane St Andrews Road G Route Underground (East of M49) Seabank (Severn Road)
Haul Roads	7.5km
Temporary Pylons	2 lattice type
Culverts	24-25
Bridges	5
Excavation for underground cable	2.5km (Preferred Route (Option A)) 2.7km (Alternative Route (Option B))

Risk Assessment to the Construction Phase Works

5.9.1 A longitudinal section along the route of the proposed overhead line is shown in **Inset 5.18** along with the 1 in 30 (3.3%) annual probability NaFRA flood level. This indicates that some sections of the construction area and route are likely to be inundated in a 1 in 30 (3.3%) annual probability flood event. Locally, flood water could exceed 0.5m in depth. Trench sections for the underground cable may be inundated from fluvial flooding or groundwater emergence and will require pumped drainage.

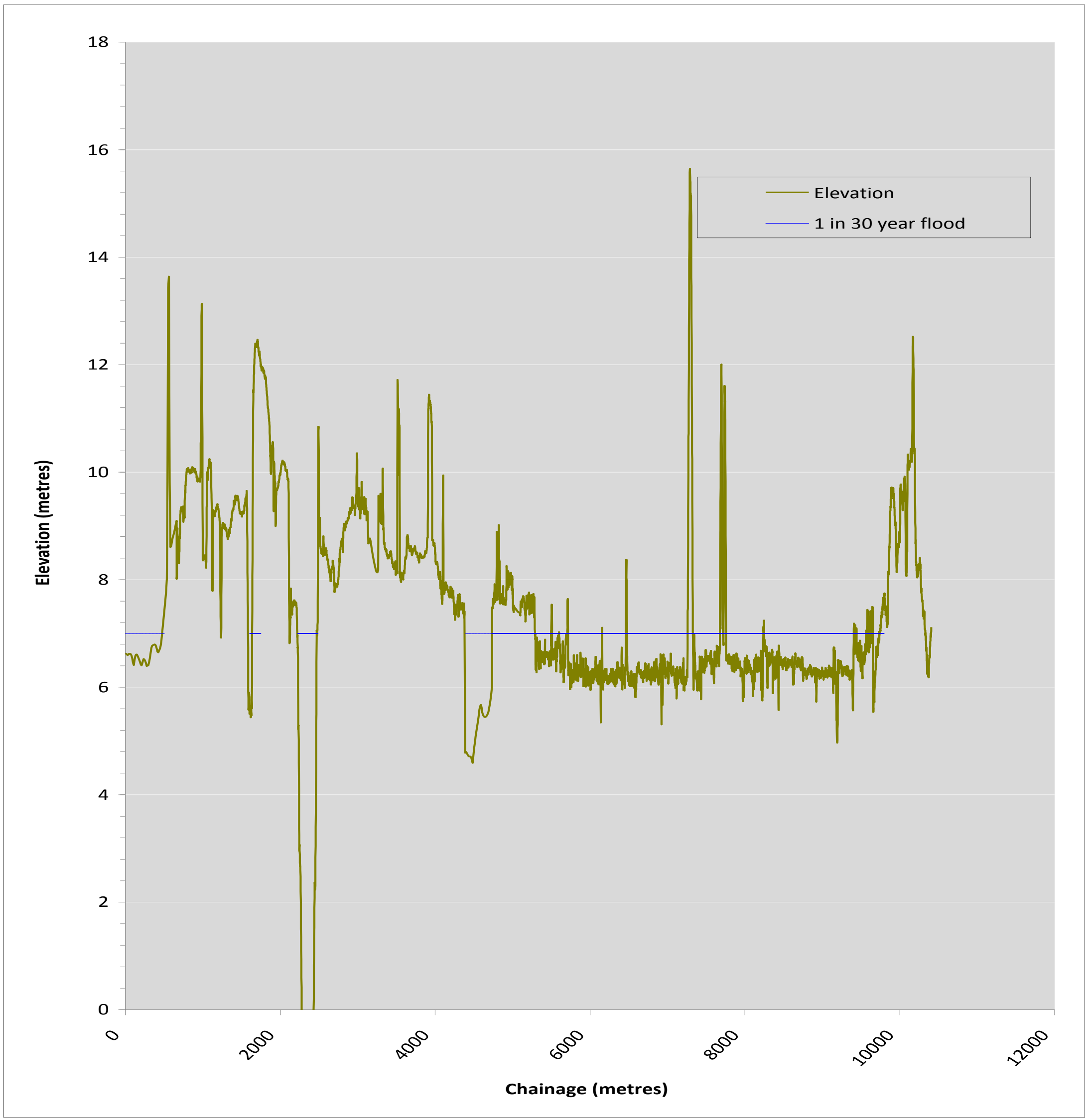
5.9.2 The ground elevation at BW Underground Route East compound is approximately the same as the modelled 1 in 200 (0.5%) annual probability maximum tidal elevation (at Node FID 48, 2km offshore) at Avonmouth. Therefore it is not expected to flood in the 1 in 10 (10%) annual probability event. However, the Avonmouth/Severnside Level 2 SFRA (Ref.3.19) Technical Report (Ref.5.28) states that the coastal defences downstream of Severn Beach to Avonmouth are in a poor condition. Some defences are privately owned and their Standard of Protection and state of maintenance is not recorded. Flooding in a 1 in 200 (0.5%) annual probability tidal event could reach a depth of 3m at the proposed G Route Underground Cables (East of M49) compound. The likelihood of this occurring in the 5 year (or 7 year) construction period is very low.

5.9.3 Modelled surface water flood extents in this Route Section are distributed throughout with many localised areas flooded in a 1 in 30 (3.3%) event. The surface water flood map indicates that the G Route Underground (East of M49) compound would be inundated in a 1 in 30 (3.3%) annual probability flood event. All other compounds in this reach are not impacted by modelled surface water flow paths. Some haul roads would pass through areas vulnerable to surface water flooding.

5.9.4 There is no risk of flooding from a reservoir failure.

5.9.5 **Inset 5.19** shows the likelihood and severity of the effects of various sources of flood risk on the proposed construction phase works. Tidal and fluvial flood risks are grouped together as the impacts are essentially the same, and the fluvial impact for the most part is tidally influenced due to potential tide-locking of outfalls.

Inset 5.18: Route Section G Topographic profile and NaFRA 1 in 30 Annual Probability Flood Extent



Inset 5.19: Flood Risk to the Proposed Construction Phase Works – Section G

Severity	Significant			
	Moderate		Fluvial/Tidal	
	Low	Groundwater	Surface Water	
	Very Low		Water Services	
		Low	Medium	High
		Likelihood of occurrence		

5.9.6 There is variation in the likelihood of the various sources of flooding occurring, and also in the severity of the impact leading to potential disruption to the construction programme, and damage to the construction phase works. Overall, there is a medium risk of flooding to the construction phase works.

5.9.7 There is a need to implement flood risk mitigation measures within this Route Section to limit the flood risk to the construction phase works.

Impact of the Construction Phase Works on Flood Risk Elsewhere

Table 5.18 shows the potential impacts of the construction phase on flood risk elsewhere.

Table 5.18 Potential Impact of the Construction Phase Works on Flood Risk Elsewhere – Route Section G

Flood Source	Potential Impact of the Temporary Works during Construction Phase	Comment
Fluvial	Loss of floodplain storage Compartmentalisation of floodplain Watercourse conveyance capacity reduced	Mitigation required
Tidal	None	Works cannot physically influence tidal flood levels. No mitigation required.
Surface Water	Increased impermeable area leading to increased runoff rates and volumes Disruption of existing flow paths	Mitigation required
Groundwater	Dewatering of excavations leading to local lowering, or temporary works for excavations requiring cutoff leading to barrier to groundwater flow. Local disruption to groundwater flow paths due to piling	No mitigation required as short term and highly localised. De-watering of excavations and related design of temporary works to be addressed by contractor as part of wider environmental management during construction.
Water Services	None	No impact of works on any water services. No mitigation required.
Reservoirs	None	Not applicable – no reservoir flood inundation mapping affecting this Route Section.

5.9.8 The above assessment of the impact of the Proposed Development construction phase on flood risk elsewhere indicates that the proposed construction phase works could increase the flood risk. Without mitigation, the construction phase has the potential to impact on local receptors with moderate severity. Flood risk mitigation measures are required to mitigate the effect of the construction phase on flooding from fluvial and surface water sources (**Inset 5.20**).

Inset 5.20: Potential Impact of the Construction Phase Works on Flood Risk Elsewhere – Route Section G

Hazard	Severity	Action
Fluvial	Moderate	Mitigation required
Tidal	None	None required
Surface Water	Moderate	Mitigation required
Groundwater	Very Low	None required
Water Services	Very Low	None required
Reservoirs	Not applicable	Not applicable

5.10 Route Section H – Hinkley Line Entries

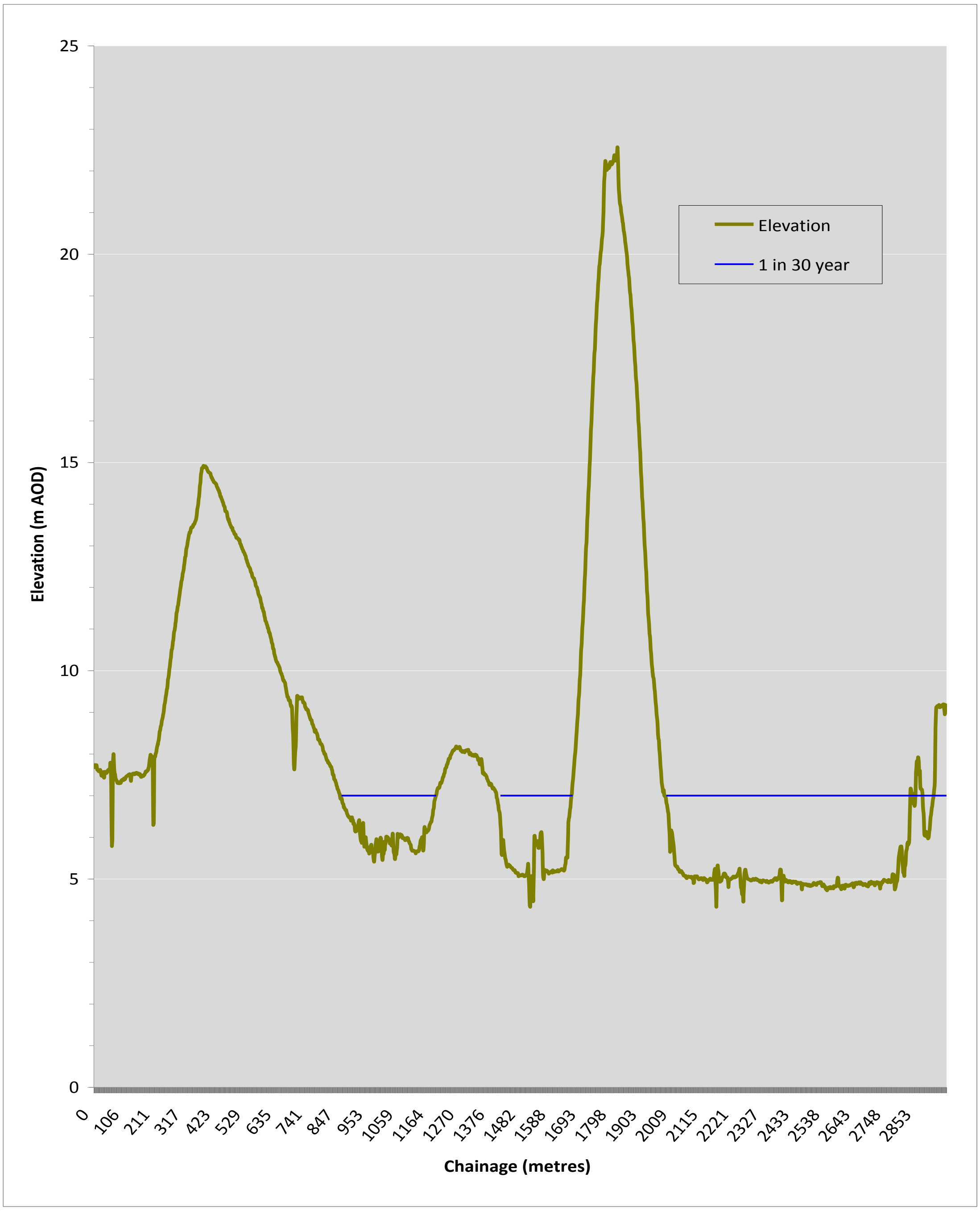
Table 5.19 Summary of Construction Phase Works – Route Section H

Works	Details
Compounds:	0
Haul Roads	1.9km
Temporary Pylons	0
Culverts	2
Bridges	0

Risk Assessment to the Construction Phase Works

5.10.1 A longitudinal section along the route of the proposed overhead line is shown in **Inset 5.21** along with the 1 in 30 annual probability NaFRA flood level. This indicates that large areas of the route are likely to be inundated in a 1 in 30 (3.3%) annual probability flood event. Flood depths could exceed 2m in a 1 in 30 (3.3%) annual probability event.

Inset 5.21: Route Section H Topographic Profile and NaFRA 1 in 30 Annual Probability Flood Extent



5.10.2 The modelled surface water flood extents cover a large part of Route Section H even in a 1 in 30 (3.3%) annual probability flood event. They are however, largely confined to watercourse routes and on the whole, are not intercepted by the proposed haul road routes.

5.10.3 **Inset 5.22** shows the likelihood and severity of the effects of various sources of flood risk on the proposed construction works. Tidal and fluvial flood risk are grouped together as the impacts are essentially the same, and the fluvial impact for the most part is tidally influenced due to potential tide-locking of outfalls.

5.10.4 There are no reservoirs in this Route Section.

Inset 5.22: Flood Risk to the Proposed Construction Phase Works – Section H

Severity				
	Significant			
	Moderate		Fluvial/Tidal	
	Low	Groundwater	Surface Water	
	Very Low	Water Services		
		Low	Medium	High
		Likelihood of occurrence		

5.10.5 There is variation in the likelihood of the various sources of flooding occurring, and also in the severity of the impact leading to potential disruption to the construction programme, and damage to the temporary works.

5.10.6 Overall, there is a Medium risk of flooding to the construction phase works with the main hazard being from fluvial/tidal sources. There is a need to implement flood risk mitigation measures within this Route Section to limit the flood risk from surface water runoff to the construction phase works.

Impact of the Construction Phase Works on Flood Risk Elsewhere

Table 5.20 shows how the construction works could increase flood risk elsewhere.

Table 5.20 Potential Impact of the Construction Phase Works on Flood Risk Elsewhere – Route Section H

Flood Source	Potential Impact of the Temporary Works during Construction Phase	Comment
Fluvial	Loss of floodplain storage Compartmentalisation of floodplain Watercourse conveyance capacity reduced	Mitigation required
Tidal	None	Works cannot physically influence tidal flood levels. No mitigation required.
Surface Water	Increased impermeable area leading to increased runoff rates and volumes Disruption of existing flow paths	Mitigation required

Flood Source	Potential Impact of the Temporary Works during Construction Phase	Comment
Groundwater	Dewatering of excavations leading to local lowering, or temporary works for excavations requiring cut-off leading to barrier to groundwater flow. Local disruption to groundwater flow paths due to piling	No mitigation required as short term and highly localised. De-watering of excavations and related design of temporary works to be addressed by contractor as part of wider environmental management during construction.
Water Services	None	No impact of works on any water services. No mitigation required.
Reservoirs	None	Not applicable – no reservoir flood inundation mapping affecting this Route Section.

5.10.7 The above assessment of the impact of the Proposed Development on flood risk elsewhere indicates that the proposed construction phase works could increase the flood risk. Without mitigation, the construction phase has the potential to impact on local receptors with moderate severity. Flood risk mitigation measures are required to mitigate the effect of the construction phase on flooding from surface water sources (**Inset 5.23**).

Inset 5.23: Potential Impact of the Construction Phase Works on Flood Risk Elsewhere – Route Section H

Hazard	Severity	Action
Fluvial	Low	Mitigation required
Tidal	None	None required
Surface Water	Moderate	Mitigation required
Groundwater	Very Low	None required
Water Services	Very Low	None required
Reservoirs	Not applicable	Not applicable

5.11 Summary

5.11.1 An assessment of how the construction phase of the Proposed Development may impact on flood risk elsewhere has shown that the construction phase works could increase flood risk to local receptors. **Table 5.21** shows the severity of the impact if mitigation measures are not put in place. Mitigation measures are required where the severity of impact is moderate or significant (shown emboldened in **Table 5.21**).

Table 5.21 Assessed Potential Impact of Proposed Construction Phase works on Nearby Receptors without Mitigation

Route Section	Fluvial	Tidal	Surface Water	Groundwater	Water Services	Reservoirs
A - Puriton Ridge	Low	None	**Moderate**	Very Low	Very Low	N/A
B - Somerset Levels and Moors South	**Significant**	None	**Moderate**	Very Low	Very Low	N/A
C - Mendip Hills AONB	Low	None	**Moderate**	Low	Very Low	N/A
D - Somerset Levels and Moors North	**Significant**	None	**Moderate**	Very Low	Very Low	N/A
E -Tickenham Ridge	Very Low	None	**Moderate**	Low	Very Low	N/A
F - Portishead	**Moderate**	None	**Moderate**	Very Low	Very Low	N/A
G - Avonmouth	**Moderate**	None	**Moderate**	Very Low	Very Low	N/A
H - Hinkley Line Entries	Low	None	**Moderate**	Very Low	Very Low	N/A

6. CLIMATE CHANGE

6.1 Introduction

6.1.1 This section considers climate change impacts (section 6.2), focused on sea level rise, increased river flows and increased rainfall intensities, covering the period to 2060. Consideration is also given to continued operation at the site beyond 2060, and the sensitivity of the proposed works at the site to an extreme climate change scenario (section 6.3).

6.2 Climate Change Impacts

6.2.1 Within the context of the existing flood risk along the Proposed Development route and the requirements of the National Policy Statements for Energy (specifically EN-1 and EN-5), climate change impacts from different flood sources have been considered alongside the present day scenario within sections 4 and 5 using UKCP09 climate projections. By way of summary, the principal climate change impacts potentially affecting the Proposed Development route are:

- sea level rise affecting tidal flood risk;
- increase in fluvial flood flows; and
- increase in rainfall intensity affecting pluvial/surface water flood risk.

6.2.2 The consideration of climate change impacts also meets the requirements set out in the UK Climate Change Risk Assessment: Government Report (Ref.6.29) which are consistent with the requirements of the NPS and UKCP09 climate projections.

6.2.3 Climate change impacts from different flood sources are considered along the proposed route with regard to the permanent works for the operational phase of the Proposed Development. For the construction phase, the climate change impacts are not considered, due to the short term nature (in climate change terms) of the construction phase.

6.2.4 For the operational phase of the Proposed Development sea level rise and an increase in fluvial flood flows both manifest themselves in the same way in terms of the potential impact on the permanent works i.e. through an increase in extreme flood water levels along the route. These two aspects are therefore considered together.

<u>Sea Level Rise and Increased Fluvial Flows</u>

6.2.5 The operational design life of the Proposed Development is 40 years. However, it is recognised that infrastructure related to overhead lines and underground cables is likely to remain in use beyond this timeframe. Consideration therefore needs to be given to both the timeframe for the Proposed Development of 40 years, and the potential for future operation beyond this period with some parts of the assets associated with the overhead lines and underground cables requiring replacement.

6.2.6 To account for the sea level rise, an allowance has been made in accordance with the UKCP09 projections using the “upper end estimate” as defined in Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management

Authorities (Ref.6.30). This approach meets the requirements for the climate change assessment identified within the EN-1 National Policy Statement for Energy (DECC, 2011). This upper end estimate represents the Inter-governmental Panel on Climate Change (Ref.6.31) at the 95th percentile confidence limit.

6.2.7 The sea level rise allowances included for the UKCP09 upper end estimates are 4mm per year up to 2025, 7mm per year from 2026 to 2050, and 11mm per year from 2051 to 2080. This gives a total rise of 325mm from 2015 (the proposed start of construction) to 2060 which would be the anticipated end of operational life of part of the asset base for the proposed overhead line and underground cable route. In the event that the assets are replaced, or continue to be used for a further 20 years to around 2080, this would give an additional rise of 220mm, giving a total rise of 545mm from 2020 to 2080.

6.2.8 For the undefended case, in which there are no fluvial or tidal defences in place, extreme tidal flood levels are assumed to be approximately 0.6m higher than the current undefended case.

6.2.9 The recommended allowance for increase in fluvial flows is 20% based on current guidance. Water level outputs from hydraulic models along the full length of the route are not available from existing models. However, some model data is available for various locations that incorporate climate change in fluvial models. The estimated increase in fluvial water levels from major watercourses along the proposed route is in the range 0.1m to 0.2m, between the current situation and the “with climate change” estimate.

6.2.10 Overall, the impact of extreme tide level increase is considered to be greater than the impact on water level as a result of an increase in extreme fluvial flows.

6.2.11 Within the context of overall fluvial and tidal flood risk, to allow for the combined influence of higher sea levels and increased fluvial flows, an increase in water level of 0.6m is assumed along the proposed route where it is located within Flood Zone 3.

6.2.12 This potential additional flood depth under a future climate change scenario to well beyond the proposed operational life of the Proposed Development exposes the permanent works to an increase in fluvial/tidal hazard. This may manifest itself as greater flood depths, more frequent flooding, or flooding for greater durations. However, the underground cables, overhead lines, pylons and other works associated with the transmission infrastructure are resilient to flooding, with operations unaffected by increased flood depth, duration or frequency.

Increased Rainfall Intensity

6.2.13 For the surface water runoff assessment, an allowance of 10% increase in the rainfall intensity values for the period 2040 to 2069 is recommended to account for the impact of climate change in accordance with Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities (Environment Agency, 2011), which specifically references UKCP09 projections. This increase would apply at the end of the operational life of the proposed overhead line and underground cable route at around 2060.

6.2.14 In the event that the infrastructure remains in place beyond the proposed operational life of 40 years, for a further 20 years to around 2080, an allowance of 20% increase in rainfall intensity values is recommended.

6.2.15 Given that the surface water flood risk has been shown to be generally very low along the vast majority of the proposed route, an increase in rainfall intensities is not considered to significantly increase the likelihood of flooding. However, even in those isolated locations where surface water flooding may present a hazard, the impact of flooding from surface water would be minimal because the infrastructure is designed to be resilient to flooding, as noted for fluvial and tidal flood risk.

6.2.16 The climate change impact of increased rainfall intensity is therefore concluded to be minor.

6.3 Sensitivity to Extreme Climate Change Scenario

6.3.1 Within the UKCP09 projections, set in the context of NPS requirements in EN-1, consideration is given to the most extreme UKCP09 climate change scenario, referred to as the H++ scenario.

6.3.2 The H++ scenario provides an estimate of sea level rise and river flood flow change beyond the likely range but within physical plausibility. It is useful for contingency planning to understand what might be required if climate change were to happen much more rapidly than expected.

6.3.3 For the Proposed Development route, it is the tidal flood risk associated with sea level rise combined with its influence on fluvial flood levels that would have the biggest overall impact. Adaptive measures in the future would be driven by a combination of actual climate change and future flood and coastal risk management strategies and policies for the area. However, taking the H++ scenario gives an extreme tide level 325mm higher than the UKCP09 High emissions, 95th percentile value by 2060. At the end of the proposed operational life of the proposed overhead line and underground cable route at around 2060, this potential increase in flood depths under this scenario would not affect the operation of the infrastructure. The proposed overhead line and underground cable route is designed to be resilient to greater flood depths than this allowing for future adaptation beyond 2060 in the event that the H++ scenario is realised and the route is still required beyond 2060.

7. FLOOD RISK MANAGEMENT MEASURES

7.1 Introduction

7.1.1 Sections 4 and 5 of this FRA identify the risks associated with the operational and construction phases of the Proposed Development.

7.1.2 The broad conclusion from the assessment related to the operational phase is that once the works are in place and operational, whilst the works may be exposed to various flood hazards, the severity of the impact of any flooding is negligible, and therefore the overall risk to the Proposed Development is low.

7.1.3 The impact of flooding on the permanent works is negligible because the design of the overhead lines, underground cables, pylons and other associated infrastructure is resilient to flooding. It is emphasised that elements of the Proposed Development related to the substations and CSE compounds are excluded from this FRA. The resilience of these elements is considered within the specific FRA covering these structures.

7.1.4 No specific mitigation measures are proposed in relation to the operational phase, apart from those implicit within the design that make the underground cables and overhead lines resilient to flooding.

7.1.5 The permanent works will also not impact on flood risk elsewhere. It has been demonstrated that the influence of the works on each flood source is negligible. Therefore, no specific additional mitigation measures are proposed for the permanent works.

7.1.6 The conclusions from the assessment of the construction phase indicate that there is the potential for the construction phase works to be affected by flooding from various sources, and that without mitigation the works could increase flood risk elsewhere.

7.1.7 The mitigation measures proposed focus on minimising the impact of flooding on the construction phase works, and the impact that the construction phase works would have on flood risk elsewhere (section 7.2). Balancing mitigation measures with other risks that the mitigation measures themselves may introduce is also considered (section 7.3). The minor loss of floodplain storage during the construction phase is addressed (section 7.4). In addition to these mitigation measures, consideration is also given to access and egress (section 7.5), and flood warning and evacuation (section 7.6). The existing flood defences which provide flood protection to the route are identified (section 7.7). Residual risk, both to the works and resulting from the construction works is considered (section 7.8). Mitigation measures for the operational phase are discussed in section 7.9. Finally, this section summarises how the Sequential and Exception Tests are met (section 7.10).

7.1.8 The Construction Environmental Management Plan at **Volume 5.26.1** provides environmental management and construction principles to protect the water environment. These include details on preventing sediment entering watercourses.

7.2 Mitigation Measures for Construction Phase Works

7.2.1 The nature of the mitigation measures and the flood risks that they seek to address is such that a specific measure generally addresses more than one issue with regard to either:

- addressing the risk from more than one flood source; or
- undertaking measures that are beneficial in both reducing the flood risk to the Proposed Development and reducing the potential impact elsewhere as a result of the Proposed Development.

7.2.2 The mitigation measures are therefore considered for each of the main construction phase works elements which are summarised under the following headings:

- haul roads;
- construction compounds;
- culvert crossings;
- bridge crossing; and
- laying underground cables.

7.2.3 In addition to these main construction phase works elements, stockpiling of topsoil is a fundamental requirement for both the haul roads and the construction compounds.

7.2.4 The mitigation measures proposed with regard to stockpiling of topsoil for the construction of haul roads, compounds, and culvert crossings, relate predominantly to surface water flood risk and fluvial/tidal flood risk.

7.2.5 Other flood risks, as noted in sections 4 and 5 are generally less of a concern because the impact or extent of the risk is low, or the likelihood of occurrence is very low (e.g. reservoir failure). Therefore, in identifying the risks to, and from, the construction phase works, this will largely address the small risks associated with other sources of flood risk.

Stockpiling of Topsoil

7.2.6 The construction method for haul road and compounds on soft ground invariably requires the stripping of topsoil and then to place the sub-base and running surface on the formation. For practical considerations, including that of cost and to minimise carbon footprint, the spoil arising should be placed as close to the source as possible. However, this could result in long bunds of stockpile across the floodplain which could impede flow across the floodplain and reduce floodplain storage.

7.2.7 Consideration has therefore been given to how material should be stored to maintain the existing flow paths and to prevent compartmentalising the floodplains. The proposed mitigation measures are identified in **Table 7.1**. All of these measures apply to the haul roads, with several measures also applying to the compounds.

7.2.8 The large expanses of flood zones mean that there is very little opportunity to move stockpiles out of the Flood Zones 3 and 2 and into Flood Zone 1. Most of the stockpiles will be within potentially flooded areas. The proposed measures need to be applied understanding the principles rather than the letter as some adjustments on site will be inevitable. Calculations indicate that the requirements can be met applying these measures along the haul roads for example but in some cases some transportation will be necessary to maintain the required spacing and stockpile dimension limits.

Table 7.1 Proposed Mitigation Measures for Topsoil Stockpiling

Mitigation	**Reason**	**Mitigation Reference**
Stockpiles will be located on higher ground (i.e. outside Flood Zone 3) where practicable.	To minimise loss of floodplain volume; To minimise the risk of top soil being washed away in the event of a major flood event.	S1
Each stockpile will not exceed 25m in length.	To minimise disruption of flow paths and maintain hydraulic continuity of the floodplain around both ends of each stockpile.	S2
There will be a minimum gap of 25m between adjacent stockpiles, except where both adjacent stockpiles are shorter, in which case the gap must be at least as long as the longest adjacent stockpile. Some stock pile lengths and associated gaps may only be 10m.	To prevent trapping large volumes of water behind the stockpiles and to maintain natural flow paths	S3
Where stockpiles are placed on both sides of the haul road the gaps between them should coincide.	To maintain connectivity of flow paths	S4
Gaps in the stockpiles will be located to preserve existing low points and flow paths.	To minimise the interruption of natural flow routes	S5
Stockpiles should not exceed 1.4m above the existing ground level, and be less than 8m wide at the toe.	To retain a workable footprint width using typical construction plant for the stockpile with 1:2.5 side slopes and a crest width of up to 1m.	S6
Sections of haul road with stockpiles alongside will not exceed a total of 1/3 of the length of all haul roads within Flood Zone 3.	To prevent floodplain compartmentalisation and to maintain natural flow paths	S7
Stockpiles to be seeded to encourage stabilisation of topsoil.	To prevent sedimentation of watercourses; To prevent loss of topsoil in a major flood event, thereby reducing the availability of material for reinstatement.	S8

Haul Roads

7.2.9 Mitigation measures proposed in relation to the construction of haul roads are shown in **Table 7.2**. These mitigation measures are included in the draft Construction Environmental Management Plan (CEMP) (**Volume 5.26.1A**) and therefore subject to Requirement 5 of Schedule 3 of the draft DCO (**Volume 2.1A**). Drainage Management Plans would be prepared during the detailed design stage and prior to commencement of construction. These would cover the entire route providing location specific details of these typical mitigation measures and would be subject to approval by the Environment Agency, Internal Drainage Board or Local Planning Authority as appropriate, in accordance with Requirement 6 of Schedule 3 of the draft DCO (**Volume 2.1A)**.

Table 7.2 Haul Road Mitigation Measures

Mitigation	**Reason**	**Mitigation Reference**
Haul roads generally to be as close to ground level as possible (between 50mm and 100mm above the ground surface except where crossing peat or embanked over watercourse crossings. Where haul roads cross peat they must be on floating roads with drainage pipes.	To avoid disrupting flow paths and compartmentalising the floodplain thereby losing the hydraulic connection between the “upstream” and “downstream” sides of the haul road. Slightly raised road surface is required to allow to drain. Floating roads on peat to have drainage pipes to retain floodplain connectivity.	H1
Where haul roads cross any rhyne, no stockpile is to be placed within 9m of the top of either bank.	The IDB require access on both banks for maintenance and to minimise flow impedance around the structure.	H2
Haul roads would be constructed of material that is at least as permeable as the topsoil removed, where practicable.	To retain the natural runoff (Greenfield) rate	H3

Mitigation	Reason	Mitigation Reference
Runoff from haul roads would generally not be drained via a piped or open channel drainage system. Runoff would discharge directly from the haul road to allow it to filter through vegetated verges. Where settlement or filtering is not practicable or effective, alternative disposal options would be considered for example, discharge onto a grassed / vegetated area (with consent from the landowner and following EA consultation). No formal haul road drainage system to be constructed except where floating roads are used on peat.	To retain natural drainage as far as possible; To reduce the likelihood of rapid runoff from the haul road and minimise erosion; To prevent sediment washing off the haul roads and entering watercourses (to maintain water quality).	H4
All haul road construction material to be removed at the end of construction and reinstatement with stockpiles of topsoil to a level slightly above natural ground level (typically <50mm).	To return the haul roads to a natural condition, allowing for settlement of reinstated topsoil.	H5

Construction Compounds

7.2.10 Mitigation measures proposed in relation to the construction of site compounds are shown in **Table 7.3**. Each measure is given a specific reference (C1 to C7). Depending on the location of specific compounds different measures may be appropriate, largely driven by the Flood Zone in which the compound is located. **Table 7.4** summarises each compound, the route section in which it is located, and the proposed measures. As for the Haul Roads, these mitigation measures are included in the draft CEMP (**Volume 5.26.1A**).

Table 7.3 Compound Mitigation Measures

Mitigation	Reason	Mitigation Reference
Compounds will be surfaced with material that is at least as permeable as the topsoil to be removed, where practicable. This is with the exception of the use of bitumen (20mx20m) for a platform for the crane at the A38 Bristol Road Compound.	To retain natural runoff (Greenfield) rate.	C1

Mitigation	Reason	Mitigation Reference
Any runoff from the compounds would be to the vegetated ground in line with SuDS principles. SuDS measures may include attenuation storage; infiltration trenches/soakaways. Where settlement or filtering is not practicable or effective, alternative disposal options would be considered for example, discharge onto a grassed / vegetated area (with consent from the landowner and following EA consultation).	To avoid disruption to natural flow paths; To retain natural runoff (Greenfield) rate; To avoid discharge of sediment into watercourses (to maintain water quality).	C2
At sites with bunds or other forms of visual/acoustic barriers, ensure appropriate gaps in the screening (or culverts through earth bunds where these are used).	To allow free flow of water in the main direction of flow across the compound; To allow free drainage of surface water from the compound.	C3
Offices and other site facilities will be raised above the modelled 1 in 10 (10%) annual probability event level where modelled data are available. Where not available this would be estimated from the best available information. Facilities could be elevated on stilts, or in some cases, located on the higher areas of the compound.	To minimise loss of floodplain storage; To minimise risk of equipment being mobilised by flood waters, impacting somewhere else downstream; To allow free flow of water across the compound in a flood event.	C4
Minimal stockpiling of materials. Where storage of materials is necessary, store above the 1 in 10% (10%) annual probability event level.	To minimise loss of floodplain storage; To minimise risk of materials being mobilised by flood waters, impacting somewhere else downstream; To allow free flow of water across the compound in a flood event.	C5
Minimal storage of potential pollutants e.g. fuel, hazardous substances.	To minimise risk of pollution of watercourses, as well as mobilisation of drums and other storage containers that could result in downstream impacts.	C6
Site closure and evacuation plan	To minimise loss of plant, materials, risk to operatives in a flood event; To minimise risk of pollution of flood water.	C7

7.2.11 **Table 7.4** also shows the calculated Greenfield runoff rate for each compound. Each compound will utilise Sustainable Drainage (SuDS) as appropriate to limit runoff to the Greenfield rate. This approach is consistent with SuDS principles as required under the Flood and Water Management Act 2010. (Ref.2.9) The drainage design will be finalised at the Detailed Design stage.

Table 7.4 Site Specific Mitigation Measures for Each Compound

Route Section	**Compound Name**	**National Grid Reference**	**Greenfield Runoff Allowable Discharge (l/s/ha)**	**Mitigation Reference**
A	Bridgwater Tee (Bath Road)	3327 1396	7.0	C1-7
B	A38 Bristol Road (Underground Cables)	3375 1529	7.7	C1-7
B	A38 Bristol Road (Overhead Line)	3373 1530	7.7	C1-7
B	South of the Mendip Hills (Hams Lane)	3373 1544	7.7	C1-7
C	Barton Road	3383 1563	9.2	C1-2
C	Castle Hill	3406 1583	8.9	C1-2
D	Towerhead Road	3412 1595	9.7	C1-2
D	Sandford AT Route Overhead Line Compound	3413 1607	8.5	C1-7
D	Sandford Substation Compound	3415 1603	8.5	C1-2
D	Engine Lane	3456 1695	8.7	C1-2
D	Nailsea	3461 1708	8.5	C1-2
D	Church Lane	3459 1717	8.8	C1-7
E	Clevedon Road	3462 1719	8.8	C1-2
E	Whitehouse Lane	3480 1730	9.1	C1-2
E	Caswell Hill	3490 1748	9.2	C1-2
F	Sheepway	3487 1757	9.2	C1-7
F	BW Underground Route West	3491 1767	9.2	C1-2
G	BW Underground Route East	3513 1764	8.4	C1-7
G	St Andrews Road	3518 1787	8.1	C1-7
G	Kings Weston Lane	3534 1789	8.1	C1-7
G	G Route Underground (East of M49)	3539 1789	8.1	C1-7
G	Seabank (Severn Road)	3540 1821	7.9	C1-7

Culvert Crossings

7.2.12 Culvert crossings will be constructed to minimise the impact on flood risk using the mitigation measures identified in **Table 7.5**.

Table 7.5 Culvert Mitigation Measures

Mitigation	Reason	Mitigation Reference
Culvert size to be selected to minimise afflux (maximum afflux of 100mm).	Maintain existing conveyance capacity	W1
No multiple pipes	Maintain existing conveyance capacity	W2
Box culverts will have no concrete bedding	Minimise environmental damage	W3
Circular culverts will have concrete bedding on IDB ditches	Prevent settling and therefore loss of flow capacity	W4
Headwalls will have a batter	Stability	W5
Maintain minimum clearance of overhead lines over watercourses	Ensure access for maintenance	W6

Bridge Crossings

7.2.13 Permanent bridge crossings will be constructed to minimise the impact on flood risk using the mitigation measures identified in **Table 7.6**.

Table 7.6 Bridge Mitigation Measures

Mitigation	Reason	Mitigation Reference
Bridge soffit will be above the 100 year flood level plus 600mm to allow for climate change and freeboard.	Minimise loss of channel capacity	B1
No piers in the watercourse	Minimise loss of channel capacity Minimise loss of conveyance	B2
Maintain minimum clearance of overhead lines over watercourses of 8.1m above bank level over IDB managed rhynes and 10.9m above bank level over Main Rivers.	Ensure access for maintenance	B3

Laying Underground Cables

7.2.14 The method of laying underground cable will require topsoil stripping. Where physically and technically possible, the topsoil stripped from within Flood Zone 3, wherever it is close to the boundary with Flood Zone 1, should be stockpiled in Flood Zone 1. The material stripped within Flood Zone 1 should be stored within the same zone. In all cases, stockpiling mitigation measure constraints should be observed. Trenches for cable laying are open for a short term only, being backfilled as the cable laying progresses, therefore, the associated stockpiles are not included in the floodplain displacement volume calculations.

7.3 Balancing Mitigation Measures with Other Environmental Risks

7.3.1 Within the context of developing flood risk mitigation measures during the construction phase, consideration is given to balancing temporary flood risks, either to the construction phase works or as a result of the construction phase works, with other environmental risks. This is particularly important given that the risks related to construction are both temporary and short term.

7.3.2 For example, placing a compound in Flood Zone 1 remote from the proposed location for a specific compound in Flood Zone 3 could lead to extended haul road lengths to transport equipment and materials from the Flood Zone 1 location to the location where the actual construction activities are required. The result of locating the compound in Flood Zone 1 instead of Flood Zone 3 could result in:

- a greater influence on flood risk – the haul road to provide access may have a greater influence on flood risk than the compound located within Flood Zone 3; and/or
- a greater environmental impact compared to having the compound closer to the working area (noise, traffic movements, visual impacts, ecological impact).

7.3.3 Both of these impacts are wider sustainability impacts that could outweigh the flood risk associated with putting the compound in Flood Zone 3.

7.3.4 A further example is the provision of compensatory storage in Flood Zone 1 at the same elevation at which the storage is "lost" due to the presence of the compounds or haul roads. In some instances, the nearest available Flood Zone 1 location could be several kilometres from the site and cause a negative environmental impact in an otherwise unaffected location.

7.3.5 The loss of floodplain storage by stockpiling of soils is temporary, being within the five year construction programme (seven years as considered through the FRA Sensitivity Test in **Volume 5.29.2.3**). The provision of compensatory storage could have significant environmental implications and actually exacerbate the situation as it would require additional earthworks. The justification has to be considered within the context of very extensive floodplains and the minor loss of floodplain storage overall.

7.4 Floodplain Displacement due to Construction and Mitigation Measures

7.4.1 The construction of the transmission line over a 57km length necessitates a number of construction site compounds with access haul roads distributed along the entire length. As described earlier, with the route crossing extensive floodplains, much of the construction phase infrastructure will be sited within Flood Zone 3.

7.4.2 The stockpiles, which will be linear features along the sides of haul roads, will displace flood storage i.e. take up space which would otherwise take flood water.

The displacement will be a function of the principles and calculations set out in this section. The displacement will be based on prisms of soil stockpiles up to 25m long, 8m wide at the base but tapering toward a crest no more than 1m wide. The cross-section of the stockpiles has been calculated based on an assumed side slope of 1:2.5 which gives a maximum height of 1.4m and a crest 1m wide. Between each prism would be a 25m gap so that along any length of haul road, no more than 50% of the length on any one side would have a stockpile adjacent to it. Depending on the specific location constraints, some stockpiles and gaps may be shorter, for example a 10m stockpile adjacent to a 10m gap. If there is room, both sides of the road could have a stockpile provided that the gaps are coincident so as not to impede flood flow.

7.4.3 The volume of soil for stockpiling that would be generated is based on an excavated depth of 0.3m. The haul road excavation width is assumed to be 4m for haul roads that are related to overhead line sections, and 7m for haul roads related to underground cable sections.

7.4.4 The construction of temporary site compounds will also generate volumes of topsoil for stockpiling. As for the haul roads, these would also be stored in stockpiles not exceeding 8m base width, and would be located close to the compound sites. The assumed depth of excavation at the compounds is also 0.3m.

7.4.5 To calculate the impact of the haul road and compound construction on flood risk the following contributing volumes are taken into account:

- excavated volume of topsoil stripped from the haul roads and compounds is calculated from depth (0.3m) times the plan area. For the haul roads the calculation is based on a linear metre of haul road;
- excavated material that is stockpiled will “bulk”, giving an increase in volume after shaping and compacting the stockpile, assumed to be 30%. This bulking effect has implications for the length of stockpile required (in terms of the physical space available) adjacent to the haul road or compound; and
- the haul roads and construction compounds are conservatively assumed to be constructed to 0.3m above the original ground level, which effectively takes up flood storage space if they are located within Flood Zone 3.

7.4.6 **Table 7.7** shows the calculation of the stockpile length required per linear metre of haul road in both underground cable and overhead line sections. The figures show that for the proposed stockpile profile, less than 50% of the route length would need to be used for stockpiles, assuming stockpiling on one side of the haul road. This confirms that the proposed approach to stockpiling is reasonable and achievable. Details of these calculations are included in **Volume 5.23.5.2, Appendix J**.

Table 7.7 Stockpile Mitigation Measures – Haul Road Topsoil Stockpile Length

Haul Road and Stockpile Dimensions and Volumes	Haul Road along Overhead Line Section	Haul Road along Underground Cable Section
Haul road width (m)	4	7
Excavation depth (m):	0.3	0.3
Excavated volume per linear metre of haul road (m^3/m):	1.2	2.1
Allowance for bulking of material from excavation (30%):	0.36	0.63
Total excavated volume to be stockpiled per linear metre of haul road (m^3/m):	1.56	2.73
Stockpile cross-sectional area (m^2):	6.3	6.3
Length of stockpile required per linear metre of haul road excavation (m):	**0.25**	**0.43**
Linear metres of haul road excavation that can be stored in a linear metre of stockpile (m):	**4.04**	**2.31**

7.4.7 To assess the impact that the temporary stockpiles from both the haul roads and construction compounds would have on reducing floodplain storage, the following key parameters are required: total volume in Flood Zone 3 taken up by haul road and compound excavation and construction; and area of floodplain over which this loss of floodplain storage is spread. Due to the variable topography along the route, this analysis is completed for each Route Section, including Options A and B for the routing through Route Section F. The volume of water displaced will be equivalent to the stockpile volume up to the depth of flood water above ground level, taking account of the side slopes of the stockpiles. The area over which the loss of floodplain storage is spread is assumed to be the Flood Zone 3 area that falls within 1km either side of the centreline of the route.

7.4.8 Flood depth is assumed to range from ground level up to 1m deep. To test the sensitivity of the displaced volume as a percentage of the flood volume within the floodplain, flood depths of 0.3m and 1m were calculated. A conservative approach whereby all of the stockpiled material within Flood Zone 3 occupies flood storage volume is also considered. The implication of this is that the flood depth across Flood Zone 3 is 1.4m (the maximum proposed height of the stockpiles) or that stockpiles need to be lower in some locations as a result of limited working space or other constraints, and hence all the stockpiled material is below the flood level.

7.4.9 In **Table 7.8** the volume of water displaced by the stockpiles for floods of 0.3m, 1.0m and 1.4m depth in Flood Zone 3 is given for each Route Section. It is clear that the displaced volume (loss of floodplain storage) is very small. The biggest percentage loss of floodplain is approximately 1% at 0.3m depth and 0.3% at 1m depth (Route Section F, Option B).

Table 7.8 Haul Road and Compound Construction Impacts on Floodplain Volumes

Route Section	Section Name	Area of floodplain (FZ3) within 1km either side of the route (m^2)	Storage loss in FZ3 for 1.4m flood depth (m^3)	Storage loss in FZ3 for 1.0m flood depth (m^3)	Storage loss in FZ3 for 0.3m flood depth (m^3)	Storage loss in FZ3 at 1.4m depth (%)	Storage loss in FZ3 at 1.0m depth (%)	Storage loss in FZ3 at 0.3m depth (%)
A	Puriton Ridge	4,730,000	17,436	16,329	11,728	0.26%	0.35%	0.83%
B	Somerset Levels & Moors South	27,570,000	82,196	76,977	55,287	0.21%	0.28%	0.67%
C	Mendip Hills AONB	1,180,000	446	417	300	0.03%	0.04%	0.08%
D	Somerset Levels & Moors North	29,150,000	57,191	53,560	38,468	0.14%	0.18%	0.44%
E	Tickenham Ridge	0	-	-	-	0.00%	0.00%	0.00%
F (A)	Portishead (Option A)	1,560,000	5,675	5,315	3,817	0.26%	0.34%	0.82%
F (B)	Portishead (Option B)	3,510,000	15,561	14,573	10,467	0.32%	0.42%	0.99%
G	Avonmouth	11,230,000	37,268	34,901	25,067	0.24%	0.31%	0.74%
H	Hinkley	1,930,000	2,799	2,622	1,883	0.10%	0.14%	0.33%

7.4.10 **Table 7.9** shows the impact that this estimated loss of floodplain storage would have on flood water levels. The Route Sections with the largest impact, Sections A, F and G, would result in an increase in floodplain depth of less than 5mm. This impact is therefore not significant. Full details of the calculations for floodplain storage loss and the resultant estimated increase in flood levels for each Route Section is included in **Volume 5.33.5.2, Appendix J,** which also includes a breakdown of the contributions from haul roads and construction compounds.

7.4.11 In conclusion, the displacement of floodplain due to stockpiles of spoil and construction of the haul roads and construction compounds is very small relative to the overall floodplain storage volume.

Table 7.9 Haul Road and Compound Construction Impacts on Floodplain Water Levels

Route Section	Section Name	Estimated increase in floodplain water level for given flood depth due to haul roads and compounds (mm)		
		Flood Depth in FZ3 of 1.4m	Flood Depth in FZ3 of 1.0m	Flood Depth in FZ3 of 0.3m
A	Puriton Ridge	3.7	3.5	2.5
B	Somerset Levels & Moors South	3.0	2.8	2.0
C	Mendip Hills AONB	0.4	0.4	0.3
D	Somerset Levels & Moors North	2.0	1.8	1.3
E	Tickenham Ridge	0.0	0.0	0.0
F (Option A)	Portishead (Option A)	3.6	3.4	2.4
F (Option B)	Portishead (Option B)	4.4	4.2	3.0
G	Avonmouth	3.3	3.1	2.2
H	Hinkley	1.5	1.4	1.0

7.5 Access and Egress for Maintenance

7.5.1 Once the works are completed, the requirement for access to the pylons, the overhead lines and underground cable works is limited. Any routine maintenance to these works would be in accordance with standard National Grid procedures and would be timed to avoid periods of flooding.

7.5.2 For the overhead lines, access is only generally required in the event that the overhead lines become damaged. However, the requirement for repair to overhead lines following storm damage or other event is extremely rare. The design of the works takes into account the loadings incurred during extreme wind events, and hence damage to 400kV and 132kV overhead lines is unlikely.

7.5.3 For the underground cables access to the jointing bays is typically required once every 4 to 5 years for inspection.

7.5.4 In the event that planned access is needed, consideration would be given to the location of works in Flood Zone 3 and flood warnings for the area to avoid periods of flood risk. Routine inspections would be planned to take account of forecast tidal surges, major flood events and prevailing weather conditions.

7.5.5 Given the limited nature of access requirements to any of the permanent works, it is demonstrated that access it not a significant concern, and therefore, the works are safe for "users" i.e. operations staff during times of flood.

7.6 Flood Warning and Escape and Evacuation

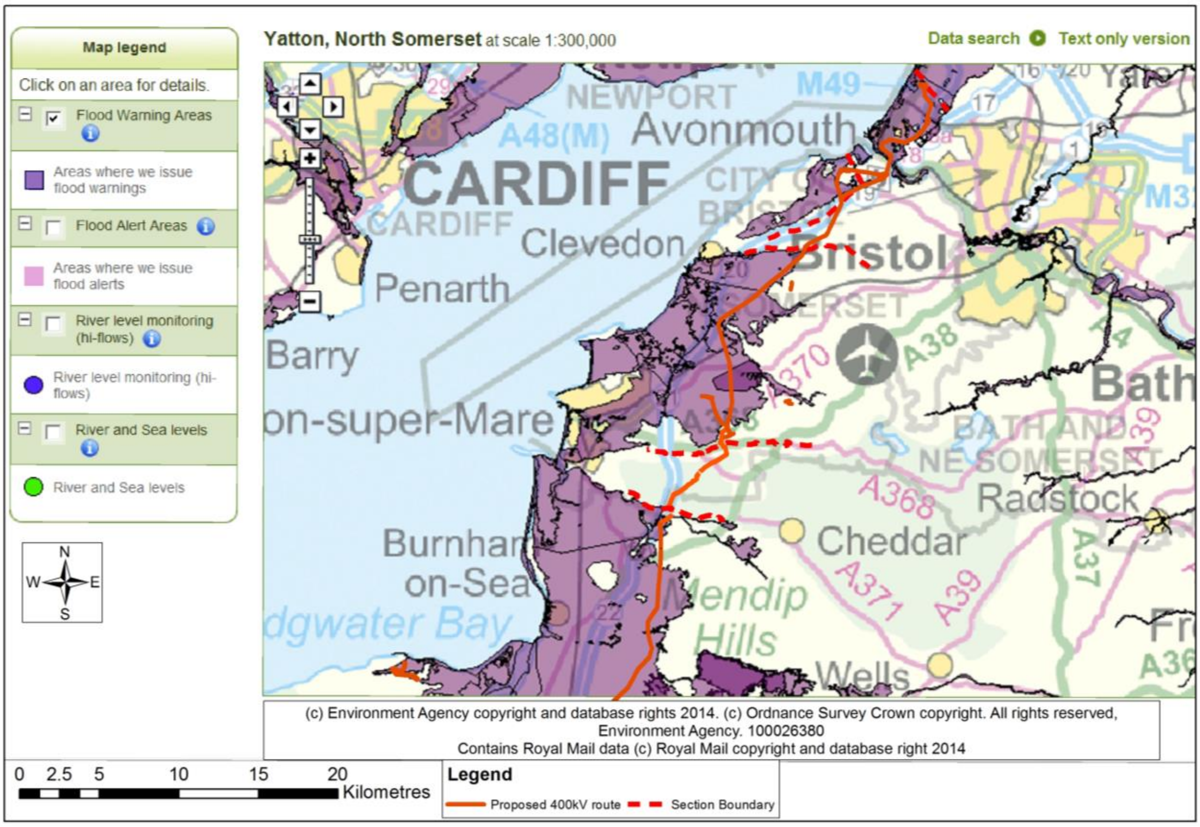
7.6.1 It is noted in section 5 that there are potentially flooding impacts during the construction phase in the event of a major fluvial and/or tidal event. Section 7.2 has demonstrated that careful management of the construction phase is required to minimise the impact of flooding on the construction phase works (and the impact that the works could potentially have on flooding elsewhere).

7.6.2 Even when all mitigation measures are in place there is a residual risk to the construction areas, particularly within Flood Zone 3. As there are major works within Flood Zone 3 the need for escape and evacuation during a major event is recognised as a means of managing this residual risk. This is primarily related to the safety of construction personnel, but also with regard to the removal of plant and materials to avoid a pollution risk.

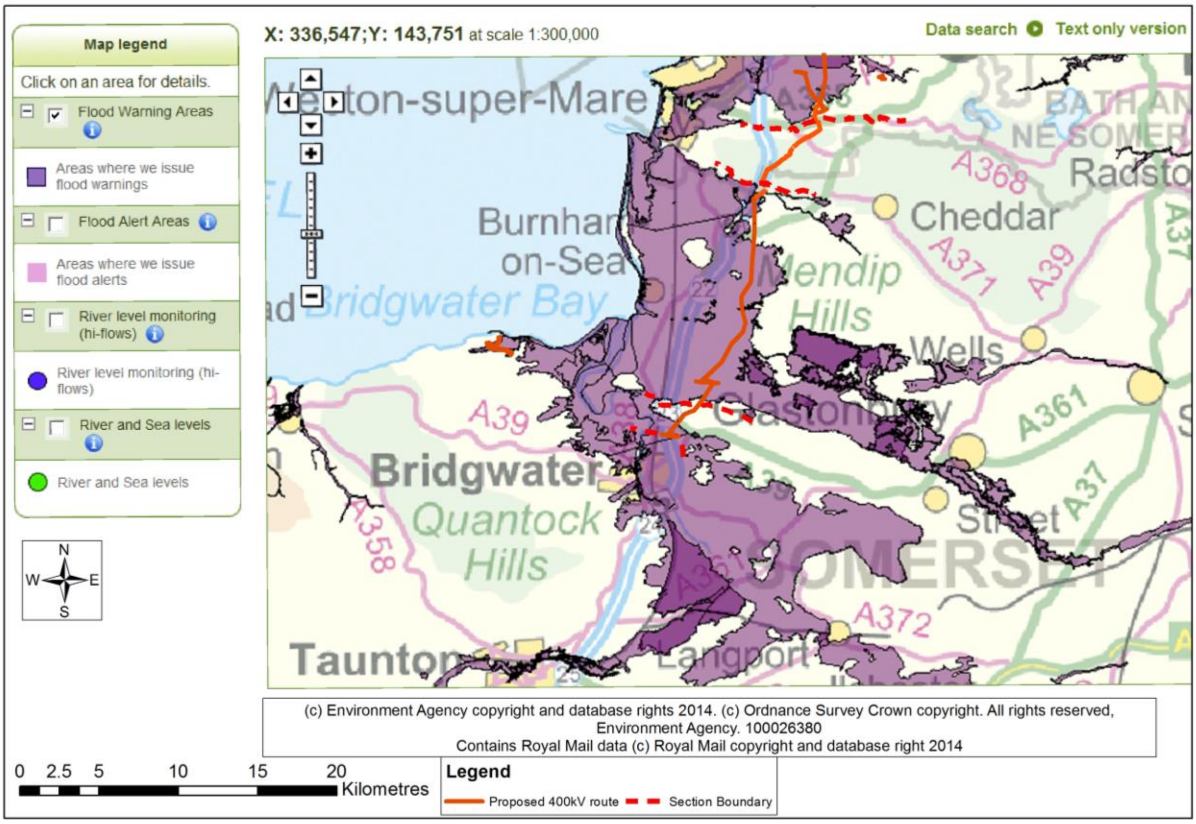
7.6.3 The nature of Flood Zone 3 along the proposed route is such that the onset of flooding is likely to be slow, developing over several days or even weeks as a result of sustained autumn and winter rainfall, as exemplified on parts of the Somerset Levels during the winter of 2013/14. This slow response to rainfall provides sufficient opportunity to respond to the Flood Warnings. The contractor would produce a site closure and evacuation plan that allows vacation of the site within the Flood Warning lead time.

7.6.4 **Insets 7.1 and 7.2** show the proposed route and the areas designated by the Environment Agency to receive Flood Warnings. During the construction phase, National Grid and the contractor would be signed up to the Floodline Warnings Direct Service provided by the Environment Agency so that adequate action could be taken to evacuate affected locations along the proposed route.

Inset 7.1: Flood Warning Areas – Northern Part of Proposed Development Route



Inset 7.2: Flood Warning Areas – Southern Part of Proposed Development Route



7.6.5 As flood warnings can be provided by phone, text or email, and the working sites would be extensive, arrangements would be made so that the warnings are issued to a suitable National Grid operations centre (or site offices) and to the contractor. The details of this arrangement would be developed following appointment of the contractor.

7.6.6 In addition to the fluvial and tidal flood risk in Flood Zone 3 areas, there is also a potential flood risk in the very unlikely event of a failure of Blagdon Lake or the Barrow Gurney Reservoirs. These potential reservoir flood sources are discussed in greater detail under section 4 and 5 with regard to Route Section D (Somerset Levels and Moors North) of the proposed route.

7.6.7 Reservoir flooding, whilst unlikely, has the potential to be severe as a result of potentially rapid onset of flooding following a breach. Bristol Water, responsible for the Barrow Gurney Reservoirs and Blagdon Lake should be informed of the operations in the area and establish a contact arrangement for use in an emergency.

7.6.8 Details of evacuation plans for different parts of the proposed route would be developed prior to commencing construction and would detail the procedure to be followed once a flood warning is received, either from the Environment Agency for fluvial/tidal flooding, or from Bristol Water for a reservoir breach. Primary considerations for the evacuation plan include:

- **evacuation of personnel** from the working areas at risk of flooding – this is the primary safety consideration, and is the highest priority in the unlikely event that there is insufficient time to undertake the following activities;
- **making the site safe** and prior to evacuation – this would include appropriate storage of equipment and materials, securing items within site compounds to prevent them being mobilised in flood water; and
- **removal of critical plant and equipment** from Flood Zone 3 – this may be removal from the haul roads or from the compounds, and could include raising critical items above the design flood level or removing them from the floodplain completely to a suitable alternative compound. At construction stage, the contractor would identify the need (or not) to remove equipment from working areas based on the flood warnings.

7.6.9 Potential evacuation routes for all compounds located within Flood Zone 3 and for compounds in other Flood Zones that are surrounded by Flood Zone 3 have been identified as shown in **Table 7.10**. Provisional evacuation routes are based on major construction traffic routes where possible and seeking the shortest route out of Flood Zone 3. Haul road evacuation routes are likely to be based on the nearest compound evacuation route, and would be confirmed at construction stage.

Table 7.10 Indicative Evacuation from Construction Related Compounds

Compound Name	National Grid Reference	Flood Zone	Evacuation Route
Bridgwater Tee (Bath Road)	3327 1396	3	North then west on A39 to Junction 23 of M5. Head south or north. Alternatively A39 eastwards which is minimum distance in Flood Zone 3.
A38 Bristol Road (Overhead Line) and A38 Bristol Road (Underground Cables)	3374 1530	3	If passable, east on A38. If this route is unavailable, the alternatives are: Webbington Road east to A38 (Note not a Major Construction Traffic Route). Haul road north to Sandford then east on A368 to A38 heading north east.
South of the Mendip Hills (Hams Lane)	3373 1544	3	Webbington Road east to A38 (Note not a Major Construction Traffic Route). Haul road north to Sandford then east on A368 to A38 heading north east.
Barton Road	3383 1563	1	Webbington Road east to A38 (Note not a Major Construction Traffic Route). Haul road north to Sandford then east on A368 to A38 heading north east.
Castle Hill	3406 1583	1	Haul road north to Sandford then east on A368 to A38 heading north east.
Towerhead Road	3412 1595	1	East on A368 to A38 heading north-east
Sandford Compounds	3414 1605	3/1	Nye Road south to A368 head east or Haul road to A368 east (but crosses FZ3 at Towerhead Brook)
Engine Lane Compound	3456 1695	1	North on Engine Lane and North Street, East on Queens Road. South on Station Road to Backwell. A370 north-east.
Nailsea Compound	3461 1708	1	South on haul road. East along Hanham Way/Queens Road. South on Station Road to Backwell. A370 north-east.
Church Lane	3459 1717	3	East on B3130 Clevedon Road then east on B3128
Clevedon Road	3462 1719	1	East on B3130 Clevedon Road then east on B3128
Whitehouse Lane	3480 1730	1	South on Cuckoo Lane. East on B3128.
Caswell Hill	3490 1748	1	East along Caswell Lane through Portbury (Note not a Major Construction Traffic Route) to M5 junction 19. M5 either north or south.
Sheepway	3487 1757	3	East on Sheepway to A369 then east to Junction 19 of M5 heading east.

Compound Name	National Grid Reference	Flood Zone	Evacuation Route
BW Underground Route West	3491 1767	1	Haul road east to Portbury Dock Road, then south to M5 junction 19. M5 either north or south.
BW Underground Route East	3513 1764	1	Haul road west to Portbury Dock Road, then south to M5 junction 19. M5 either north or south.
St Andrews Road	3518 1787	3	South on A403 to roundabout, east on A4 then to Junction 18 or 18A of M5. M5 either north or south or M49 north-west
Kings Weston Lane	3534 1789	3	South west on haul road then onto Avonmouth Way. At A4 roundabout east onto M5 Junction 18 or 18A. M5 either north or south or M49 north-west
G Route Underground (East of M49)	3539 1789	3	South west along haul road then onto Avonmouth Way. At A4 roundabout east onto M5 Junction 18 or 18A. M5 either north or south or M49 north-west.
Seabank (Severn Road)	3540 1821	3	South on A403 to roundabout, east on A4 then to Junction 18 or 18A of M5. M5 either north or south or M49 north-west.

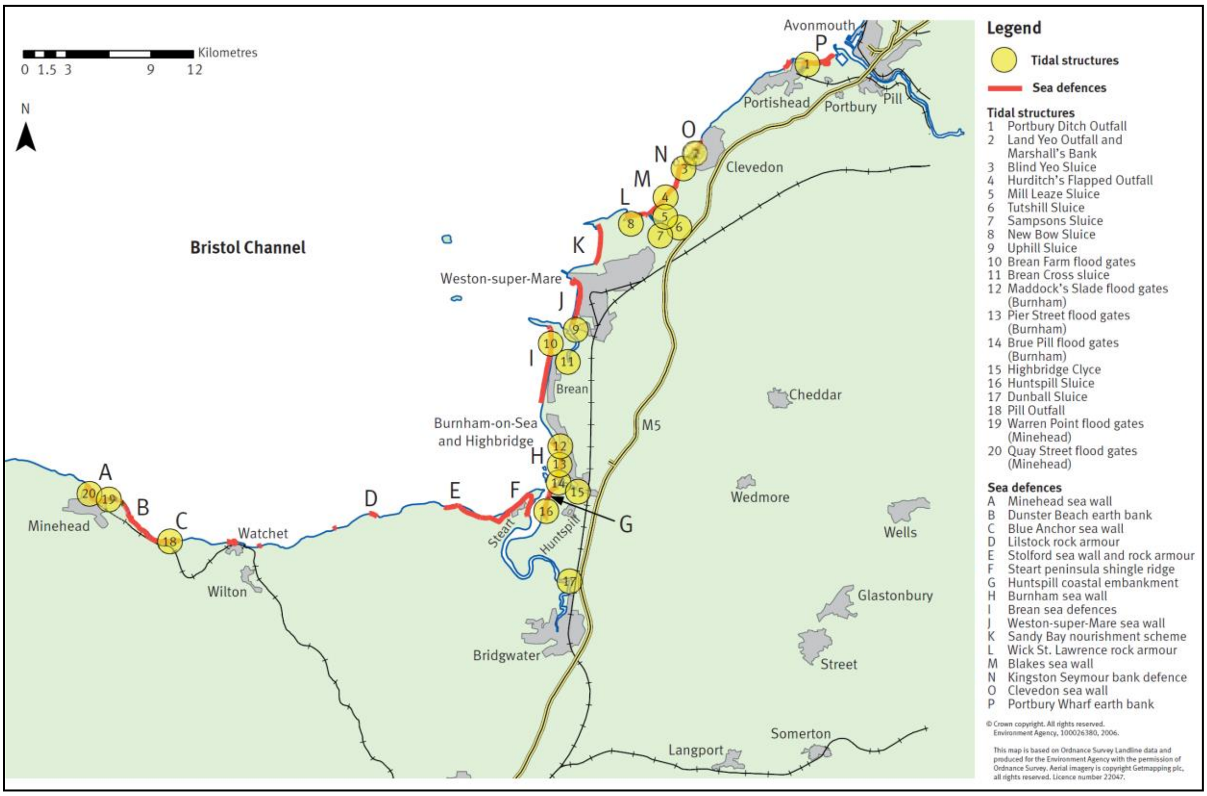
7.7 Flood Defences

7.7.1 Much of the proposed route between Bridgwater and Seabank is on very low lying land, crossing the Somerset Levels and Moors, as well as low lying tidal floodplains bordering the Bristol Channel.

7.7.2 As identified in previous sections, there is a high fluvial and tidal flood risk for various Route Sections. However, there are formal flood defences in place to protect large sections of the proposed route.

7.7.3 Along the length of the proposed route, there are flood defences, typically in the form of earth embankments, on several Main Rivers. There are also a series of major hydraulic control structures, typically tidal sluices, which control river levels inland and prevent tidal inflows along the rivers. Integral to the wider flood protection for much of the length of the route are a series of sea defences. **Inset 7.3** is an extract from “Somerset and the Sea” (Ref.7.32) which shows key sea defences and tidal structures. The defences are all located several kilometres west of the proposed route, but without them, there would be a significantly increased flood risk along the proposed route.

Inset 7.3: Somerset Sea Defences



Source: Somerset and the Sea, Environment Agency

7.7.4 Associated with many of the tidal structures are a series of flood embankments providing protection against fluvial flooding, which at times can be significantly influenced by the tide. **Table 7.11** summarises the key watercourses which have flood defences protecting parts of the route (directly or indirectly), and the tidal structures which are integral to the overall flood defence for the river.

Table 7.11 Key Flood Defences along the Proposed Route

Route Section	**Watercourse and Flood Defences *(references in parentheses are defences shown in Inset 7.1)***	**Flood Risk**
A	River Parrett: Embankments – west of route	Fluvial flood risk with tidal influence.
A	King's Sedgemoor Drain: Embankments – along route Dunball Sluice (17) – west of route	Fluvial flood risk with tidal influence.
B	Huntspill River: Embankments – along route Huntspill Sluice (16) – west of route	Fluvial flood risk with tidal influence.
B	Cripps River: Embankments – east of route	Fluvial flood risk with tidal influence. Tributary to the River Brue.
B	River Brue: Brue Pill Tidal Embankments – west of route Highbridge Clyce (15) – west of route	Fluvial flood risk with tidal influence.
B	Lower Axe; Axe Tidal Banks - west of route Brean Cross Sluice (11) - west of route	Fluvial flood risk with tidal influence.
D	Congresbury Yeo: Embankments – along route Tutshill Sluice (6) - west of route	Fluvial flood risk with tidal influence.
F	Portbury Ditch Embankments – north west of route Tidal Outfall (1) – north west of route	Primarily tidal flood risk. Outfall direct to Severn Estuary.
F	Drove Rhyne Embankments – north of route	Primarily tidal flood risk. Outfall direct to Severn Estuary.
H	Coastline Stolford Sea Wall (E)	Tidal flood risk.

7.7.5 Sections 4 and 5 of this FRA demonstrate that the flood risk to the development and posed by its construction is greater during the construction phase than during the operational phase. With the proposed timeframe for the construction being in the short to medium term, it is reasonable to assume that these defences would remain in place during the construction phase. The flood levels "with defences" are therefore used as the basis for the design water levels to inform the flood risk during construction.

7.7.6 **Volume 5.23.5.2, Appendix I** shows the flood outline for Main Rivers and the sea with flood defences in place for the 1 in 30 (3.3%) annual probability event. For comparison, it also shows the Flood Zone 3 outline, which represents the 1 in 100 (1%) annual probability fluvial flood event or the 1 in 200 (0.5%) annual probability tidal flood event.

7.7.7 The works associated with the overhead lines and underground cables would not affect any flood defence maintenance activities. The key factor related to this is the clearance that the overhead lines have over each of the existing flood embankments. The overhead line clearances at each Main River crossing have been discussed with the Environment Agency and the line has been designed to ensure a minimum clearance of 10.9m above the local mean bank crest level at those rivers where the Environment Agency has indicated it carries out maintenance activities (those classified as Main Rivers). The Somerset Drainage Board Consortium advise that required vertical clearance above bank top height for the drainage rhynes they maintain is 8.1m.

7.8 Residual Effects

7.8.1 The aim of the mitigation measures is to reduce the severity and likelihood that the proposed construction phase works would have on increasing flood risk elsewhere. **Table 7.12** shows the impact of the proposed construction phase on flood risk elsewhere when all necessary mitigation measures are implemented.

7.8.2 The mitigation measures in most Route Sections reduce the impact of the construction phase works to a low severity defined as having the potential to cause some localised disruption such as flooded field or minor road only. An investigation has been undertaken to identify any vulnerable locations along the route where the presence of the haul road may cause flooding problems due to potential compartmentalisation of the floodplain. The entire route of the haul road has been assessed using LiDAR data and the surface water flood map (1 in 30 (3.3%) AEP) to identify locations where the raised haul road could cause a backwater effect. At between 50-300mm above ground level, the haul road would have a minimal capability to retain floodwater and it does not create a prolonged interruption to natural flow paths. No areas were identified that were considered to be particularly vulnerable. The analysis demonstrates that the residual risk is limited to very localised areas of ponding and these are most likely to be in the low lying sections of the route. The following locations were noted, with mapping included in**, Volume 5.23.5.2 Appendix J** to support the analysis:

- Route Section B at Old River Axe crossing (NGR 3374 1535) shown in **Figure 2, Volume 5.23.5.2 Appendix J**.
  - The haul road crosses the Old River Axe where it is embanked and at a higher elevation than the surrounding moors. The temporary crossing of the Old River Axe would be via a bridge designed to minimise any hydraulic restriction in the River The configuration of the haul road would allow any spill from the watercourse to follow its natural route to the low lying moor.. Surface water and overland flows in the area would be able to cross the haul road through the numerous culvert crossings indicated on Figure 2, **, Volume 5.23.5.2 Appendix J.** There are no properties or roads in the vicinity of the Old River Axe crossing.
- Route Section D in the vicinity of the Nailsea Compound (NGR 3457 1705) shown in **Figure 3, Volume 5.23.5.2 Appendix J**.
  - This location has several haul roads and a compound in close proximity to Nailsea and in an area shown as at risk from the 1 in 30 (3.3%) AEP surface water flood event. Nailsea is located on ground elevated

approximately 2m above Nailsea Moor, over which the haul roads cross. This height difference is sufficient to protect the settlement from any ponding caused by the haul roads. However, the 1 in 30 (3.3%) AEP surface water flood extent is shown to cross the Causeway, an access road between Nailsea and the B3130 and Tickenham. Whilst the haul road is proposed to run parallel to the North Drove Rhyne on an existing track (The Drove) there is the potential to increase the depth and frequency of flooding in this location potentially impacting on the Causeway.

  - This will be mitigated through the watercourse crossings to be provided at each watercourse crossing, for example, C-LD76-CR01, 02 and 03 (**Figure 3, Volume 5.23.5.2 Appendix J**).
  - For the haul road located to the east of Parish Brook, effectively upstream of Parish Brook in terms of surface water flow paths, it is seen from **Figure 3, Volume 5.23.5.2 Appendix J**) that there is the potential for the haul road and the Nailsea Compound to act as a barrier to surface water flows from Nailsea, as seen from the two primary surface water flow paths along Watery Lane and crossing Causeway View (**Figure 3, Volume 5.23.5.2 Appendix J**). The potential risk that this presents would be addressed through the watercourse crossings W-ROUTE-CR01, 03 and 04.

- Route Section D/E at Church Lane and Clevedon Road Compound area (NGR: 3459 1717) shown in **Figure 4, Appendix J, Volume 5.23.5.2**.
  - This area was investigated because of the close proximity to properties and roads and the presence of a 1 in 30 (3.3%) AEP surface water flood outline. Close inspection of the levels indicates that the terrain is dropping from east to west and that the haul road only crosses the flow path where it is the Land Yeo watercourse. An appropriately sized bridge (soffit 600mm above the 1 in 100 (1%) AEP flood) at the Land Yeo crossing should mitigate the flood risk in this location.
- Route Section G at Kings Weston Lane Compound (NGR: 3533 1787) shown in **Figure 5, Volume 5.23.5.2 Appendix J**.
  - Two haul roads meet at Kings Weston Lane. There is the potential for the haul roads (which are perpendicular to Kings Weston Lane) to interrupt the 1 in 30 (3.3%) AEP surface water flow path from the south side of the haul road entering the nearby drains and progressing into the Kings Weston Rhyne. Without mitigation the haul road could cause ponding to start earlier than previously in a 1 in 30 (3.3%) AEP event and to occur in less severe events. The proposed watercourse crossings G-ROUTE-CR04, 05 and 06 (**Figure 5, Volume 5.23.5.2 Appendix J**) would mitigate this risk, but the haul road level at this location should also be as close as possible to ground level to minimise the impact.
- Route Section H at Hinkley (NGR: 3209 1454) shown in **Figure 6, Volume 5.23.5.2 Appendix J**.

- There is the potential for the haul road, which is perpendicular to the surface water flow path, to block the surface water flow path and its discharge into the local drainage network. However, the surface water flow path enters a drain which runs alongside the haul road, subsequently connecting to other watercourses that form part of the land drainage network. No specific additional mitigation is required beyond the mitigation measures for haul road construction adjacent to and over watercourses

7.8.3 Following mitigation, Route Section BRoute Section D are still at Moderate Risk as a result of the construction phase increasing flood risk from fluvial sources. It is emphasised that these areas potentially affected are already at risk of flooding, and the potential need to evacuate in the event of a major fluvial flood already exists. However, the presence of the construction phase works raises this flood risk elsewhere on a temporary basis anticipated to be up to five years (seven years as indicated through the FRA Sensitivity Test, **Volume 5.29.2.3**).

7.8.4 Following completion of construction, all haul roads, temporary compounds and associated temporary works such as haul road culverts and bridge crossings would be removed, in accordance with requirements 15 and 20 of Schedule 3 of the draft DCO.

7.8.5 The soil stockpiles, which would be created when the haul roads and compounds are constructed, would be used in the reinstatement where possible, as follows:

- Assuming a maximum depth of excavation of 300mm for the haul road construction, this gives an indication of the depth of reinstatement that would be required.
- Reinstating and compacting the stockpiled topsoil would give a reinstated ground level typically around 50mm higher than the adjacent ground level. This will allow for a small amount of settlement in the reinstated areas.
- This settlement allowance is within the range of depth of natural undulations that are present across the floodplain, thereby resulting in negligible residual impacts after construction is complete.

7.9 Mitigation Measures for Operational Phase

7.9.1 The Proposed Development is classified as Essential Infrastructure and is Water Compatible. An assessment of the risks caused by the operational phase (as detailed in section 4 of this FRA) indicates that there is no anticipated increase in flood risk elsewhere and that no mitigation measures are required. However, its location within Flood Zones 2 and 3 require that a sequential approach has been adopted in the site selection. This is demonstrated in the Sequential Test Report in **Volume 5.23.5.2, Appendix A**. The application of the Sequential and Exception Tests is summarised in section 7.10.

Table 7.12 Flood Risks posed by the Construction Phase to Other Receptors

Route Section	Action	Fluvial	Tidal	Surface Water	Groundwater	Water Services	Reservoirs
A- Puriton Ridge	No Mitigation	Low	None	Moderate	Very Low	Very Low	None
	With Mitigation	N/A	N/A	Low	N/A	N/A	N/A
B- Somerset Levels and Moors South	No Mitigation	Significant	None	Moderate	Very Low	Very Low	None
	With Mitigation	**Moderate**	N/A	Low	N/A	N/A	N/A
C- Mendip Hills AONB	No Mitigation	Low	None	Moderate	Low	Very Low	None
	With Mitigation	N/A	N/A	Low	N/A	N/A	N/A
D- Somerset Levels and Moors North	No Mitigation	Significant	None	Moderate	Very Low	Very Low	None
	With Mitigation	**Moderate**	N/A	Low	N/A	N/A	N/A
E-Tickenham Ridge	No Mitigation	Very Low	None	Moderate	Low	Very Low	None
	With Mitigation	N/A	N/A	Low	N/A	N/A	N/A
F- Portishead	No Mitigation	Moderate	None	Moderate	Very Low	Very Low	None
	With Mitigation	Low	N/A	Low	N/A	N/A	N/A
G- Avonmouth	No Mitigation	Moderate	None	Moderate	Very Low	Very Low	None
	With Mitigation	Low	N/A	Low	N/A	N/A	N/A
H- Hinkley Line Entries	No Mitigation	Low	None	Moderate	Very Low	Very Low	None
	With Mitigation	N/A	N/A	Low	N/A	N/A	N/A

7.10 Application of the Sequential and Exception Tests

7.10.1 Sections 2.16 and 2.17 set out the requirements of the Sequential and Exception Tests. This section summarises how these tests have been met. The wider consideration of the Sequential Test for the Proposed Development as a whole is included in the Hinkley Point C Connection Route FRA Appendices, (**Volume 5.23.5.2, Appendix A**).

7.10.2 With regard to the location of the proposed route crossing all Flood Zones, in particular Flood Zones 3a and 3b, both the Sequential Test and Exception Test need to be passed for "Essential Infrastructure".

7.10.3 For the Sequential Test, the analysis within the preceding sections has demonstrated that the overhead lines and underground cables could remain operational and safe in times of flood. This has taken specific account of:

- mitigation for tidal (and other) flood risk;
- access and egress for planned maintenance; and
- escape and evacuation routes.

7.10.4 Additionally, there are no other suitable routes to locate the works so as to avoid Flood Zone 3 within the context of a connection requirement between Bridgwater and Seabank.

7.10.5 It is considered that the proposed works related to the overhead lines and underground cables meet the requirements of the Sequential Test.

7.10.6 For the Exception Test, the vulnerability of the works has been considered, and it has been demonstrated that the various assets related to the overhead lines and underground cables would be unmanned, posing no risk to users. The nature of the tidal and fluvial flood risk is such that there are likely to be forecasts and warnings of major storm surges in advance of the need to mobilise to any locations for maintenance, allowing maintenance to be scheduled around any potential flood conditions.

7.10.7 Following completion of the works there is no increase in flood risk elsewhere.

7.10.8 Within the constraints of the nature of the works, there are no suitable previously “developed” areas that could be used for the overhead lines and underground cables. However, as far as possible, the proposed route makes use of existing overhead line routes.

7.10.9 The wider sustainability benefits are considered to outweigh the flood risk, as without the proposed connection between Bridgwater and Seabank CSE there would be insufficient transmission infrastructure in the region to enable a move towards a low-carbon economy.

It is considered that the proposed works related to the overhead lines and underground cables meet the requirements of the Exception Test.

8. CONCLUSIONS

8.1 General

8.1.1 This FRA complies with the requirements set out in National Policy Statements, specifically Overarching Energy Policy (EN-1) and Electricity Networks Infrastructure Policy (EN-5) and demonstrates that flood risk from all sources has been considered for the proposed overhead line and underground cable route.

8.1.2 The proposed Hinkley C Connection route from Bridgwater to Seabank crosses all three Flood Zones (Flood Zone 1, 2 and 3) with approximately 60% of the route falling within Flood Zone 3. Along much of the route within Flood Zone 3 fluvial and tidal flood risk are considered together, as fluvial flood risk is strongly influenced in many cases by the tidelocking of control structures or tidal flows along watercourses on high tides.

8.1.3 The designation of areas in Flood Zone 3 means that the area has a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

8.1.4 The NPPF sets out a Sequential Test, which states that preference should be given to development located within Flood Zone 1. If there is no reasonably available site in Flood Zone 1, then built development can be located in Flood Zone 2. If there is no reasonably available site in Flood Zone 1 or 2, then nationally significant energy infrastructure projects such as the Hinkley Point C Connection project - classified as “Essential Infrastructure” - can be located in Flood Zone 3 subject to passing a series of criteria known as the Exception Test.

8.1.5 For the overhead lines and underground cables which form part of the Proposed Development, it is demonstrated that the requirements of both the Sequential Test and the Exception Test have been met.

8.1.6 Due to the nature of the construction works required across large areas of Flood Zone 3 detailed specific consideration has been given to flood risk during the construction phase.

8.1.7 An assessment of the flood hazards during construction and operation has concluded that:

- The primary flood hazards to which both the Proposed Development and the construction phase works are exposed is fluvial and tidal flooding.
- The exposure to the fluvial and tidal flood hazards, and therefore the likelihood of an event occurring, is lower for the construction phase than for the operational phase due to the different timeframes for each phase: five years for construction (seven years in the FRA Sensitivity Test, **Volume 5.29.2.3**); 40 years for operation.
- The severity of the impact of a flood event (from any source) on the construction phase works is significantly higher than the impact on the permanent works.

- The overall balance of risk between “higher likelihood, lower severity” events during the operational phase (on the permanent works) and “lower likelihood, higher severity” events during the construction phase (on the temporary works) is such that the overall flood risk is higher during the construction phase. This principle applies to both the impact on the construction works, and the impact resulting from the construction works on flood risk elsewhere.

- Whilst the primary exposure to flood hazard is from fluvial and tidal events, there are isolated locations within some Route Sections that are exposed to other sources of flood hazard.

- There is a need for mitigation measures to be developed with regard to various flood risks. This has a significant focus on mitigating the potential impact on flood risk elsewhere as a result of the construction works.

8.1.8 The impact of climate change has been assessed using the latest UKCP09 projections. This covers the anticipated operational life of the works to 2060. The overhead lines and the underground cables are resilient to flooding, and would remain so with regard to extreme events under this climate change scenario. It may be anticipated that the works may be flooded to greater depths, more frequently, or for more prolonged durations, but this would not impact on operational aspects.

8.1.9 In the event that the works are required beyond 2060, the climate change impacts would be negligible. Even under the H++ climate change scenario, there would be no detriment to the operation of Hinkley C Connection route, despite the higher likelihood of flooding occurring along the route as the works are resilient to significant flood depths for prolonged periods.

8.2 Flood Risk to the Overhead Lines and Underground Cables

8.2.1 Flood risk to the overhead lines and underground cables during its operational life varies along the route as the hydrological, hydrogeological and topographical characteristics vary. However, the works are resilient to inundation and would continue to operate as normal even when there is extensive flooding for prolonged periods of time, which is quite possible over some parts of the route, particularly Sections B and D in the Somerset Levels and Moors.

8.2.2 The flood risks are greater during the construction phase. On the whole, flood risk to the works during the construction phase could not be fully mitigated without having a significant impact on flood risk elsewhere. For example, raising haul roads significantly to reduce the likelihood of them being flooded, would have a negative impact on flooding elsewhere by compartmentalising the floodplain and disrupting natural floodplain and surface water flow paths. Such mitigation measures are therefore not appropriate.

8.2.3 The primary mitigation measure with regard to limiting the impact of flooding on the construction phase would be that when fluvial, tidal or surface water flooding occurs the affected work areas would need to be closed down and the area evacuated until the flood event recedes. To support this mitigation measure, a site closure and evacuation plan would be developed that would be instigated on a flood warning provided through the Environment Agency's Flood Warnings Direct service, or from the observed onset of flooding.

8.2.4 There is a very low probability, high impact risk from the possible breach of reservoirs affecting parts of the route. To support the mitigation of this risk, emergency plans would be made through the reservoirs' operator Bristol Water.

8.3 Impact on Flood Risk Elsewhere due to Overhead Lines and Underground Cables

8.3.1 The impact of the overhead lines and underground cables on flood risk elsewhere during its operational life is minimal, and makes no quantifiable change to flood risk.

8.3.2 During construction, there is the potential for the works to disrupt natural hydrological processes and as a result increase the flood risk elsewhere. The stripping and stockpiling of topsoil, the construction of haul roads and compounds and the culverting of watercourses have been identified as having the potential to increase flood risk elsewhere. These activities have the potential to:

- increase runoff rates and volumes;
- reduce floodplain connectivity;
- reduce floodplain volumes;
- reduce watercourse channel capacities; and
- change groundwater flow paths.

8.3.3 Mitigation measures have therefore been identified that would minimise the impact of the construction phase works on flood risk elsewhere. In most Route Sections the proposed mitigation measures will ensure that there is a low or very low impact on nearby receptors. Only in the Somerset Levels and Moors North and South (Route Sections B and D) is the residual risk moderate (**Table 8.1**). This means that there remains the possibility that the works in this area could increase the flood risk locally (above the existing flood risk) that may not have occurred if the flood event occurred without the presence of the construction works. Shaded areas of **Table 8.1** show where mitigation measures have not been applied as none are considered necessary.

8.3.4 These actions provide significant mitigation, reducing the risk as far as is reasonably practicable. Whilst the risks are not completely eliminated, the residual risk is short term, lasting only for the duration of the construction programme, anticipated to be five years (up to seven years as indicated through the FRA Sensitivity Test, **Volume 5.29.2.3**).

Table 8.1 Impact of the Construction Phase Works on Flood Risk Elsewhere following Mitigation (Residual Risk)

Route Section	Fluvial	Tidal	Surface Water	Groundwater	Water Services	Reservoirs
A	Low	None	Low	Very Low	Very Low	None
B	**Moderate**	None	Low	Very Low	Very Low	None
C	Low	None	Low	Low	Very Low	None
D	**Moderate**	None	Low	Very Low	Very Low	None
E	Very Low	None	Low	Low	Very Low	None
F	Low	None	Low	Very Low	Very Low	None
G	Low	None	Low	Very Low	Very Low	None
H	Low	None	Low	Very Low	Very Low	None

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