VikingLink

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# UK Onshore Scheme

## Environmental Statement

## Volume 2 Document ES-2-C.03

## Chapter 19

## Water Resources & Hydrology (Proposed Converter Station)

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| Environmental Statement Volume 2 | | | |
|---|---|---|---|
| **ES Reference** | **Chapter** | **Chapter Title** | |
| ES-2-A.01 | Ch01 | Introduction | |
| ES-2-A.02 | Ch02 | Development of the UK Onshore Scheme | |
| ES-2-A.03 | Ch03 | The UK Onshore Scheme | |
| ES-2-A.04 | Ch04 | Environmental Impact Assessment Methods | |
| ES-2-B.01 | Ch05 | The Proposed Underground DC Cable | |
| ES-2-B.02 | Ch06 | Intertidal Zone | |
| ES-2-B.03 | Ch07 | Geology & Hydrogeology | |
| ES-2-B.04 | Ch08 | Water Resources & Hydrology | |
| ES-2-B.05 | Ch09 | Agriculture & Soils | |
| ES-2-B.06 | Ch10 | Ecology | |
| ES-2-B.07 | Ch11 | Landscape & Visual Amenity | |
| ES-2-B.08 | Ch12 | Archaeology & Cultural Heritage | |
| ES-2-B.09 | Ch13 | Socio-economics & Tourism | |
| ES-2-B.10 | Ch14 | Traffic & Transport | |
| ES-2-B.11 | Ch15 | Noise & Vibration | |
| ES-2-B.12 | Ch16 | Register of Mitigation | |
| ES-2-C.01 | Ch17 | The Proposed Converter Station | |
| ES-2-C.02 | Ch18 | Geology & Hydrogeology | |
| **ES-2-C.03** | **Ch19** | **Water Resources & Hydrology** | |
| ES-2-C.04 | Ch20 | Agriculture & Soils | |
| ES-2-C.05 | Ch21 | Ecology | |
| ES-2-C.06 | Ch22 | Landscape & Visual Amenity | |
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| ES-2-C.08 | Ch24 | Socio-economics & Tourism | |
| ES-2-C.09 | Ch25 | Traffic & Transport | |
| ES-2-C.10 | Ch26 | Noise & Vibration | |
| ES-2-C.11 | Ch27 | Register of Mitigation | |
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# Glossary & Abbreviations

| Glossary of Terms | |
|---|---|
| **Term** | **Meaning** |
| Alternating Current (AC) | Electric power transmission in which the voltage varies in a sinusoidal fashion. This is the most common form of electricity transmission and distribution. |
| base scheme design | The design of the UK Onshore Scheme for the purposes of the planning application. |
| connection point | The existing Bicker Fen 400 kV Substation; the point on the National Electricity Transmission System (NETS) where Viking Link connects. |
| the Contractor | Party or parties responsible for the detailed design and construction UK Onshore Scheme. |
| converter station | Facility containing specialist equipment (some indoors and some potentially outdoors) for the purposes of converting electricity from AC to DC or DC to AC. |
| converter station site | The proposed site occupying approx. 30 ha containing the converter station and associated landscaping, drainage as well as land required for construction. |
| converter station zone | The proposed zone occupying approx. 8 ha containing the converter station buildings, outdoor electrical equipment and hardstandings within a security fence. |
| detailed scheme design | The design of the Scheme developed by the Contractor within the Limits of Deviation (AC and DC cables) and Rochdale Envelope (converter station). |
| Direct Current (DC) | Electric power transmission in which the voltage is continuous. This is most commonly used for long distance point to point transmission. |
| Limits of Deviation | These define the maximum extents of the corridor for which planning permission is sought and within which proposed DC and AC cable routes may be installed. |
| Open cut methods | Cable installation methods which require the excavation of a trench into which ducts or cables can be directly laid. |
| the Project | Viking Link, from the connection point at Revsing Substation in Denmark to the connection Bicker Fen Substation in Great Britain). |
| Rochdale Envelope | This defines the parameters of the proposed converter station for which planning permission is sought including its location, layout and dimensions. |
| the Scheme | UK Onshore Scheme from MLWS to the connection point comprising underground AC and DC cables, converter station and access road. |
| Temporary Construction Compound | Compound used by the Contractor for siting of offices, welfare facilities, storage and laydown. |
| Temporary Construction Facilities | All areas used for temporary construction requirements including compounds, working areas. |

| Glossary of Terms | |
|---|---|
| **Term** | **Meaning** |
| Temporary Works Area | Larger working area located on or adjacent to the working width used where construction activities requires a larger area for example at trenchless crossings. |
| trenchless methods | Cable installation methods used to cross obstacles such as roads or watercourses and ensure less disturbance at the ground surface. |
| working width (AC cables) | The 50 m wide working corridor required for the installation of underground AC cables. |
| working width (DC cables) | The 30 m wide working corridor required for the installation of underground DC cables. |

| List of Abbreviation | |
|---|---|
| **Abbreviation** | **Meaning** |
| AOD | Above Ordnance Datum |
| bgl | Below ground level |
| BGS | British Geological Survey |
| BRE | Building Research Establishment |
| DECC | Department of Energy and Climate Change |
| DEFRA | Department for Environment Food and Rural Affairs |
| DMRB | Design Manual for Roads and Bridges |
| DTM | Digital Terrain Model |
| EA | Environment Agency |
| EIA | Environmental Impact Assessment |
| FAWMA | Flood and Water Management Act 2010 |
| FRA | Flood Risk Assessment |
| IDB | Internal Drainage Board |
| LLFA | Lead Local Flood Authority |
| LoD | Limits of Deviation |
| m AOD | Metres Above Ordnance Datum (unit height) |
| NETS | National Electricity Transmission System |
| NPPF | National Planning Policy Framework |
| PPG | Planning Practice Guidance |
| SFRA | Strategic Flood Risk Assessment |
| SPZ | Source Protection Zone |
| SuDS | Sustainable Drainage Systems |

| List of Abbreviation | |
|---|---|
| **Abbreviation** | **Meaning** |
| WFD | Water Framework Directive |
| ZoI | Zone of Influence |

# 1 Introduction

## 1.1 Introduction

1.1.1 This chapter has been prepared by RPS. It reports the results of baseline studies and the assessment of the potential impacts of the proposed converter station (including the proposed Alternating Current (AC) cable route and proposed permanent access road) on Water Resources and Hydrology. Table 19.1 below sets out the structure of the Environmental Statement (ES) with respect to water resources and hydrology.

1.1.2 Impacts on water resources and hydrology are interrelated with impacts on Hydrogeology (ES-2-C.02 Ch18 Geology and Hydrogeology), Soil (ES-2-C.04 Ch20 Agriculture and Soils) and Ecology (ES-2-C.05 Ch21 Ecology), with detailed analysis of cumulative effects outlined in ES-2-D.01 Ch28 Cumulative Effects.

**Table 19.1 Environmental Statement: Water Resources and Hydrology**

| ES Reference | ES Volume | ES Chapter | Content |
|---|---|---|---|
| ES-2-B.04 | 2 | 08 | Main Report: Proposed Underground DC Cable |
| **ES-2-C.03** | **2** | **19** | **Main Report: Proposed Converter Station** |
| ES-3-B.01 | 3 | 08 | Figures: Proposed Underground DC Cable |
| ES-3-C.01 | 3 | 19 | Figures: Proposed Converter Station |
| ES-4-B.04 | 4 | 08 | Technical Appendices: Proposed Underground DC Cable |
| ES-4-C.03 | 4 | 19 | Technical Appendices: Proposed Converter Station |

## 1.2 Chapter Structure

1.1.3 The remainder of this chapter is structured as follows:

- Section 2. Approach to Assessment. Describes the approach to the identification and assessment of impacts resulting from the proposed converter station, permanent access road and proposed AC cable route.
- Section 3. Basis of Assessment. Sets out the key assumptions in relation to the proposed converter station, proposed AC cable route and permanent access road which have been made in undertaking the impact assessment.
- Section 4. Planning Policy and Legislative Considerations. Summarises the key planning policies and legislations which have been considered as part of the assessment.
- Section 5. Baseline Conditions. Reports the results of desktop and field studies undertaken in relation to the proposed converter station, proposed AC cable route and permanent access road to establish existing conditions.

- Section 6. Potential Impacts. Identifies the potential impacts on water resources and hydrology in relation to the proposed converter station, proposed AC cable route and permanent access road which may occur as a result of temporary, operational, longer term and decommissioning impacts.
- Section 7. Mitigation. Identifies the mitigation which is proposed including measures which are incorporated into the siting, design and construction of the proposed converter station.
- Section 8. Residual Effects. Reports the residual effects in relation to the proposed converter station, proposed AC cable route and permanent access road which remain taking into account proposed mitigation and identifies whether these are significant or not.
- Section 9. Cumulative Effects. Identifies the inter-project and intra-project cumulative effects, those which may occur in combination with other developments and with each component.
- Section 10. Summary of Assessment. Provides a summary of the key findings of the impact assessment.
- Section 11. References.

# 2 Approach to Assessment

## 2.1 Introduction

2.1.1 This section describes the approach to the identification and assessment of impacts resulting from the construction and operation of the proposed converter station (including proposed permanent access road and proposed AC cable route) on water resources and hydrology.

## 2.2 Summary of Consultation

Scoping Opinion Review

2.2.1 Table 19.2 summarises the issues raised in the scoping opinion in relation to water resources and hydrology and outlines how these have been addressed.

**Table 19.2 Scoping opinion (Water Resources and Hydrology)**

| Consultee | Summary of Comment | How and where addressed |
|---|---|---|
| Boston Borough Council (BBC) | BBC recommends that likely construction and operation effects of the development (including effects on land drainage) be acknowledged and appropriate mitigation measures including measures for groundwater are adopted. | The likely effects of the construction and operational phase of the Scheme will be assessed within the Environmental Impact Assessment (EIA). Mitigation measures have been presented within Volume 2 Part C confirming that land drainage will be restored to an equivalent level as they were prior to construction following the construction phase. Storm water management systems will also be put into place during construction to minimise the risk posed to receiving surface water features.<br>All large tidal defences and embanked watercourses will be crossed by trenchless techniques to minimise the potential impacts. Crossing techniques will be discussed and agreed with the relevant Local Planning Authority (LPA), Internal Drainage Board (IDB) and the Environment Agency (EA). |

| Table 19.2 Scoping opinion (Water Resources and Hydrology) | | |
|---|---|---|
| **Consultee** | **Summary of Comment** | **How and where addressed** |
| Environment Agency (EA) | The EA advise that a Flood Risk Assessment (FRA) should accompany the application which demonstrates flood risk sensitive equipment would be located above the predicted flood level for the 0.1% plus Climate Change event. The site would need to be able to remain operational at all times during flood events.<br>The FRA should consider the upper end 65% climate change allowance and should 'likely' include a hydraulic model. | A FRA for the converter station is submitted separately as part of the planning application. The FRA has been produced in line with the requirements of the National Planning Policy Framework (NPPF) and associated guidance. The FRA assesses the impacts of tidal and fluvial flood risk including the risk of flooding from overtopping and a breach of existing flood defences. An outline drainage strategy has also been produced in line with relevant Sustainable Drainage Systems (SuDS) guidance and is appended to the converter station FRA. |
| EA | Open cut watercourse crossings may be suitable for smaller watercourses, however this method would not be permitted for crossing EA Main Rivers.<br>The EA note that the mitigation measures proposed specifically the pollution incident reaction plan, should also include mitigation for groundwater risks as well as surface water.<br>The EA agreed that the project should have a negligible impact on the affected waterbodies, provided that pollution prevention and control measures are applied at the construction stage and that SUDS are used to mitigate the permanent increase of surface water run-off. | All water crossing techniques will be agreed with the appropriate authority and outlined in the crossing schedule in Chapter 17 Proposed Converter Station.<br><br>Mitigation measures have been presented within this Chapter and compiled in ES-2-C.11, Chapter 27 Register of Mitigation.<br><br>SuDS have been incorporated within the base scheme design and have been presented within the convert station FRA. |
| East Lindsey District Council (ELDC) Environmental Health | No long term significant environmental and pollution risk present | No comments were needed. |

| Table 19.2 Scoping opinion (Water Resources and Hydrology) | | |
|---|---|---|
| **Consultee** | **Summary of Comment** | **How and where addressed** |
| Lincolnshire County Council (LCC) | LCC advised that a detailed assessment of existing land drainage should be undertaken and that temporary (during construction) and permanent (during operation) mitigation is agreed. This includes any temporary working areas, or where site has a potential impact on neighbouring land uses. | Mitigation measures are presented within this Chapter and compiled in ES-2-C.11, Chapter 27 Register of Mitigation. This confirms that land drainage will be restored following the construction phase.<br>Storm water management systems will also be put into place during construction to minimise the risk posed to receiving surface water features. |
| Natural England | Natural England suggests that the MAGIC map should be utilised and referenced accordingly to ensure that all possible sites with the potential to be affected by water resources and hydrology have been identified. | The MAGIC map has been utilised within the ES to assess water resources and hydrology within the study area. |

## 2.3 Scope of Assessment

### Aspects to be Assessed

2.3.1 The effects considered in this chapter include those on surface water resources and hydrology that occur as a result of the UK Onshore Scheme. The following types of effects are assessed in this chapter:

- Effects on flood risk and flood defences;
- Effects on surface water resources; and
- Effects on drainage infrastructure.

### Spatial Scope

2.3.2 The assessment has considered the potential direct and indirect impact associated with the Scheme within the Limits of Deviation (LoD). The study area is based on the extent to which the UK Onshore Scheme may have an impact on water resources and hydrology, also referred to as the Zone of Influence (ZoI). For the proposed converter station this is determined to be 1 km from the proposed converter station site. For the proposed AC cable route a 250 m buffer either side of the proposed AC cable route was identified as the ZoI. For the permanent access road a 250 m buffer either side of the proposed route was also determined to be the appropriate ZoI.

2.3.3 These ZoIs are illustrated on Figure 19.1 Water Resources and Hydrology Study Areas.

### Temporal Scope

2.3.4 In assessing the effects, the likely duration of effect has been considered as either:

- Temporary impacts – construction phase comprising the groundworks for AC cable installation and the construction of the proposed converter station; and
- Longer term, operational and permanent impacts – operational phase and beyond.

## 2.4 Assessment Guidance

2.4.1 There is no specific guidance in relation to assessing the impact of interconnectors or the components which they incorporate (e.g. converter stations, underground cables etc.) on water recourses and hydrology. Therefore the Design Manual for Roads and Bridges (DMRB) has been used as it is considered to be the most appropriate methodology as it is designed for assessing the effects of linear schemes. The assessment methodology is based on guidance provided in the DMRB, Volume 11, Part 10 (Ref: 19.2).

2.4.2 The assessment of potential effects on water resources takes account of the impacts from the proposed converter station, permanent access road and the proposed AC cable route on the prevailing hydrological, surface water drainage, flooding and water quality environments.

2.4.3 The list below sets out the main documents used, where appropriate, to inform the impact assessment including the identification of sensitivity or value of receptors and the magnitude of impacts.

### European

- Water Framework Directive (Ref: 19.3) (Directive 2000/60/EC of the European Parliament and of the Council of 23, October 2000).

### National

- National Planning Policy Framework (2012) (Ref: 19.4);
- Planning Practice Guidance ID7 Flood Risk and Coastal Change, online (http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change/) (Ref: 19.5); and
- Water Environment (Water Framework Directive) (England and Wales) Regulations (2017), which transport the Water Directive 200/60/EC into UK law (Ref: 19.6).

### Guidance

- Environment Agency (February 2016) Guidance Flood risk assessments: climate change allowances (Ref: 19.7);
- National SuDS Working Group, Interim Code of Practice for Sustainable Drainage Systems, 2004 (Ref: 19.8);

- CIRIA C532 Control of Water Pollution from Construction Sites (Ref: 19.9);
- CIRIA C649 Control of water pollution from linear construction projects: site guide. Construction Industries Research Association (Ref: 19.10);
- CIRIA C648 Control of water pollution from linear construction projects: technical guidance. Construction Industries Research Association (Ref: 19.11);
- CIRIA 753 The SUDS Manual, 2015 (Ref: 19.12); and
- CIRIA Report C741 Environmental Good Practice on Site (Ref: 19.13).

## 2.5 Assessment Criteria

### Sensitivity of Receptors

2.5.1 The sensitivity of a hydrological receptor or attribute is largely determined by its quality, rarity and scale. The determination of sensitivity takes into account the scale at which the attribute is important. This can be defined as being at a local level (e.g. on the Scheme site or immediately adjacent); district level (beyond the Scheme boundary but within the district); county level (e.g. Lincolnshire); regional level (e.g. East Midlands); national (e.g. England) or international level (e.g. Europe).

2.5.2 For the purpose of this ES, 'flood risk' is defined as the permanent removal of or increase in low permeability surfacing leading to an alteration in pre-development surface water run-off rates or a derogation of floodplain storage. 'Temporary' flood risk is the temporary removal or alteration in permeable surfacing leading to a temporary increase in surface water run-off or derogation of floodplain storage (for example during construction).

2.5.3 Table 19.3 below has been followed in considering the sensitivity of receptors affected by the proposed converter station, permanent access road and proposed AC cable route. This table takes into account guidance provided in Section 2.1 and A4.3 of the DMRB and the author's professional judgement.

**Table 19.3 Sensitivity criteria (Water Resources and Hydrology)**

| Sensitivity | Description | Examples |
|---|---|---|
| Very High | The receptor has little or no capacity to absorb change without fundamentally altering its present character, is of very high environmental value, or of international importance.<br>Receptor is of high value or of critical importance to local, regional or national economy. Receptor is highly vulnerable to impacts that may arise from the proposed converter station, permanent access road and proposed AC cable route and recoverability is long term or not possible. | Surface water: Water Framework Directive (WFD) Current Overall Status of High.<br>Flood risk: Land within Flood Zone 3b/3a or more than one hundred residential properties protected from flooding by flood defence infrastructure or natural floodplain storage. |

| Table 19.3 Sensitivity criteria (Water Resources and Hydrology) | | |
|---|---|---|
| **Sensitivity** | **Description** | **Examples** |
| High | The receptor has low capacity to absorb change without fundamentally altering its present character, is of high environmental value, or of national importance.<br>Receptor is of moderate value with reasonable contribution to local, regional or national economy. Receptor is generally vulnerable to impacts that may arise from the proposed converter station, permanent access road and proposed AC cable route and recoverability is slow and/or costly. | Surface water: WFD Current Overall Status of Good.<br>Flood risk: Land within Flood Zone 3a or between one and one hundred residential properties or industrial premises protected from flooding by flood defence infrastructure or by natural floodplain storage. |
| Medium | The receptor has moderate capacity to absorb change without significantly altering its present character, has some environmental value, or is of regional importance.<br>Receptor is of minor value with small levels of contribution to local, regional or national economy. Receptor is somewhat vulnerable to impacts that may arise from the proposed converter station, permanent access road and proposed AC cable route and has moderate to high levels of recoverability. | Surface water: WFD Current Overall Status of Moderate.<br>Flood risk: Floodplain within Flood Zone 3a and/or 2 or limited constraints and a low to medium probability of flooding of residential and industrial properties. |
| Low | The receptor is tolerant of change without detriment to its character, is low environmental value, or local importance.<br>Receptor is of low value with little contribution to local, regional or national economy. Receptor is not generally vulnerable to impacts that may arise from the proposed converter station, permanent access road and proposed AC cable route and / or has high recoverability. | Surface water: WFD Current Overall Status of Poor.<br>Flood risk: Flood Plan within Flood Zone 2 and/or 1 or limited constraints and a low to very low probability of flooding of residential and industrial properties. |
| Negligible | The receptor is resistant to change and is of little environmental value.<br>Receptor is of negligible value with no contribution to local, regional or national economy. Receptor is not vulnerable to impacts that may arise from the proposed converter station, permanent access road and proposed AC cable route and/or has high recoverability. | Surface water: WFD Current Overall Status of Bad.<br>Flood risk: Areas outside flood plain (Flood Zone 1) or flood plain with very low probability of flooding industrial properties. |

## Magnitude of Impacts

2.5.4 The magnitude of any predicted impact is dependent on its size, duration, timing (e.g. seasonality) and frequency (permanent, seasonal etc.). A qualitative appraisal of the likely magnitude of the predicted impact is provided within this assessment, taking into account the measures proposed to be adopted as part of the proposed converter station, permanent access road and proposed AC cable route to control such impacts. The magnitude of the predicted impact has been described using the criteria outlined in Table 19.4 below. This table takes into account guidance provided in Section 2.1**Error! Reference source not found.** and A4.4 of DMRB and the author's professional judgement.

**Table 19.4: Impact Magnitude Criteria (Water Resources and Hydrology)**

| Magnitude | Description | Examples |
|---|---|---|
| High | Total loss or major alternation to key elements/features of the baseline conditions such that post development character/composition of baseline condition will be fundamentally changed. | Total loss of flood plain storage and/or local drainage networks causing an increase in flood risk.<br>Large scale contamination event discharging into a designated area of protection causing significant observable degradation in water resource quality. |
| Medium | Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition of the baseline condition will be materially changed. | Partial loss of flood plain storage causing an increase in surface water runoff in turn causing an increase in flood risk.<br>Contamination event occurring which causes a change in the local baseline condition and an observable degradation in water resource quality. |
| Low | Minor shift away from baseline conditions. Changes arising from the alteration will be detectable but not material; the underlying character/composition of the baseline condition will be similar to the pre-development situation. | Disruption of drainage networks causing a local, short term increase in flood risk.<br>Unmitigated maintenance works leading to an increase in flood risk.<br>A short term contamination event with a short term impact on baseline, causing short term degradation in water |

| Table 19.4: Impact Magnitude Criteria (Water Resources and Hydrology) | | |
|---|---|---|
| **Magnitude** | **Description** | **Examples** |
| | | resource quality. |
| Negligible | Very little to no observable change from baseline conditions. Change is barely distinguishable, approximating to a "no change" situation. | A disruption of on-site drainage networks occurring after mitigation and on-site management strategies are in place and therefore no observable increase in flood risk.<br>Small, localised contamination event causing no change to baseline and therefore no degradation in water resource quality. |

### Assessing the Significance of Effects

2.5.5 The significance of potential effects has been determined taking into account the sensitivity of the receptor and the magnitude of each impact. Table 19.5 below is used to inform the evaluation of the significance of effects. This table is based on guidance provided for linear schemes within the DMRB.

| Table 19.5: Assessment of Significance (Water Resources and Hydrology) | | | | | |
|---|---|---|---|---|---|
| **Magnitude of Impact** | **Sensitivity of Receptor** | | | | |
| | **Very High** | **High** | **Medium** | **Low** | **Negligible** |
| **High** | Major | Major | Moderate | Moderate | Minor |
| **Medium** | Major | Moderate | Moderate | Minor | Negligible |
| **Low** | Moderate | Moderate | Minor | Negligible | Negligible |
| **Negligible** | Minor | Minor | Negligible | Negligible | Negligible |

2.5.6 For the purposes of this assessment any effect that is major or moderate is considered to be significant. Any effect that is minor or negligible is not significant.

## 2.6 Assumptions or Limitations

2.6.1 The baseline hydrological characterisation and, consequently the hydrological and water resources assessment is based on publicly available data obtained from the EA, LCC, BBC,

SHDC, Black Sluice IDB and commercial data supply companies. Additional information has also been supplied by stakeholders during the scoping and consultation stages.

# 3 Basis of Assessment

## 3.1 Overview

3.1.1 This chapter sets out the basis of assessment in relation to the proposed converter station, proposed AC cable route and permanent access road of the UK Onshore Scheme during construction, operation and decommissioning in respect of effects on water resources and hydrology.

3.1.2 The realistic worst case engineering design assumptions are presented in line with the 'Rochdale Envelope' approach and are incorporated into a base scheme design. For each element of this chapter the design assumptions have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group.

3.1.3 The assessment is based on the design of the proposed converter station, proposed AC cable route and permanent access road described in chapter 17 of the ES. The assessment considers a realistic worst case based on the maximum scale of each of these components and as a result it is considered that no effects greater than those assessed are likely to occur.

## 3.2 The Proposed Converter Station (including the permanent access road)

3.2.1 The base scheme design for the proposed converter station zone and permanent access road has been developed in order to establish a realistic worst case scenario on which to base the impact assessment. Key assumptions are set out in Table 19.6 below:

**Table 19.6: Proposed Converter Station/permanent access road engineering design assumptions**

| Base Scheme Design | Dimensions/Realistic Worst Case Scenario |
|---|---|
| Proposed converter station footprint | Approximately 4.8 ha. |
| Additional Hardstanding | Approximately 1.4 ha. |
| 2 Poles each including 3 transformers each (plus one spare transformer) | 15 m x 15m.<br>Total area up to1,575 $m^2$. |
| Routine maintenance of the proposed converter station | May involve the use of oils, greases and other substances with associated potential for accidental spillages.<br>Oils/chemical spills to ground are worst case condition. |
| Construction | Undertaken over a 2 to 3 year programme steered to observe seasonal restrictions where practicable and avoid soil handling activities in |

| Table 19.6: Proposed Converter Station/permanent access road engineering design assumptions | |
|---|---|
| **Base Scheme Design** | **Dimensions/Realistic Worst Case Scenario** |
| | winter months. |
| Operation | Potential risk of oil spillage. |
| Decommissioning (proposed converter station) | May include the dismantling and removal of all components for recycling or disposal. |
| **Permanent Access Road** | |
| Permanent Access Road. | Approximately 1.7 ha. |
| Carriageway Width. | Up to 6.0 m. |
| Elevation. | Minimum 2.7 m. |
| Hammond Beck Bridge. | 20 m Bridge Deck.<br>Pre-stressed, precast concrete beams and a reinforced concrete deck sat on bankseat abutments and piles.<br>50 year working life. |

## 3.3 Proposed Underground AC Cable Route

3.3.1 The base scheme design for the proposed AC cable route has been developed in order to establish a realistic worst case scenario on which to base the impact assessment. Key assumptions are set out in Table 19.7 below:

| Table 19.7: Proposed AC Cable Route engineering design assumptions | |
|---|---|
| **Base Scheme Design** | **Dimensions/Realistic Worst Case Scenario** |
| AC cable route corridor length | Up to 2.34 km. |
| AC cable route corridor working width | Up to 50 m (note wider at crossings). |
| Number of cables | Up to 6 AC cables. |
| Number of trenches | Up to 2. |
| Cable trench width | Typically 1.5 m. |
| Cable trench depth | Typically 1.5 m. |
| Cable joints | Typically every 700 m to 1km. |
| Link pillars | Each box up to 1.0 m x 1.0m. |
| Fibre inspection/pulling pits | Buried box every 250 m. |
| Trenching | Approximately 10 -20 days per km with ducts (depends on methods i.e. Open cut or trenchless techniques). |
| Cable pull/winching | 4-7 days per section based on complexity of pull |

| Table 19.7: Proposed AC Cable Route engineering design assumptions | |
|---|---|
| **Base Scheme Design** | **Dimensions/Realistic Worst Case Scenario** |
| Pre-installed ducts | Allow 30 days per km. |
| Decommissioning (proposed AC cable route) | Removing all or part of the AC cable route. |
| **Proposed AC route 'connection works' with existing Bicker Fen 400 kV Substation** | |
| Up to 2 Substation bays within the northern and southern extents. | |
| Erection and installation of relevant electrical equipment to facilitate connection to the 400 kV Bicker Fen Substation. | |

## The Proposed AC Cable Route Installation Methods

3.3.2 The assessment of the proposed AC cable route has been undertaken based on the installation methods described in Table 19.8. These are described in more detail in chapter 17 of the ES.

| Table 19.8: Proposed AC cable route installation engineering design assumptions |
|---|
| **"Open Cut" construction technique** |
| Top soil strip working width, mounding topsoil on one side. |
| Install temporary accesses road for construction traffic (running on sub-soil, bog mats or temporary road if ground conditions require). |
| Dig trench mounding sub-soil on opposite side to top soil. |
| Install base of cement bound sand. Trench is left open for DC cable pulling. |
| Joint bays at intervals approx. 800 - 1200 m. Assume 800 m for assessment purposes. |
| Install post construction drainage to maintain integrity of land drainage system. |
| Remove temporary road (if required) and 'rip'/loosen subsoil beneath running track to relieve compaction. |
| Spread top soil. |
| Reseed/return to farmer for cultivation etc. |
| Duration - trenching approximately10 - 20 days per km (depends on methods). |
| **"Non-open cut" construction technique** |
| ***Horizontal Directional Drill*** |
| Launch and reception compounds approximately 50 m wide by 50 m. |
| Use of bentonite to lubricate drill. |
| One bore with a cable duct of an approximate inner diameter of 200 mm would be required for each cable. |
| ***Pipe Jacking (Auger bore or Microbore)*** |
| Require excavation of pits (minimum 200 $m^2$) on either side of crossing (working area 50 m by 50 m). |
| One bore with a pipe of an approximate inner diameter of 305 mm would be required for each cable. |

| Table 19.8: Proposed AC cable route installation engineering design assumptions |
|---|
| A cable duct of an approximate inner diameter of 200 mm would be installed in the tunnel pipe to take the cable. |
| Gaps between ducts and tunnel pipe would be grouted. |

## 3.4 Design Mitigation

3.4.1 Potential impacts to the water environment will be avoided where practicable through careful consideration of the drainage design, construction techniques and operational best practices of the proposed converter station, permanent access road and proposed AC cable route. The EA, Lead Local Flood Authority (LLFA and IDB will be consulted through the construction works and planning process to ensure appropriate permits and consents are in place. Designed mitigation and construction mitigation measures are outlined below and featured in the Construction Environmental Management Plan (CEMP).

3.4.2 These are measures incorporated into the base scheme design such as the design of the cable route, the layout of the proposed converter station and onsite drainage. Design mitigation for the proposed converter station, permanent access road and proposed AC cable route are identified in ES-2-C.11, Chapter 27 Register of Mitigation.

3.4.3 As part of the design process, a number of design mitigation measures have been proposed to reduce the potential for impacts on water resources and hydrology, as identified within Table 19.9 below. These measures are considered standard industry practice for this type of development and therefore have been incorporated in the base scheme design as assessed within the potential impacts (Section 6 of this chapter).

| Table 19.9: Design Mitigation Measures Adopted as part of the proposal with respect to water resources and hydrology. | |
|---|---|
| **Design Mitigation measures adopted as part of the proposal** | **Justification** |
| **Construction** | |
| **Outline Drainage Strategy**<br>The proposed converter station would result in the construction of low permeable surfacing, increasing the rate of surface water run-off from the site. A surface water management plan is required to ensure the existing run-off rates to the surrounding water environment are maintained at pre development rates.<br>The detailed design of the surface water management strategy (Ref JNY9289-01a) would be based on a series of infiltration / soakaway tests carried out on proposed converter station zone and the worst case attenuation volumes outlined in the FRA (totalling 9,404 $m^3$ ). The tests would be undertaken prior to construction and in | To address the NPPF, EA and SHDC surface water run-off requirements. |

| Table 19.9: Design Mitigation Measures Adopted as part of the proposal with respect to water resources and hydrology. | |
|---|---|
| **Design Mitigation measures adopted as part of the proposal** | **Justification** |
| accordance with the Building Research Establishment (BRE) Digest 365 Guidelines (Ref: 19.14). The strategy would ensure that the mean annual run-off rate is maintained at the current greenfield run-off rate.<br><br>Measures to mitigate against water pollution would also apply and would include measures set out below. | |
| **Best Practice Measures**<br><br>Construction work would be undertaken in accordance with the Code of Construction Practice (Chapter 10) which will inform the CEMP, and guidance including:<br><br>· EA guidance for discharges to surface water and groundwater: environmental permits (Ref: 19.15);<br><br>· EA guidance for oil storage regulations for businesses (Ref: 19.16);<br><br>· EA guidance for work on a river, flood defence or sea defence (Ref: 19.17);<br><br>· EA Pollution Prevention Guidance (Ref: 19.18), which have been withdrawn. However, still provide useful best practice guidance:<br><br>· EA, Pollution Prevention Guidance Note 6 (PPG6): Pollution Prevention Guidelines – Working at Construction and Demolition Sites;<br><br>· EA, Pollution Prevention Guidance Note 5 (PPG5):– Working in, near or liable to affect watercourses;<br><br>· Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors CIRIA (C532) (Ref: 19.19); CIRIA – SuDS Manual;<br><br>· CIRIA (C741) Environmental good practice on site guide (Ref: 19.13);<br><br>· CIRIA (C648) Control of water pollution from linear construction projects (Ref: 19.11);<br><br>· Prevent surface water being affected during earthwork operations. No discharge to surface watercourses will occur without permission from the EA (SuDS Manual Ref: 19.12);<br><br>· Wheel washers and dust suppression measures to be used as appropriate to prevent the migration of pollutants(SuDS Manual Ref: 19.12);<br><br>· Regular cleaning of roads of any construction waste and dirt to be carried out (SuDS Manual);A construction method statement to be submitted for approval by the responsibly (SuDS Manual); and | To accord with guidance and best practice for constructional works. |

| Table 19.9: Design Mitigation Measures Adopted as part of the proposal with respect to water resources and hydrology. | |
|---|---|
| **Design Mitigation measures adopted as part of the proposal** | **Justification** |
| · Defra/Environment Agency, October 2005. Flood Risk Assessment Guidance for New Development, Phase 2 FD2320/TR2 (Ref: 19.20). | |
| **Pollution Prevention Measures**<br><br>Refuelling of machinery would be undertaken within designated areas where spillages can be easily contained. Machinery would be routinely checked to ensure it is in good working condition.<br><br>Any tanks and associated pipe work containing substances included in List 1 of the Groundwater Directive would be double skinned and be provided with intermediate leak detection equipment.<br><br>The following specific mitigation measures for the protection of surface water during construction activates would be implemented:<br><br>· Management of construction works to comply with the necessary standards and consent conditions as identified by the EA and LLFA (LCC);<br><br>· A briefing for all staff highlighting the importance of water quality, the location of watercourses and pollution prevention included within the site induction;<br><br>· Areas with prevalent run-off to be identified and drainage actively managed, e.g. through bunding and / or temporary drainage;<br><br>· Areas at risk of spillage, such as vehicle maintenance areas and hazardous substance stores (including fuel, oils and chemicals) to be bunded and carefully sited to minimise the risk of hazardous substances entering the drainage system or the local watercourses. Additionally the bunded areas will have impermeable bases to limit the potential for migration of contaminants into groundwater following any leakage / spillage. Bunds used to store fuel, oil etc. to have a 110% capacity of the volume of fuel, oil etc. to be stored;<br><br>· Disturbance to areas close to watercourses reduced to the minimum necessary for the work;<br><br>· Excavated material to be placed in such a way as to avoid any disturbance of areas near to the banks of watercourses and any spillage into the watercourses;<br><br>· Construction materials to be managed in such a way as to effectively minimise the risk posed to the aquatic environment;<br><br>· Plant machinery and vehicles to be maintained in a | To accord with guidance and best practice for constructional works. |

| Table 19.9: Design Mitigation Measures Adopted as part of the proposal with respect to water resources and hydrology. | |
|---|---|
| **Design Mitigation measures adopted as part of the proposal** | **Justification** |
| good condition to reduce the risk of fuel leaks;<br>· Drainage works to be constructed to relevant statutory guidance and approved via the LLA prior to the commencement of construction; and<br>· Consultation with the EA to be ongoing throughout the construction period to promote best practice and to implement proposed mitigation measures. | |
| **Maintenance** | |
| Operational practices within the proposed converter station to incorporate measures to prevent pollution and increased flood risk, to include emergency spill response procedures, clean up and remediation of contaminated water run-off. | To reduce the risk of surface water pollution based on guidance in e.g.<br>Guidance on discharges to surface water and groundwater;<br>Guidance on work on a river, flood defence or sea defence; and<br>Best practice guidance EA PPG22: Pollution Prevention Guidelines – Dealing with Spills (*Withdrawn use as guidelines*). |

# 4 Planning Policy and Legislative Considerations

## 4.1 Key planning Policy

4.1.1 National Grid Viking Link Limited (NGVL) will comply with planning policy associated with the construction of the proposed converter station, permanent access road and proposed AC cable route. An outline of the relevant planning policy specific to water resources and hydrology is provided below.

## 4.2 Key National Planning Policy

National Planning Policy Framework (2012)

4.2.1 The National Planning Policy Framework 2012 (Ref: 19.4) (NPPF) is a material consideration in determining planning applications. Paragraphs 99 to 108 of the NPPF outline the development requirements in terms of flood risk, water quality and resources and the impact of climate change, stipulating that a site specific FRA is required for proposals for new developments in Flood Zones 2 and 3 and for any proposal for developments on 1 ha or greater in Flood Zone 1

4.2.2 On 6th March 2014 the Department for Communities and Local Government (DCLG) launched Planning Practice Guidance ID7 as a web-based resource. The Planning Practice Guidance ID7 (DCLG, 2014) for Flood Risk and Coastal Change (Ref: 19.5) provides additional guidance for the implementation of the NPPF in relation to development and flood risk.

## 4.3 Local Planning Policy

Boston Borough Council Local Plan (Adopted April 1999, saved policies)

4.3.1 The BBC Local Plan (1999) (Ref: 19.21) is the development plan for the borough. The Local Plan consists of a series of documents which set out the spatial vision for BBC, the strategy for delivery of this vision and detailed policies and guidance for managing development in the borough and development sites where change are anticipated.

4.3.2 The policies with particular reference to water resources and hydrology are as follows:

- Policy G4 Safeguarding the Water Environment states that: "*Planning permission will not be granted for developments which will have an adverse effect on the water environment, or the quality of surface or groundwater*".
- Policy G5 Flood Protection states that "*Planning permission will not be granted for development which threaten the effectiveness of land drainage systems or river or sea defences, unless mitigating measures are undertaken as part of the development*".

## South Holland District Council Local Plan 2006

4.3.3 The SHDC Local Plan (Ref: 19.22) sets out the planning policies which will guide and control new development in the District until 2021.

4.3.4 Following the direction by the Secretary of State, as of 18th July 2009, the policy regarding Development and Flood Risk is no longer valid.

4.3.5 The policies relevant to SuDS and pollution and contamination have been outlined below.

### Policy SG11: Sustainable Urban Drainage System (SUDS)

4.3.6 Development generating surface water run-off, likely to result in increased flood risk, will be permitted provided that:

- The development's surface water management system accords with sustainable development principles and has been designed as part of the development layout; and
- The system will effectively control and adequately mitigate or attenuate any adverse effects from surface water run-off on people, habitats of acknowledged importance and property; and
- Developers can ensure long term maintenance of the drainage systems, where necessary through planning obligations.

4.3.7 Where this is not possible the developer will be required to implement an alternative method of surface water disposal that is to the Council's satisfaction.

### Policy SG13: Pollution and Contamination

4.3.8 Planning permission will only be permitted for development proposals which:

- do not cause unacceptable levels of pollution of the surrounding area by noise, light, toxic or offensive odour, airborne pollutants or by the release of waste products;
- provide, as necessary, appropriate treatment of land to clean up pollution and contamination.

## Central Lincolnshire Local Plan - Adopted April 2017

4.3.9 The Central Lincolnshire Local Plan (Ref 19.23) was adopted by the Central Lincolnshire Joint Strategic Planning Committee on 24th April 2017 and it now replaces the Local Plans of the City of Lincoln, West Lindsey and North Kesteven District Councils. It contains planning policies and allocations for the growth and regeneration of Central Lincolnshire up to 2036. The policy with particular reference to water resources & hydrology are:

- Policy LP14 managing water resources and flood risk states "*All development proposals will be considered against the NPPF, including application of the sequential and, if necessary, the exception test. Through appropriate consultation and option appraisal, development proposals should demonstrate:*

*i. that they are informed by and take account of the best available information from all sources of flood risk and by site specific flood risk assessments where appropriate;*

ii. *that there is no unacceptable increased risk of flooding to the development site or to existing properties;*

iii. *that the development will be safe during its lifetime, does not affect the integrity of existing flood defences and any necessary flood mitigation measures have been agreed with the relevant bodies;*

iv. *that the adoption, ongoing maintenance and management of any mitigation measures have been considered and any necessary agreements are in place;*

v. *how proposals have taken a positive approach to reducing overall flood risk and have considered the potential to contribute towards solutions for the wider area; and*

vi. *that they have incorporated Sustainable Drainage Systems (SuDS) in to the proposals unless they can be shown to be impractical.*

· *Development proposals that are likely to impact on surface or ground water should consider the requirements of the Water Framework Directive. Development proposals should demonstrate:*

vii. *that development contributes positively to the water environment and its ecology where possible and does not adversely affect surface and ground water quality in line with the requirements of the Water Framework Directive;*

viii. *how Sustainable Drainage Systems (SuDS) to deliver improvements to water quality, the water environment and where possible to improve amenity and biodiversity have been incorporated into the proposal unless they can be shown to be impractical;*

ix. *that suitable access is safeguarded for the maintenance of water resources, flood defences and drainage infrastructure;*

x. *that adequate provision is made to safeguard the future maintenance of water bodies to which surface water is discharged, preferably by an appropriate authority (e.g. Environment Agency, Internal Drainage Board, Water Company, the Canal and River Trust or local council).*"

## 4.4 Key National Legislation

4.4.1 NGVL and their appointed contractors will comply with legislation associated with the construction of the proposed converter station, permanent access road and AC cable route. An outline of the relevant legislation specific to water resources and hydrology are provided below.

### Flood and Water Management Act 2010

4.4.2 The Flood and Water Management Act (FAWMA) 2010 (Ref: 19.24) implements the recommendations from Sir Michel Pitt's Review of the floods in 2007 and places a series of responsibilities on councils. The main aim of the Act is to improve flood risk management.

4.4.3 The Act designates councils as a LLFA with a 'lead' role in managing flood risk from surface water, groundwater and ordinary watercourses across their jurisdictional area. This involves closely working with partners involved in flood and water management, namely the EA and Black Sluice IDB.

### Land Drainage Act 1991

4.4.4 Under Section 23 of the Land Drainage Act 1991 (LDA 1991) (Ref: 19.25) consent is required from the relevant IDB for any works likely to obstruct, or affect the flow of, a watercourse. The relevant drainage authorities in respect of the proposed converter station and permanent access are the EA, Black Sluice IDB and SHDC, with the proposed AC cable route lying within SHDC, BBC and Black Sluice IDB as the relevant LLFAs. Section 66 of the LDA 1991 makes provisions for the creation of byelaws considered necessary for securing the efficient working of the drainage system. Under the byelaws consent is required from the relevant drainage authority for any development within a particular distance of a drainage work. Within the Black Sluice IDB no obstruction is permitted without prior consent for works within 9.0 m of the edge of a watercourse.

### Water Resources Act 1991

4.4.5 The Water Resources Act 1991 (WRA 1991) (Ref: 19-26) makes provision for the creation of byelaws by the EA. Paragraph 5 of Schedule 25 allows for the EA to create byelaws for flood defence and drainage purposes. Paragraph 6 allows for byelaws for purposes of fisheries functions to be made. Paragraph 6A makes provision for the creation of fisheries byelaws for marine or aquatic environmental purposes.

### The Environmental Permitting (England and Wales) Regulations 2016

4.4.6 Schedule 25 of the Environmental Permitting (England and Wales) Regulation 2016 (Ref: 19.27) applies in relation to flood risk activity in, over or under a watercourse. Under the regulations, consent is required from the EA to undertake works or to erect structures within 8 m of a non-tidal water body (and 16 m of a tidal body).

# 5 Baseline Conditions

## 5.1 Study Areas

5.1.1 The proposed converter station site comprises an irregular shaped parcel of agricultural land situated between North Ing Drove road and Middle Fen Drove road, centred on Ordnance Survey National Grid reference 518705, 337377, circa (c.) 2 km west of Northorpe village centre, Lincolnshire. The proposed converter station site is defined by three drains which run the extent of three sides of the site. The drains include the Mill drain located along the northern boundary, and North Ing Drive Drain, which originates along the northern boundary then arcs along the western boundary connecting with Mil Drain in the northwest corner of the proposed converter station site.

5.1.2 Publicly available Digital Terrain Mapping (DTM) (Ref: 19.28) indicates that the proposed converter station zone is located within/on a parcel of undulating land with the southern boundary levelled at c.1.8 m Above Ordnance Datum (AOD) increasing to c.3.0 m AOD towards the northeast corner.

5.1.3 The permanent access road crosses a number of parcels of agricultural land and drainage channels to south of the proposed converter station. Publicly available DTM (Ref: 19.28) indicates that the permanent access road is located across undulating land with a maximum elevation of 3.2 m AOD at Hammond Beck dropping to c. 1.8 m AOD within the eastern extent of the road.

5.1.4 The proposed AC cable route runs through BBC and SHDC districts comprising agricultural land, crossing a number of drainage channels, north of the proposed converter station. The proposed AC cable route runs east and then north east of the proposed converter station connecting to the National Electricity Transmission System (NETS) at the existing Bicker Fen 400 kV Substation. Publicly available DTM (Ref: 19.28) indicates that the proposed AC cable route crosses undulating land with the southern area levelled at a maximum of 2.7 m AOD to 1.3 m AOD within the northern extent in proximity to Bicker Fen Substation.

5.1.5 The study area for which baseline data has been collected for the purpose of the Environmental Impact Assessment (EIA) is set out below.

5.1.6 A 1 km buffer around the proposed converter station, which includes the ZoI, has been selected for data collection, to take into account any potential significant effects that may affect identified receptors and to identify existing assets or infrastructure that might affect or be affected by the proposed converter station. (Figure 19.1 Water Resources and Hydrology Study areas).

5.1.7 For the proposed AC cable route a 250 m buffer either side of the location was selected for data collection primarily to identify any existing assets or infrastructure that may affect or be affected by the proposed AC cable route. The 250 m buffer was also selected as it is considered

appropriate for data collection taking into the account the nature of the element and likely ZoI on hydrological receptors (Figure 19.1 Water Resources and Hydrology Study areas).

5.1.8 The permanent access road also incorporated a 250 m buffer either side of the element location for data collection primarily to identify any existing assets or infrastructure that might affect or be affected by the road. A 250 m buffer is considered appropriate for data collection taking into account the nature of the road and likely ZoI on hydrological receptors. (Figure 19.1 Water Resources and Hydrology Study Areas).

## 5.2 Characterisation of the Baseline Environment

5.2.1 The proposed converter station and permanent access road lie entirely within SHDC, with the proposed AC cable route partly lying within SHDC and BBC authority boundaries. The SHDC and BBC areas are defined as rural areas in the vicinity of the proposed converter station and associated infrastructure, where much of the land is drained for agriculture.

5.2.2 The closest EA designated Main River (Figure 19.2 Water Resources and Hydrology EA Main Rivers) to the proposed converter station and associated infrastructure is the South Forty Foot Drain which is fed by a complex network of ordinary watercourses, drainage ditches and irrigation channels with many falling within the 1 km buffer of the proposed converter station and associated infrastructure. The South Forty Foot Drain flows in a general northerly direction towards Boston and discharges into the Haven via London Road pumping station.

5.2.3 The permanent access road and proposed AC cable route cross a number of Black Sluice IDB watercourses, with the permanent access road crossing Hammond Beck.

5.2.4 Responsibility for ordinary watercourses which feed the South Forty Foot Drain fall under the jurisdiction of LCC as the LLFA, Black Sluice IDB and SHDC under the Water and Flood Management Act 2010 and LDA 1991. The IDB is required to exercise general supervision over all matter relating to water level management of land within its district.

5.2.5 Further descriptions of the key hydrological and flood risk characteristics within the study areas are set out below.

## 5.3 Flood Risk and Flood Defences

5.3.1 Potential sources of flooding to the proposed converter station, the proposed AC cable route and permanent access road have been assessed in detail within the associated FRA (ES-4-C.03 Ch19 Water Resources and Hydrology) and summarised below.

### Fluvial and Tidal Flooding

5.3.2 The closest watercourses to the proposed converter station are Mill Drain (along the northern boundary), North Ing Drove (along the southern boundary) and a branch south from Mill Drain to North Ing Drove along the western boundary; all of which are managed by the Black Sluice IDB (Figure 19.3 Water Resources and Hydrology Black Sluice IDB Drain).

5.3.3 The closest EA designated Main River is the South Forty Foot which flows northwards in an open embanked channel approximately 820 m to the west of the proposed converter station.

5.3.4 The EA undefended flood map (Figure 19.4 Water Resources and Hydrology EA Flood Zone 3) (Ref: 19.29) for planning indicates that the central and southern areas of the proposed converter station site, the AC cable route and the access road are situated within Flood Zone 2 and 3, defined as being at medium to high risk of fluvial/tidal flooding. The north, east and western extents of the proposed converter station site are shown to be located in Flood Zone 1.

5.3.5 The connection works area of the proposed AC cable route are located within EA undefended Flood Zone 3, defined as being at high risk of fluvial and / or tidal flooding.

### Flood Modelling Assessment

5.3.6 EA flood modelling of the South Forty Foot Drain (2009) (Ref: 19.30/19.31) including flood defences indicates that the proposed converter station remains flood-free for events up to and including the 1 in 1000 year plus climate change event.

5.3.7 The South Holland Strategic Flood Risk Assessment (SFRA) (January 2010) (Ref: 19.32) model outputs indicates that for a combined 1 in 100 year fluvial and 1 in 100 year tidal event, based on a present day scenario and including flood defences, the proposed converter station remains flood free.

5.3.8 However, modelled scenarios including climate change (2115) and breaches in flood defences along South Forty Foot Drain would result in the proposed converter station being subject to flood depths ranging from 0 to 1 m.

5.3.9 An assessment between modelled flood outputs and the proposed converter station levels indicates that the maximum flood extent reaches an average of 2.6 mAOD, which compared against low lying land in the central (average 1.95 mAOD) and southern (average 1.8 mAOD) area of the proposed converter station equates to 0.65 m and 0.8 m flood depth respectively (Figure 19.5 full figures and details present within FRA (ES-4-C.03 Ch19 Water Resources and Hydrology)).

5.3.10 It is proposed that the converter station zone is re-profiled to establish a flat development platform level at 2.9 mAOD. Further calculations have been undertaken which indicate that the re-profiled converter station zone would remain flood free, with a 0.3 m freeboard during the worst case 1 in 1,000 year event including a breach and climate change. Therefore, it is considers that the re-profiled converter station zone would be at low risk of fluvial and/or tidal flooding.

5.3.11 The permanent access road is located within an area assessed as at risk of flooding from fluvial and/or tidal flooding, defined as being within Flood Zone 2 and 3. An initial assessment of the permanent access road using the publicly available DTM and the maximum flood depth extents from the EA and SHDC mapping (see ES-4-C.03 Chapter 19 Water Resources and Hydrology (FRA) for further details) indicates a maximum flood depth of 0.66 m (flood level of 2.70 m AOD)

for a 1 in 100 year fluvial event combined with a 1 in 200 year tidal event during the 2115 climate change scenario.

5.3.12 It is proposed that the permanent access road will be re-profiled to establish a construction/finished level minimum of 2.7 m AOD. The re-profiling of the permanent access road will allow vehicle movement along the road during extreme flood events.

5.3.13 The proposed AC cable route is located within an area assessed as at risk of flooding from fluvial and/or tidal flooding being within Flood Zone 2 and 3, defined as land having a 1 in 100 or greater annual probability of river flooding; or land having a 1 in 200 or greater annual probability of sea flooding.

### Flood Defences

5.3.14 The EA currently has a rolling programme of flood defence reviews with a policy to protect properties, acknowledging that there would still be at risk from more extreme events, driven by climate change as land use and management changes.

5.3.15 The River Witham Catchment Flood Management Plan (CFMP) (Ref: 19.33) indicates that the proposed converter station, permanent access road and proposed AC cable route are located within an area designated as CFMP Policy Area 4 (The Fens) defined as '*areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change*'.

5.3.16 The South Holland SFRA (2010) reference change map indicates that the closest node point to the proposed converter station (Chainage 18) along the South Forty Foot Drain has an earth bank flood defence with a defence crest level of 4.92 mAOD. Compared against modelled flood levels the defences provide protection against events with above the 1 in 100 year plus climate change annual event probability with a freeboard of 1.68m.

5.3.17 A more detailed summary of flood defences can be found within the FRA (ES-4-C.03 Ch19 Water Resources and Hydrology).

### Flooding from rising / high groundwater

5.3.18 A detailed geological review of the proposed converter station and proposed AC cable route is available in Chapter 20: Geology and Hydrogeology. In summary, the British Geological Survey (BGS) 1:50,000 scale online map (Ref: 19.34) indicates the proposed converter station, proposed AC cable route and permanent access road is underlain by superficial deposits consisting of the Barroway Drove Bed (Soft to firm, dark brown or orange-brown, mottled grey, sandy clay with loose and very loose orange-brown, medium sand) and Till (Firm to stiff, brown grey, slightly sandy gravelly clay. Gravel was noted to be fine and medium, occasionally coarse, of mainly chalk and quartzite). The solid geology (bedrock) consists of the Oxford Clay Formation (Ancholme Group).

5.3.19 The Oxford Clay formation is classified as an unproductive stratum, which comprises rock layers or drift deposits with low permeability that has negligible significance for water supply or river base flow.

5.3.20 Groundwater monitoring undertaken by AECOM (October 2016) during the preliminary ground investigation on the proposed converter station site within the three boreholes (BH 01, BH02, BH03) indicates that the depth to groundwater ranged between 0.58 metres below ground level (m bgl) and 2.53 mbgl within the Barroway Drove Beds.

5.3.21 Groundwater monitoring undertaken on the proposed permanent access road on the 8th May 2017 within the three monitoring installations (HR-BH001, HR-BH002A and HR-BH003) indicates the depth to groundwater level as 1.11 m below ground level (bgl) in HR-BH001, 3.41 m bgl in HR-BH002(A) and 2.41 m bgl in HR-BH003 which all lie within the Barroway Drove Beds.

5.3.22 The BGS Groundwater Flooding Susceptibility map provided within the Landmark Envirocheck® Report obtained indicates the proposed converter station site is not in an area at risk of groundwater flooding. The SHDC SFRA (2010) states "*there are no reports of groundwater flooding occurring in the District. This issue is therefore taken as having no strategic significance in relation to flood risk*".

5.3.23 Based on the information outlined above the potential for groundwater flooding is considered to be low.

### Groundwater Source Protection Zone

5.3.24 EA mapping shows the proposed converter station, proposed AC cable route and permanent access road is not located within a Source Protection Zone (SPZ).

### Flooding from Surface Water Runoff

5.3.25 EA surface water flood mapping (Ref: 19.29) indicates that the majority of the proposed converter station, permanent access road and proposed AC cable route is at negligible to very low risk, with less than a 1 in 1,000 chance of flooding. Localised areas within the proposed converter station are shown to be at low risk of surface water flooding defined as having between a 1 in 1000 and 1 in 100 chance of flooding.

5.3.26 Overall, the proposed converter station, proposed AC cable route and permanent access road are assessed as having a very low susceptibility to surface water flooding.

### Reservoir Failure Assessment

5.3.27 EA mapping (ES-3-C.03 Chapter 19) (Ref: 19.29) illustrates that the proposed converter station, proposed AC cable route and permanent access road is not within the maximum extent of flooding from any reservoirs.

### Sewer/Water Main Failure Assessment

5.3.28 As the proposed converter station, proposed AC cable route working width and permanent access road are presently agricultural/grass land it is considered unlikely that there will be any formal sewer system or water main present. However, the proposed AC cable route would cross a number of ordinary watercourses maintained by Black Sluice IDB.

5.3.29 The SHDC SFRA indicates that the proposed converter station and permanent access road working width has not been affected by flooding from artificial sources. The BBC SFRA does not indicate any flooding from artificial sources within the Bicker catchment, in turn to the proposed AC cable route working width.

5.3.30 Taking into account the existing development and the absence of any historical sewer flooding the overall risk of flooding via sewers to the proposed converter station zone, proposed AC cable route and permanent access road has been assessed to be low.

### Historical Flood Events

5.3.31 EA and South Holland SFRA have confirmed that there are no recorded historical flood events within the proposed converter station zone and the proposed AC cable route working width.

### Current Flood Risk

5.3.32 Based on the EA flood modelling of the South Forty Foot Drain (2009) the proposed converter station zone, permanent access road and proposed AC cable route is defined as at low risk of fluvial flooding including flood defences. However, SHDC mapping indicates in the event of a breach including climate change the proposed converter station is at risk of flooding to a worst case maximum depth of 0.65 m within the centre of the proposed converter station site and 0.8 m along the southern boundary.

5.3.33 An initial assessment of flood depth along the permanent access road indicates that the road is at risk of flooding to a depth of 0.66 m for a 1 in 100 year fluvial event combined with a 1 in 200 year tidal event during the 2115 climate change scenario.

## 5.4 Surface Water Resources

### Surface Watercourses

5.4.1 As noted in section 3.4.2 the closest watercourses to the proposed converter station are Mill Drain (along the northern boundary), North Ing Drove (along the southern boundary) and a branch south from Mill Drain to North Ing Drove along the western boundary; all of which are managed by Black Sluice IDB.

5.4.2 The closest EA designated Main River is the South Forty Foot Drain, which flows northwards in an open embanked channel approximately 820 m to the west of the proposed converter station.

5.4.3 The permanent access road crosses a number of Black Sluice IDB managed drains with the largest being Hammond Beck, which flows in a general northerly direction discharging into South Forty Foot Drain at Hubbert's Bridge.

5.4.4 The proposed AC cable route will cross Vicarage Drove Drain, Mill Drain and Boundary drain managed by Black Sluice IDB.

5.4.5 Potential crossing types for the proposed AC cable route are described in Volume 2, Chapter 17: The Proposed Converter Station. The project description (ES-2-C.01, Volume 2, Chapter 17: The Proposed Converter Station) outlines that main river, those with significant flow rates and crossing where channel width and depth preclude the use of open-cut will be crossed via trenchless techniques and therefore flow rates will not be affected.

5.4.6 A number of surface watercourses will be crossed by the proposed AC cable route (Table 19.10). An engineering review has been undertaken for each watercourse, which indicates that the majority will be crossed by trenchless techniques. One field drain (DX36b/2) has been identified as could be crossed by open cut techniques based on channel water flow rates and depth (less than 0.5 m depth). A detailed survey of the drains will be undertaken to confirm the crossing technique.

**Table 19.10: Summary of surface water cable crossing locations and techniques for the proposed AC cable route.**

| Crossing Location | Grid Reference | | River/Beck | Operator (Consenting Body) | Crossing technique |
|---|---|---|---|---|---|
| | Eastings | Northings | | | |
| DX36b/3 | 519856 | 338557 | Vicarage Drove Drain | Black Sluice IDB | Trenchless |
| DX36b/4 | 519844 | 338569 | | | Trenchless |
| DX36b/2 | 519906 | 338430 | | | Open cut |
| DX36b/1 | 519845 | 338336 | | | Trenchless |
| DX36a/1 | 519755 | 338338 | Vicarage Drove Drain | Black Sluice IDB | Trenchless |
| DX36a/2 | 519698 | 338391 | | | Trenchless |
| DX36/6 | 519784 | 338232 | | | Trenchless |
| DX36a/3 | 519662 | 338410 | | | Trenchless |
| DX36/5 | 519591 | 337855 | | | Trenchless |
| DX36/4 | 519562 | 337801 | Boundary Drain West | Black Sluice IDB | Trenchless |
| DX36/3 | 519288 | 337302 | | | Trenchless |
| DX36/2 | 519281 | 337289 | Middle Fen Drove Drain | Black Sluice IDB | Trenchless |
| DX36/1 | 519034 | 337293 | | | Trenchless |

## Surface Water Quality

5.4.7 The EA Catchment Data Explorer (Ref: 19.35) provides the most current WFD Current Overall Status classifications for the EA designated main water courses within 1 km search radius of the proposed converter station and 250 m of the proposed AC cable route and permanent access road. Table 19.11 below lists the water body and associated WFD classification grade within the 1 km search radius.

**Table 19.11: WFD water quality data**

| Waterbody Name | Current Overall Status (2015) | Objective Status (2027) |
|---|---|---|
| Black Sluice IDB draining to the South Forty Foot Drain | Moderate | Good |

5.4.8 In summary, the WFD records show that the watercourses within the 1 km search radius have a WFD status of Moderate which is defined as *"…moderate change from natural conditions as a result of human activity. There are some restrictions on the beneficial uses of the water body. No impact on amenity. Some impact on wildlife and fisheries."* However, lower status waterbodies have objectives to improve with most aiming to achieve Good status by 2027.

5.4.9 A full description of the WFD classification process and associated definitions are available at: https://www.gov.uk/government/consultations/river-basin-management-planning-ministerial-guidance-and-standards.

## Surface Water Abstraction

5.4.10 EA/Landmark Envirocheck® Report (Ref: 19.36) data indicate that there are no surface water abstraction licenses within 250 m of the proposed AC cable route. One surface water abstraction licence is within 250 m of the permanent access road and 1 km of the proposed converter station, summarised in Table 19.12 below:

**Table 19.12: Summary of Surface Water Abstraction Licence**

| Licence Number | National Grid Reference | Receiving | Abstraction Type | Operator | Discharge Environment | Max Annual Quantity ($m^3$) |
|---|---|---|---|---|---|---|
| 4/30/12/*S/0129 | TF18703630 | Tributary of Hammond Beck | Spray Irrigation - Direct | Brocklehurst Mallard Hurn Farm | Surface Water | 2,273 |

### Surface Water Drainage

5.4.11 The proposed converter station, proposed AC cable route and permanent access road are in proximity to or cross a number of existing field drains, ditches and irrigation channels. The majority of the surface water channels crossed are privately owned and maintained. Several channels fall under the jurisdiction of either the Black Sluice IDB or the LLFA and therefore, fall under the requirements of the LDA 1991.

5.4.12 Section 109 of the Water Resources Act 1991 and EA land drainage and sea defence byelaws (Ref: 19.37) stipulate that consent is required from the relevant authority for any works within 8m of a non-tidal water body (8 m starts from the toe of any flood defence or raised embankment) and 16 m of a tidal body. This will apply to watercourses and drainage structures within the proposed converter station, permanent access road and the proposed AC cable route study areas with the Black Sluice IDB and the EA to be consulted regarding works close to their assets.

### Discharge Consents

5.4.13 EA/Landmark Envirocheck® Report obtained indicates that there is no active or unrevoked surface water discharge consents within 1 km of the proposed converter station and 250 m of the permanent access road and proposed AC cable route.

### Pollution Incidents

5.4.14 No significant pollution incidents have been reported to the EA in respect of the site of the proposed AC cable route, proposed converter station or permanent access road.

# 6 Potential Impacts

## 6.1 Overview of Potential Impacts

6.1.1 A range of potential impacts on water resources and hydrology have been identified which may occur during the construction, operation/maintenance and decommissioning of the proposed converter station, permanent access road and proposed AC cable route. The impacts have been assessed based on a realistic worst case base scheme design as outlined in Section 3 of this chapter and described in more detail in ES-2-C.01, Volume 2, Chapter 17: The Proposed Converter Station, with the impacts having been assessed incorporating the design mitigation (set out in Section 3.5 of this chapter) and following the methods described in Section 2 of this chapter.

### Temporary Construction Impacts

6.1.2 The temporary impacts of the proposed converter station, permanent access road and proposed AC cable route occur during the construction phase. These impacts are mainly due to the increase in less permeable areas of the proposed converter station and permanent access road and the cable installation techniques used for the proposed AC cable route. The temporary impacts assessed within this chapter are as follows:

- Impacts which may affect temporary (construction) flood risk;
- Impacts which may affect Main River water quality;
- Impacts which may affect minor/ordinary watercourse water quality;
- Construction works (Permanent access road, AC cable route and proposed converter station construction, temporary compound areas, heavy vehicle movements etc.) affecting field and land drainage; and
- Impacts of the proposed AC cable route ‘connection works’ within the existing Bicker Fen 400 kV Substation.

### Longer Term, Operational and Permanent Impacts

6.1.3 Operational, longer term and permanent impacts are those which would occur as a result of the proposed converter station, permanent access road and proposed AC cable route land take or as a result of its operation. The longer term impacts assessed within this chapter are as follows:

- Impacts which may affect flood risk;
- Impacts which may affect Main River water quality;
- Impacts which may affect minor/ordinary watercourse water quality; and
- Impact of operation that may affect field and land drainage.

Decommissioning impacts

6.1.4 Decommissioning impacts are those which would occur as a result of the decommissioning of the proposed converter station and associated infrastructure. The decommissioning impacts assessed within this chapter are as follows:

- Impact that may affect flood risk;
- Impact on Main River water quality; and
- Impact on ordinary watercourse water quality.

## 6.2 Temporary construction impacts

Impact which may affect temporary (construction) flood risk

6.2.1 The proposed converter station, permanent access road and proposed AC cable route are situated within a mainly rural area, with limited residential properties within the surrounding area. The sensitivity of the receptor is therefore, considered to be **medium**.

6.2.2 The proposed converter station and permanent access road have been assessed as being at high risk of flooding from fluvial sources. The proposed development areas are located on land presently defined as 'greenfield' with no hard standing. The proposed converter station zone including the permanent access road has been assessed as at risk of flooding from fluvial sources up to a depth of 0.80 m and 0.66 m respectively. A worst case 100% increase in low permeable surfacing as a consequence of the proposed converter station zone would directly impact local flood risk.

6.2.3 The permanent access road will increase low permeable surfacing along the route. The increase in low permeable area within the LoD would increase surface water runoff rates, in turn increasing channel flows and as a consequence flood risk. Construction of the proposed converter station zone and permanent access road requires a degree of ground re-profiling and foundations excavation.

6.2.4 The excavation of the foundations and levelling associated with the proposed converter station zone is likely to change the natural hydrological characteristics of the site. The combination of construction works and the increase in low permeable surfacing could increase the surface water runoff rates, in turn increasing the flood risk to surrounding receptors.

6.2.5 A temporary construction compound will be required to house construction vehicles, workers and associated equipment. The temporary compound will be constructed using permeable material underlain by a permeable geotextile membrane. Surface water runoff will be intercepted via a temporary drainage system. The system will manage surface water runoff from the construction compound in terms of both flow rate and water quality, in accordance with local policies and relevant permits.

6.2.6 Hammond Beck and a number of smaller Black Sluice IDB drains will be crossed by the permanent access road. A permanent bridge will need to be constructed across the Beck with smaller watercourses culverted.

6.2.7 During the construction of the proposed AC cable route, a temporary construction compound would be utilised in line with the proposed converter station compound. The compound would be constructed with permeable material and therefore would not increase surface water runoff.

6.2.8 The construction methodologies (as set out in Table 19.9) and the outline drainage strategy will seek to ensure the risk of flooding is not increased during the construction of the proposed converter station, permanent access road and proposed AC cable route. The impact on flood risk during construction is predicted to be of local spatial extent, short term duration, of intermittent occurrence and reversible assuming that design mitigation measures are implemented. It is predicted that any impact will affect receptors (local watercourses) directly. The magnitude is considered to be **low**.

6.2.9 The significance of effect will be of **minor adverse significance**, which is **not significant**.

Impact which may affect Main River water quality

6.2.10 The potential for significant impacts on surrounding water resources is dependent on the scale, duration and season during which the event takes place. Activities on-site during construction could lead to an increase in turbid (sediment laden) run-off and spillages/leaks of fuel, oil or other pollutants that could affect nearby main watercourses through surface water runoff. The use of heavy construction vehicles during the construction phase of the proposed converter station and permanent access road may also increase soils erosion/dust generation within the site and the surrounding area, increasing the potential for turbid run-off.

6.2.11 The proposed AC cable route has the potential to increase soil erosion with the use of open cut techniques across IDB drains. Large heavy vehicles would be used in the construction of the cable route increasing dust generation, and/or increase likelihood of spillages/leaks of fuel potentially impacting on surrounding watercourses.

6.2.12 The sensitivity of watercourses is dependent on the nature of the specific watercourse. WFD classifications obtained from the EA website for water quality indicates that the Main River within the study area have a moderate status defined as a moderate deviation from the biological, chemical and morphological condition associated with no or very low human pressure. The sensitivity of receptor is considered **medium**.

6.2.13 No direct works are proposed to Main Rivers therefore the impact is predicted to affect the receptor indirectly. The proposed AC cable route could act as a drainage channel, leading to run-off from construction areas affecting nearby watercourses, potentially causing degradation to surrounding surface watercourse quality and therefore WFD classification. However, the construction process outlined within section 3.5 of this chapter will include measures to intercept run-off and ensure that discharge from the site are controlled in quality and volume causing no degradation in WFD classification. The impact is predicted to be of local spatial extent, short to medium term duration, of intermittent occurrence and highly reversible. The magnitude is therefore, considered to be **low**.

6.2.14 The potential significance of effects of construction on Main River surface water resources have been assessed as **minor adverse significance** and considered **not significant**.

Impacts which may affect minor/ordinary watercourse water quality

6.2.15 A number of minor/ordinary watercourses and drains would be crossed by the proposed AC cable route and permanent access road associated with the installation process and construction site access roads. Construction activities within the vicinity of these watercourses has the potential to impact on the surface water quality affecting WFD classification.

6.2.16 The temporary access road within the proposed AC cable route working width may be constructed over a pre-installed culver pipe in the watercourse. The pipe will be of suitable size to accommodate the water volumes and flows. An alternative method may be to install a temporary bridge. The temporary access road will be removed following the construction programme.

6.2.17 Activities on-site during construction (including the use of heavy vehicles and the removal of sediment) could lead to an increase in turbid run-off and spillages/leaks of fuel, oil and other pollutants that could affect nearby watercourses, in turn reducing the water quality. Similarly, the proposed AC cable route (through open cut techniques) itself could act as a drainage channel, leading to run-off from construction affecting nearby watercourses. The permanent access road will cross Hammond Beck, a Black Sluice IDB drain. A bridge will be constructed to cross the Beck, using heavy vehicles and construction techniques potentially leading to an increase in soil erosion/dust generation reducing the WFD classification to surrounding watercourses, in turn possibly affecting local ecology temporarily.

6.2.18 Minor and ordinary watercourse WFD status is determined by the WFD classification of surrounding Main Rivers. The minor and ordinary watercourses in the 1 km buffer of the proposed converter station and associated infrastructure are considered to have a ‘moderate’ status. Taking this into account the sensitivity of receptor is considered **medium**.

6.2.19 As stated above, the construction techniques have the potential to cause adverse impacts on surrounding watercourses and receptors, increasing turbid run-off through soil erosion, spillages/leaks potentially causing degradation of local surface watercourse quality (in turn WFD status). However, with the incorporation of design mitigation (section 3.5 of this chapter) including construction methods into the construction process, runoff will be intercepted to ensure discharge is controlled in quality and volume. The impacts are predicted to be of local spatial extent, short term duration, intermittent occurrence and highly reversible. The magnitude is considered to be **low**.

6.2.20 The potential significance of effects of construction on ordinary watercourse water resources have been assessed as **minor adverse significance** and considered **not significant**.

### Construction works affecting field and land drainage

6.2.21 Construction works of the proposed converter station, permanent access road and proposed AC cable route may lead to the severing or blockage of field and land drains, which could lead to flooding of affected fields. Activities during construction could lead to an increase in turbid run-off and spillages/leaks of fuel, oil and other pollutants contaminating field drainage affecting nearby watercourses and ecosystems.

6.2.22 Based on the location of the proposed converter station, permanent access road and proposed AC cable route field drains the sensitivity of the receptors is considered to be **medium**.

6.2.23 The permanent removal of field drains within the proposed converter station may cause a backup on surrounding field drains, in turn increasing the flood risk to surrounding receptors. Design mitigation measures incorporated into the construction methods would include the restoration to field drains where appropriate and the incorporation of outline drainage strategy (outlined in section 3.5 of this chapter) to limit the disruption to field and land drains. The impact is predicted to be of local spatial extent with a minor shift away from the existing hydrological environment, short term duration, intermittent occurrence and reversible. The magnitude is therefore considered to be **low**.

6.2.24 The significance of effects on field drainage during the construction phase are considered to be **minor adverse significance** and considered **not significant**.

### Impacts of the proposed AC cable route 'connection works'

6.2.25 Connection work of the proposed AC cable route within the existing Bicker Fen 400 kV Substation will consist of the Installation of two substation bays spilt within the northern and southern extent of Bicker Fen Substation to allow the Project to be connected to the NETS. The existing Bicker Fen 4000 kV substation is located within Flood Zone 3 and therefore considered to be at high risk of fluvial flooding.

6.2.26 Based on the location of Bicker Fen Substation within a rural area with limited residential or commercial properties, the sensitivity of receptors is considered to be **medium**.

6.2.27 Activities on-site during construction (including the use of heavy vehicles and the removal of sediment) could lead to an increase in turbid run-off and spillages/leaks of fuel, oil and other pollutants that could affect nearby watercourses, in turn reducing the water quality. The excavation/piling for foundations within the existing Bicker Fen Substation are likely to change the natural hydrological characteristics of the site. The existing electrical infrastructure may increase impermeable surfacing within the existing Bicker Fen Substation, increasing the likelihood of surface runoff and associated surface water flood risk.

6.2.28 A Temporary Construction Compound (TCC) will be required to house construction vehicles, workers and associated equipment. The use of heavy vehicles within the TCC may compact construction materials reducing permeability, increasing surface water runoff rates. Material stored within the TCC may remove floodplain storage volume. The temporary compound will be

constructed using permeable material underlain by a permeable geotextile membrane. Surface water runoff will be intercepted via a temporary drainage system. The system will manage surface water runoff from the construction compound in terms of both flow rate and water quality, in accordance with local policies and relevant permits.

6.2.29 The construction methodologies (as set out in Table 19.8) will seek to ensure the risk of flooding is not increased during the connection work of the proposed AC cable route within the existing Bicker Fen 400 kV Substation. Design mitigation measures (as set out in section 3.5 of this chapter) incorporates strategies to intercept surface water runoff to ensure discharge is controlled in quality and volume. The impacts are predicted to be of local spatial extent with the Bicker Fen Substation situated within a rural area, short term duration, intermittent occurrence and highly reversible. The magnitude is considered to be **low**.

6.2.30 The significance of effect will be of **minor adverse significance**, which is **not significant**.

## 6.3 Longer Term, Operational and Permanent Impacts

6.3.1 The impacts of the operation and maintenance of the proposed development on water resources and hydrology within the proposed converter station, permanent access road and proposed AC cable route study area have been assessed in line with the methods outlined approach to assessment section. The potential impacts arising from the operation and maintenance of the proposed converter station for each element are presented below.

### Impact which may affect flood risk

6.3.2 As the proposed AC cable route will be buried, no increase in flood risk is anticipated.

6.3.3 The proposed converter station, permanent access road and proposed AC cable route are located within NPPF and Planning Practice Guidance (PPG) ID7 Flood Zone 2 and 3, defined as at medium to high risk of fluvial/tidal flooding. The proposed converter station, permanent access road and proposed AC cable route has been assessed as at very low risk of surface water flooding.

6.3.4 The proposed converter station, permanent access road and proposed AC cable route are situated within a mainly rural area, with limited residential properties within the surrounding area. The sensitivity of the receptor is therefore, considered to be **medium**.

6.3.5 Following construction and during the operational phase, the proposed converter station and permanent access road would result in an increase in low-permeable surface area, causing an increase to surface water run-off rates. However, with the incorporation of design mitigation (set out in section 3.5 of this chapter) runoff will be intercepted and discharged at an agreed rate.

6.3.6 With the incorporation of design mitigation impacts (including a possible increase in surface water runoff and disrupting of natural flood defences) any impacts are only likely to affect the surrounding local receptors, with short term impacts on drainage networks and runoff rates. The

impacts are therefore predicted to be of local spatial extent, short term duration, intermittent occurrence and highly reversible. The magnitude is therefore considered to be **low**.

6.3.7 The significance of effects are considered to be of **minor adverse significance**, which is n**ot significant**.

### Impact which may affect Main River water quality

6.3.8 The operation of the proposed converter station and proposed AC cable route will involve routine maintenance involving the use of chemicals, oils and grease and therefore, there is the potential for spillages to occur which may affect the water quality of main rivers.

6.3.9 The EA designated main South Forty Foot Drain has been determined to have a WFD classification of moderate. Taking this into consideration the sensitivity of receptor is considered to be **medium**.

6.3.10 The use of heavy vehicles on the permanent access road is likely to increase soil erosion dust generation, increasing the potential for contamination of surrounding watercourses.

6.3.11 The permanent access road is the main access point to the proposed converter station, with access during operation to the AC cables undertaken in the relevant field in relation to the fault. There is the potential for spillage from maintenance vehicles but it is highly unlikely and therefore impacts from the permanent access road are determined to not be significant. The proposed AC cable route could provide a lateral pathway for the movement of water which could indirectly affect water quality.

6.3.12 No direct pathway to Main Rivers has been identified. With the incorporation of design mitigation measures outlined in section 3.5 of this chapter, the impact is predicted to be of local spatial extent only impacting on surrounding main rivers, short term duration, intermittent occurrence and reversible. The magnitude is considered to be **low**.

6.3.13 The significance of effects for longer term impacts/operation on main river surface water resources have been assessed as **minor adverse significance** and therefore **not significant**.

### Impact which may affect minor/ordinary surface watercourses water quality

6.3.14 The operation of the proposed converter station and proposed AC cable route will involve routine maintenance. Maintenance may involve the use of chemicals, oils and greases and therefore, there is the potential for spillages to occur which may affect the water quality of surrounding minor/ordinary surface watercourses.

6.3.15 Minor/ordinary watercourses WFD status is taken from WFD classifications from surrounding main waterbodies. In line with EIA assessment methodology (ES-2-A.04 Chapter 04) minor/ordinary watercourses within the 1 km buffer are considered to have a ‘moderate’ WFD status. Taking this into account the sensitivity of receptor is considered **medium**.

6.3.16 The permanent access road is the main access to the proposed converter station, with access during operation to the AC cables undertaken in the relevant field in relation to any fault to the

cable. There is potential for spillage from maintenance vehicles, however it is highly unlikely and therefore impacts from the permanent access road are determined to not be significant.

6.3.17 No direct pathway to minor/ordinary watercourses has been identified. With the incorporation of design mitigation measures outlined in section 3.5 of this chapter, the impact is predicted to be of local spatial extent only impacting on surrounding main rivers, short term duration, intermittent occurrence and reversible. It is predicted that any impact will affect the receptor indirectly. The magnitude is therefore, considered to be **low**.

6.3.18 The significance of effects of operation on ordinary watercourse water resources have been assessed as **minor adverse significance** and are considered **not significant**.

### Impact of operation that may affect field and land drainage

6.3.19 Routine maintenance of the proposed converter station and proposed AC cable route will require the use of oils, chemicals and other pollutants. There is the potential for spillages to occur which could cause localised soil and possibly surface water runoff contamination. This in turn has the potential to contaminate field drainage. The use of heavy maintenance vehicles on the permanent access road has potential to increase soil erosion/dust generation, increasing the potential for contamination of surrounding field drainage.

6.3.20 Based on the location of the proposed converter station, permanent access road and proposed AC cable route, field drains the sensitivity of receptors is considered to be **medium**.

6.3.21 The permanent access road is the main access point to the proposed converter station, with access to the AC cables during operation being through the relevant field where the fault to the cable has occurred. Potential for spillage from maintenance vehicles may occur but is highly unlikely and therefore impacts from the permanent access road and proposed AC cable route are determined to not be significant to field drainage.

6.3.22 With the incorporation of appropriate construction mitigation techniques and outline drainage strategy at the proposed converter station the impact is predicted to be of local spatial extent with a minor shift away from existing hydrological environment of local receptors, short term duration, intermittent occurrence and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

6.3.23 The significance of effects on land drainage during the operational phase are determined to be **minor adverse significance** and considered **not significant**.

## 6.4 Decommissioning Impacts

6.4.1 The impacts of the decommissioning phase of the proposed development on water resources and hydrology within the proposed converter station, permanent access road and proposed AC cable route study area have been assessed in line with the methods outlined within section 2 of this chapter.

6.4.2 The decommissioning impacts of the proposed converter station, proposed AC cable route and permanent access road has been determined to be similar and no worse than construction (temporary) impacts in relation to flood risk, water quality and field drainage, and therefore are **minor adverse significance**, **which is not significant**.

# 7 Mitigation

## 7.1 Overview of Mitigation

7.1.1 Potential impacts to the water environment will be avoided where practicable through careful consideration of the drainage design, construction techniques and operational best practice of the proposed converter station, permanent access road and proposed AC cable route. The EA, LLFA and IDB will be consulted through the planning process to ensure all appropriate permits and consents are in place. The construction mitigation measures are outlined below and featured in the CEMP.

## 7.2 Construction Mitigation

7.2.1 Construction mitigation measures would reduce any potential adverse impacts associated with the proposed converter station, proposed AC cable route and permanent access road through careful consideration of the hydrological environment, drainage network and construction techniques.

### Water Quality/Flood Risk Mitigation

7.2.2 Temporary drainage mitigation techniques including, but not limited to, run-off interceptor channels would be installed prior to the construction of the formal drainage scheme to ensure that discharges from the proposed converter station, permanent access road and proposed AC cable route are controlled in quality and volume. This may include the use of settling tanks and/or ponds to remove sediment, temporary interceptors and hydraulic brakes.

7.2.3 Construction material and/or spoil within TCC will be positioned away from drainage systems or surface watercourses/field drainage and no hazardous substances will be stored within close proximity of the drainage network.

7.2.4 An outline drainage strategy forms part of the application (outlined in section 3.5 of this chapter) and the detailed drainage strategy will be finalised by the contractor and agreed with the LCC and Black Sluice IDB. The strategy will incorporate the use of appropriate SuDS techniques, interceptors and separators as required, treating surface water run-off generated from the proposed converter station, permanent access road and proposed AC cable route, prior to either infiltrating into the underlying geology or discharged into the local surface water network at an agreed rate.

7.2.5 Any area at risk of spillage, such as vehicle maintenance areas and hazardous substance stores (including fuel, oils and chemicals) will be bunded and carefully sited to minimise the risk of hazardous substances entering the drainage system or the local watercourses. Additionally the bunded areas will have impermeable bases to limit the potential for migration of contaminants into groundwater following any leakage/spillage.

7.2.6 The proposed AC cable route could act as a drainage channel, leading to run-off from construction affecting nearby watercourses. However, the construction process will include measures to intercept run-off (temporary drains installed along the length of the AC cable route trenches) and ensure that discharges from the development are controlled in quality and volume. This may include the use of settling tanks or ponds to remove sediment, temporary interceptors and a hydraulic brake.

7.2.7 Proposed techniques for crossing water features and channels for the base design scheme will be subject to consents under the LDA 1991. Individual flood defence and watercourse crossing engineering techniques are to be agreed with the relevant stakeholders prior to works commencing. In the case of the construction site access crossings, existing field accesses, tracks and roads will be used where possible. However, where accesses are not robust enough for construction traffic, the construction site access crossings will be upgraded or widened, with details to be supplied to relevant stakeholders prior to works commencing under appropriate consenting regimes. Construction site access roads may require widening up to 5 m to accommodate machinery.

7.2.8 Any oil filled equipment during the connection works of the proposed AC cable route to the Bicker Fen Substation will be bunded to ensure no leaks of pollutants to surrounding watercourses and/or field drains occur.

### Flood Risk Mitigation

7.2.9 To establish a level platform ground level the proposed converter station zone would be profiled to approximately 2.9m AOD, locating the proposed converter station above the 'worst-case' 1 in 1,000 year breach plus climate change SHDC SFRA flood event, effectively locating the proposed converter station to Flood Zone 1. Flood compensation measures are outlined within section 7.2 of this chapter.

7.2.10 A crossing schedule has been developed to distinguish the crossing technique for the proposed AC cable route to cross minor/ordinary watercourses and IDB drains (Table 19.10). The schedule indicates that the majority of the watercourses will be crossed by trenchless techniques. One surface water drain (EA ref DX36b/2) will be crossed by open-cut techniques.

7.2.11 A number of minor watercourses and drains would be crossed by the proposed AC cable route and permanent access road. The temporary construction areas may be installed over a pre-installed culvert pipe in the watercourse. The pipe will be of suitable size to accommodate the water volumes and flows. An alternative method may be to install temporary bridging. The accesses roads will be removed at the end of the construction programme. The construction works will be undertaken in accordance with a methodology for the crossing of watercourses agreed with the EA, LLFA and IDB's. This will include measures to ensure that watercourses, including their banks, are reinstated to their previous condition where possible.

7.2.12 The permanent access road bridge over Hammond Beck will be constructed with a soffit equal to or greater than existing bridge levels with designs produced in consultation with Black Sluice IDB.

Existing flood risk depth for the area indicates that the permanent access road is at risk of flooding to an estimated maximum depth of 0.66 m. Defra/Environment Agency, October 2005. Flood Risk Assessment Guidance for New Development, Phase 2 FD2320/TR2 notes:

"*Cars will stop and/or float in water as shallow as 0.5 m, whilst some emergency vehicles may survive in water of 1 m. A fire engine remains controllable in depths of 0.5m up to a flow velocity of 5 m/sec, due to high-level air intakes / exhausts*".

7.2.13 It is proposed that the permanent access road will be re-profiled to establish a level at a minimum of 2.7 m AOD.

7.2.14 The permanent access road and the proposed converter station will be signed up to the EA's flood warning system (https://www.gov.uk/sign-up-for-flood-warnings) which would give site personnel the opportunity to move to a safe area during an extreme event. Site operators will liaise with the EA and implement on-site management strategies to ensure that flood warnings are communicated efficiently in order that the site can be evacuated.

7.2.15 A flood evacuation plan will be developed for the construction and operational phases of the permanent access road, with staff training provided, to ensure in the event of the plan be activated staff are aware of the procedures upon receipt of the flooding warning, together with evacuation routes.

7.2.16 Flood evacuation Plans should be practiced regularly in order to minimise the effects of flood risk to people.

7.2.17 Suitably trained staff would need to convey flood warning information and emergency procedures to occupants. Site personnel and contracted night security services would be required to be familiar with the flood action plan. Appropriate signage across the proposed converter station site (i.e. exits and assembly points) should be installed.

## 7.3 Compensation Measures

7.3.1 A degree of ground level profiling will be required to attain a level development platform (2.9 m AOD) upon which the proposed converter station zone will be constructed. As a consequence of the proposed converter station zone ground level profiling exercise the zone would be located above the 'worst-case' 1 in 100 year breach plus climate change SHDC SFRA flood zone event indicating that components of the proposed converter station will be at low risk of flooding from fluvial and tidal sources.

7.3.2 As a result of the ground profiling a degree of floodplain storage may be lost. It is anticipated that material utilised to facilitate attaining a 2.9 m AOD foundation level would be acquired from within the proposed converter station site area, in turn maintaining existing floodplain storage. In addition, the floodplain is large and relatively flat lying, therefore the footprint associated within any profiling will have negligible impact on flood extents and depths. It has therefore been determined that additional flood compensation storage is not required.

7.3.3 The proposed permanent access road incorporates a degree of ground profiling to attain a minimum 2.7 m AOD level. The detailed design will employ, where practicable, engineering techniques to enable flood water conveyance beneath the road retaining existing floodplain storage. Therefore, no flood compensation storage is anticipated.

# 8 Residual Effects

## 8.1 Temporary Construction Effects

8.1.1 The temporary effects of the proposed converter station, proposed AC cable route and access road have been assessed on water resources and hydrology potential within the defined study area. The potential for residual effects have been assessed against the baseline conditions including the implementation of mitigation measures presented within section 7 of this chapter.

Impact which may affect temporary (construction) flood risk

8.1.2 The proposed converter station, permanent access road and proposed AC cable route are situated within a mainly rural area, with limited residential properties within the surrounding area. The sensitivity of the receptor is considered medium.

8.1.3 The proposed converter station, access road and proposed AC cable route has been assessed as being at risk of flooding from fluvial sources. The proposed converter station is located on land presently defined as a 'greenfield' with no hard surfacing. A worst case 100% increase in low permeable surfacing as a consequence of the development has been assumed, which could directly impact flood risk on adjoining agricultural land due to increases in surface water runoff rates.

8.1.4 A degree of ground level profiling is required to attain a level development platform (2.9 mAOD) upon which the proposed converter station will be constructed. As a consequence of the profiling exercise the proposed converter station zone will be located above the 'worst-case' 1 in 1,000 year breach plus climate change SHDC SFRA flood event. Effectively locating the proposed converter station to Flood Zone 1.

8.1.5 The permanent access road and temporary construction compounds may temporarily increase surface water flow rates, increasing flood risk to the development area and the surrounding receptors.

8.1.6 As stated within the potential impact section 6 above, the permanent access road will cross the Black Sluice IDB Hammond Beck with a bridge structure, potentially increasing flood risk to the surrounding area. Flood risk will be mitigated as the bridge will be constructed with a soffit equal to or greater than existing bridge levels.

8.1.7 Development specific construction mitigation (outlined within section 7 of this chapter) in conjunction with construction best practice will ensure the risk of flooding is not increased during development of the proposed converter station through the use of surface water run-off management strategies, including but not limited, appropriate SuDS compliant techniques, interceptors and separators as required, treating surface water run-off generated from the proposed converter station, detailed in ES-2-C.01, Volume 2, Chapter 17: The Proposed Converter Station and included within the CEMP.

8.1.8 With the incorporation of mitigation measures outlined within section 7 of this chapter, the impact is predicted to be of local spatial extent only impacting on surrounding receptors, short term duration and reversible. Flood risk vulnerability within the proposed converter station and permanent access road areas would decrease in relation to pre-construction levels. The magnitude of impact is therefore reduced to negligible.

8.1.9 The significance of effects of the development on flood risk has been determined to be negligible and not significant.

### Impact which may affect Main River water quality

8.1.10 As noted in section 6 of this chapter the sensitivity of the receptor is considered medium.

8.1.11 Activities during construction (including open cut trenching techniques) could lead to an increase in turbid run-off and spillages/leaks of fuel, oil and greases that could affect nearby watercourses through surface water runoff. However, the construction process would include mitigation measures (outlined in section 7 of this chapter) to intercept run-off and ensure that discharges from the development are controlled in quality and volume. This may include the use of settling tanks or ponds to remove sediment, temporary interceptors and a hydraulic brake. The potential for contamination to occur would be reduced through the detailed drainage strategy to be confirmed by the final contractors. Consequently it is considered that the magnitude of impact once mitigation measures are included would be negligible.

8.1.12 The significance of potential effects of the development on main river water quality has been determined to be negligible and not significant.

### Impact which may affect minor/ordinary watercourse water quality

8.1.13 As noted in section 6 of this chapter the sensitivity of the receptor is considered medium.

8.1.14 Activities during construction (including open cut trenching techniques) could lead to an increase in turbid run-off and spillages/leaks of fuel, oil and greases that could affect nearby watercourses through surface water runoff. However, the construction process would include mitigation measures (outlined in section 7 of this chapter) to intercept run-off and ensure that discharges from the development are controlled in quality and volume. This may include the use of settling tanks or ponds to remove sediment, temporary interceptors and a hydraulic brake. The potential for contamination to occur would be reduced by a detailed drainage strategy to be confirmed by the final contractors. Consequently it is considered that the magnitude of impact once mitigation measures are included would be negligible.

8.1.15 The significance of effects of the development on minor/ordinary water quality has been determined to be negligible and not significant.

### Construction works affecting field and land drainage

8.1.16 Construction works may lead to the severing or blockage of field drains, which could lead to flooding of affected fields. As noted in section 6 of this chapter the sensitivity of receptor is considered medium.

8.1.17 However, the impacts of the construction phase on land drainage will be low as land drains will be identified where possible and restored to pre-construction condition where practicable. Construction methodologies will include techniques to reduce the potential for blockage of field drains. Therefore, the magnitude of the impact has reduced to low.

8.1.18 The significance of effects of the development on field/land drainage has been determined to be minor adverse and not significant.

### Impacts of the proposed AC cable route 'connection works'

8.1.19 The existing Bicker Fen 400 kV Substation is located within rural area with limited residential or commercial properties. As noted in section 6 of this chapter the sensitivity of receptor is considered medium.

8.1.20 Activities on site during construction of the connection works may increase less permeable areas, increasing surface water runoff, in turn increasing surface water flood risk. Construction could also lead to an increase in turbid run-off and spillages/leaks of fuel, oil and greases that could affect nearby watercourse quality through surface water runoff.

8.1.21 Construction methodologies outlined within section 7 of this chapter will include techniques to reduce contamination of surrounding surface watercourses and field drains through bunding of areas housing hazardous substances or oil filled equipment. Consequently it is considered that the magnitude of impact once mitigation measures are included would be negligible.

8.1.22 The significance of effects of the proposed AC cable route connection works within the existing Bicker Fen 400 kV Substation has been determined to be negligible and not significant.

## 8.2 Longer Term, Operational and Permanent Effects

8.2.1 The impacts of the operation and maintenance of the proposed development on water resources and hydrology within the proposed converter station, permanent access road and the proposed AC cable route study area have been assessed in line with the methods outlined in ES-2-A.04 Volume 2 Chapter 4: Environmental Impact Assessment Methods. The potential for residual effects have been assessed against the baseline conditions with the mitigation measures presented within section 7 of this chapter implemented.

### Impact which may affect flood risk

8.2.2 The majority of the proposed converter station and permanent access road is located within NPPF and Planning Practice Guidance Flood Zone 2 and 3 'high probability', defined by the EA

as land assessed as having 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. The sensitivity of the receptor is therefore considered medium.

8.2.3 Following construction of the proposed converter station zone ground profiling and during the operational phase the proposed converter station and the permanent access road will result in an increase in low permeability surface area which has the potential to increase the surface water runoff of the proposed converter station. An FRA has been undertaken for the proposed converter station and permanent access road (ES-4-C.03 Ch21) which concludes that following development ground profiling and incorporation of appropriate SuDS attenuation techniques restricting surface water run-off flows to pre-development rates there will be no increase in flood risk to the proposed converter station or surrounding areas.

8.2.4 With the construction of the bridge crossing (Hammond Beck) to a soffit equal to or greater than existing bridge levels, no increase in flood risk is predicted. The permanent access road is to be levelled to a minimum level of 2.70 mAOD reducing the flood risk along the route.

8.2.5 As the proposed AC cable route will be buried, it has been assessed that there will be no adverse impacts on flood risk.

8.2.6 With the incorporation of the proposed mitigation measures outlined within section 7 of this chapter the impacts of operation on flood risk is assessed as negligible.

8.2.7 The significance of potential effects of the operational phase of the development, including the incorporation of mitigation measures has been assessed as negligible and not significant.

Impact which may affect Main river water quality

8.2.8 As noted in section 6 the sensitivity of the receptor is considered medium.

8.2.9 Routine maintenance of the proposed converter station and proposed AC cable route may require the use of oils and chemicals. There is the potential for spillages to occur which could cause localised soil and possibly surface water runoff contamination. This in turn has the potential to contaminate surrounding surface watercourses. The effects would be reduced by following good practice in the storage, use and disposal of oils and chemicals, and by following the recommended mitigation measures in cleaning surface water intercepted prior to discharge / removal.

8.2.10 There is also the potential for leakages of oil to occur, however the proposed converter station drainage scheme (outlined in the detailed drainage design to be confirmed by the final contractor) will include oil interceptor tanks to ensure that any oil lost from a transformer is prevented from entering the storm water discharge system.

8.2.11 Following good practices in the construction of the permanent access road would reduce any potential impact on surface water quality caused by increased sedimentation or contamination from heavy vehicle traffic.

8.2.12 It has been assessed that there will be no adverse impacts on main river watercourses due to the proposed AC cable route maintenance.

8.2.13 Taking into account the construction mitigation outlined within section 7 of this chapter it is considered that the magnitude of impact would be negligible.

8.2.14 The significance of effects of the development on main river water quality has been determined to be negligible and not significant.

### Impact which may affect minor/ordinary surface watercourse water quality

8.2.15 As noted in section 6 the sensitivity of the receptor is considered medium.

8.2.16 Routine maintenance of the proposed converter station and proposed AC cable may require the use of oils and chemicals. There is the potential for spillages to occur which could cause localised soil and possibly surface water runoff contamination. This in turn has the potential to contaminate surrounding surface watercourses. The effects would be reduced by following good practice in the storage, use and disposal of oils and chemicals, and by following the recommended mitigation measures in cleaning surface water intercepted prior to discharge / removal to be outlined within the detailed drainage strategy.

8.2.17 There is also the potential for leakages of oil to occur, however the proposed converter station detailed drainage strategy will include oil interceptor tanks to ensure that any oil lost from a transformer is prevented from entering the storm water discharge system.

8.2.18 Following good practices in the construction of the permanent access road would reduce any potential impact on surface water quality caused by increased sedimentation or contamination from heavy vehicle traffic.

8.2.19 It has been assessed that there will be no adverse impacts on ordinary surface watercourses due to the proposed AC cable route maintenance.

8.2.20 Taking into account construction mitigation outlined in section 7 of this chapter it is considered that the magnitude of impact would be negligible.

8.2.21 The significance of effects of the development on minor/ordinary surface water quality has been determined to be negligible and not significant.

### Impact of operation that may affect Field and Land drainage

8.2.22 As noted in section 6 of this chapter the sensitivity of the receptor is considered medium.

8.2.23 The impacts of the longer term (operational) phase on land drainage will be low as land drains will be identified where possible and restored to pre-construction condition where practicable. Field drains within the proposed converter station will be permanently removed and replaced with a drainage scheme restricting discharge to an agreed upon rate. Therefore, the magnitude of the impact has reduced to negligible.

8.2.24 The significance of effects of the development on field drainage has been determined to be negligible and not significant.

## 8.3 Decommissioning Effects

8.3.1 The impacts of the decommissioning of the proposed development on water resources and hydrology within the proposed converter station, permanent access road and proposed AC cable route study area have been assessed in line with the methods outlined in section 2 of this chapter.

8.3.2 The decommissioning effects of the proposed converter station, proposed AC cable route and permanent access road has been determined to be similar and no worse than that within the construction (temporary impacts) phase in relation to flood risk, water quality and field drainage, and therefore are negligible to minor and not significant.

# 9 Cumulative Effects

## 9.1 Scope of Cumulative Assessment

9.1.1 This section considers both the inter-project and intra-project cumulative effects of the proposed converter station, permanent access road and proposed AC cable route on water resources and hydrology in conjunction with other projects/development and the development itself.

9.1.2 The potential cumulative effects with other major developments and the DC cable route have been identified outlining likely significant effects (if any) and assessing the proposed converter station, permanent access road and proposed AC cable route against the baseline position, including the built and operational development.

9.1.3 In assessing cumulative impacts, other major development identified through consultation with the local planning authorities and other relevant authorities on the basis of those that are:

- Under construction;
- Permitted application(s), but not yet implemented;
- Submitted application(s) not yet determined;
- Projects on the Planning Inspectorate's Programme of Projects;
- Identified in the relevant Development Plan (and emerging Development Plans - with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited; and
- Identified in other plans and programmes (as appropriate) which set the framework for future development consents / approvals, where such development is reasonably likely to come forward.

## 9.2 Inter-project Cumulative Effects

9.2.1 A review of approved and proposed developments within a 250 m search area from the proposed converter station site, permanent access road and proposed AC cable route has been undertaken.

9.2.2 A 250 m search area is considered appropriate for data collection taking into account the nature of the development and likely ZoI on hydrological receptors. Given the landscape surrounding the development, current and ongoing activities, as well natural baseline fluctuations it will be difficult to ascertain the exact source of any impacts on flood risk and/or water quality beyond 250 m.

9.2.3 The review of approved and proposed developments as established that there are no cumulative developments within the defined 250 m study area of the proposed converter station site, permanent access road and proposed AC cable route.

9.2.4 Furthermore, where relevant, in accordance with the NPPF and Planning Practice Guidance ID7 – Flood Risk and Coastal Change, any new development is required to attenuate surface water

run-off, where practicable, to the greenfield run-off rate and provide appropriate management techniques to treat potentially contaminated run-off prior to discharge into the local drainage network.

9.2.5 Any works undertaken within 8 m of a watercourse and/or flood defence will require consent. For the consent to be provided the developer is required to demonstrate that the risk of flooding during the lifetime of the development could be mitigated to a level acceptable to the EA, LLFA and/or IDB's. Therefore, the cumulative impacts on water resources and hydrology are predicted to not be significant.

## 9.3 Intra-Project Cumulative Effects

9.3.1 Intra-project effects on the proposed converter station, permanent access road and proposed AC cable route are those effects occurring in combination with the proposed Direct Current (DC) cable route.

9.3.2 It has been determined that no intra-project cumulative effects on water resources and hydrology receptors are likely as mitigation measures outlined within this chapter (section 3.5 and 7) and will be incorporated into the construction and operation of the components reducing any potential effect to not significant.

# 10 Summary of Assessment

## 10.1 Summary

### Overview of Baseline Conditions

10.1.1 The EA undefended flood map for planners indicates that the central and southern areas of the proposed converter station, the proposed AC cable route and the access road are situated within Flood Zone 2 and 3, defined as at medium to high risk of fluvial/tidal flooding.

10.1.2 An assessment between modelled flood outputs and the proposed converter station levels indicates that the maximum flood extent reaches an average of 2.6 m AOD, which compared against low lying land in the central (average 1.95 m AOD) and southern (average 1.8 m AOD) area of the proposed converter station equates to 0.65 m and 0.8 m flood depth respectively.

10.1.3 An initial assessment of the permanent access road using the publicly available DTM and the maximum flood depth extents from the EA and SHDC mapping (see ES-4-C.03 Chapter 21 Water Resources and Hydrology (FRA) for further details) indicates a maximum flood depth of 0.66 m for a 1 in 100 year fluvial event combined with a 1 in 200 year tidal event during the 2115 climate change scenario.

10.1.4 The proposed converter station and proposed AC cable route is assessed as having a very low susceptibility to surface water flooding.

10.1.5 The EA designated main South Forty Foot Drain has a WFD status of Moderate.

### Overview of Residual Effects

10.1.6 With the incorporation of appropriate mitigation measures, the significance of residual effects for the proposed converter station, proposed AC cable route and permanent access road are defined as negligible to minor adverse and therefore not significant. All residual effects are identified in Table 19.13.

### Residual Effects in South Holland District Council

10.1.7 The residual effects within the SHDC area reflect the permanent access road and the proposed converter station. During the construction phase of the development the proposed converter station and permanent access road would increase the less permeable areas within the district, in turn potentially increase surface water flood risk.

10.1.8 Design mitigation and construction mitigation measures supplied within section 3.5 and section 7 of this chapter respectively would reduce potential residual effects to negligible to minor adverse and therefore not significant.

### Residual Effects in Boston Borough Council

10.1.9 The residual effects within BBC boundary reflect the proposed AC cable route options. Within the baseline study it was assessed that the proposed AC cable route options are hydrologically similar and therefore the effects have been assessed as one.

10.1.10 During the construction phase the residual effects of the development are likely to be in relation to an increase in turbid runoff through open cut techniques or the use of heavy vehicle movement. With the inclusion of appropriate mitigation measures as described within section 3.5 and section 7 of this report the impacts are assessed as negligible to minor adverse and therefore not significant.

10.1.11 During the operational phase it has been assessed that the proposed AC cable route would have no residual effects in relation water resources and hydrology.

### Residual Effects in North Kesteven District Council

10.1.12 No receptors are present within the North Kesteven district in relation to water resources and hydrology.

| Table 19.13: Summary of Assessment: ES-2-C.03 Volume 2 Chapter 21 - Water Resources and Hydrology | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Description of Receptor | Potential Impacts | | | Mitigation | Residual Effect | | | Significant |
| | Sensitivity | Magnitude | Significance | | Sensitivity | Magnitude | Significance | |
| Construction (Temporary Impact) Phase | | | | | | | | |
| Impact which may affect temporary (construction) on flood risk. | Medium. | Low. | Minor adverse. | The proposed construction of the converter station zone and the permanent access road would increase the less permeable area. An appropriate drainage strategy would be incorporated to manage off site flows outlined in section 7. No changes in surface water runoff rates are anticipated.<br>A flood evacuation plan will be developed in order that staff will be off-site before a flood event occurs. | Medium. | Negligible. | Negligible. | No. |
| Impact which may affect Main River water quality | Medium. | Low. | Minor adverse. | Construction of the converter station, access road and proposed AC cable route may increase soil erosion, increasing the likelihood of turbid runoff. An appropriate drainage strategy and onsite | Medium. | Negligible. | Negligible. | No. |

| Table 19.13: Summary of Assessment: ES-2-C.03 Volume 2 Chapter 21 - Water Resources and Hydrology | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Description of Receptor | Potential Impacts | | | Mitigation | Residual Effect | | | Significant |
| | Sensitivity | Magnitude | Significance | | Sensitivity | Magnitude | Significance | |
| Construction (Temporary Impact) Phase | | | | | | | | |
| | | | | management protocols would be incorporated to manage off site flows. | | | | |
| Impact which may affect Minor / ordinary watercourse water quality. | Medium. | Low. | Minor adverse. | Construction of the converter station, access road and proposed AC cable route may increase soil erosion, increasing the likelihood of turbid runoff. An appropriate drainage strategy and onsite management protocols would be incorporated to manage off site flows outlined in section 7. | Medium. | Negligible. | Negligible. | No. |
| Construction works affecting field and land drainage. | Medium. | Low. | Minor adverse. | The construction phase has the potential to disrupt surrounding field drainage through the use of open cutting techniques. Field drainage would be restored to pre development condition where practicable, outlined in section 7. | Medium. | Low. | Minor adverse. | No. |
| Impacts of the | Medium. | Low. | Minor | Connection works may | Medium. | Negligible. | Negligible. | No. |

| Table 19.13: Summary of Assessment: ES-2-C.03 Volume 2 Chapter 21 - Water Resources and Hydrology | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Description of Receptor | Potential Impacts | | | Mitigation | Residual Effect | | | Significant |
| | Sensitivity | Magnitude | Significance | | Sensitivity | Magnitude | Significance | |
| **Construction (Temporary Impact) Phase** | | | | | | | | |
| proposed AC cable route 'connection works' within the existing Bicker Fen 400 kV Substation. | | | adverse. | increase surface water runoff rates, increase soil erosion, increasing the likelihood of turbid runoff. A temporary drainage strategy, as well as on site management protocols would be incorporated to manage off site flows outlined in section 7. | | | | |
| **Operation (Longer Term) Phase** | | | | | | | | |
| Impact which may affect flood risk. | Medium. | Low. | Minor adverse. | The proposed converter station zone and permanent access road would increase the less permeable areas. An appropriate drainage strategy would be implemented to manage off site flows, outlined in section 7. No change in surface water runoff rates is anticipated.<br>A flood evacuation plan will be developed in order that staff will be off-site before a flood | Medium. | Negligible. | Negligible. | No. |

| Table 19.13: Summary of Assessment: ES-2-C.03 Volume 2 Chapter 21 - Water Resources and Hydrology | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Description of Receptor | Potential Impacts | | | Mitigation | Residual Effect | | | Significant |
| | Sensitivity | Magnitude | Significance | | Sensitivity | Magnitude | Significance | |
| Construction (Temporary Impact) Phase | | | | | | | | |
| | | | | event occurs. | | | | |
| Impact which may affect Main River water quality. | Medium. | Low. | Minor adverse. | Operation and maintenance of the converter station and proposed AC cable would use oils/chemicals which have the potential to be spilled. Implementation of best practices and an appropriate drainage scheme would manage off site flows, outlined in section 7. | Medium. | Negligible. | Negligible. | No. |
| Impact which may affect Minor / ordinary surface watercourse water quality. | Medium. | Low. | Minor adverse. | Operation/maintenance of the converter station and proposed AC cable route would require the use of oils / chemicals which have the potential to be spilled. Implementation of best practices and an appropriate drainage scheme would manage off site flows, outlined in section 7. | Medium. | Negligible. | Negligible. | No. |
| Impact of | Medium. | Low. | Minor | Field drains will be | Medium. | Negligible. | Negligible. | No. |

| Table 19.13: Summary of Assessment: ES-2-C.03 Volume 2 Chapter 21 - Water Resources and Hydrology | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Description of Receptor | Potential Impacts | | | Mitigation | Residual Effect | | | Significant |
| | Sensitivity | Magnitude | Significance | | Sensitivity | Magnitude | Significance | |
| Construction (Temporary Impact) Phase | | | | | | | | |
| operation that may affect field and land drainage. | | | adverse. | mapped/logged before the construction phase and restored to pre development condition where practicable, outlined in section 7. | | | | |

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