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Bramford to Twinstead Reinforcement

Volume 6: Environmental Information

Document 6.3.10.2: ES Appendix 10.2 – Groundwater Baseline and Assessment

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1. Introduction

1.1 Overview

1.1.1 National Grid Electricity Transmission plc (here on referred to as National Grid) is making an application for development consent to reinforce the transmission network between Bramford Substation in Suffolk, and Twinstead Tee in Essex. The Bramford to Twinstead Reinforcement (‘the project’) would be achieved by the construction and operation of a new electricity transmission line over a distance of approximately 29km (18 miles), the majority of which would follow the general alignment of the existing overhead line network.

1.1.2 This appendix has been produced to characterise the groundwater environment in order to inform Environmental Statement (ES) Chapter 10: Geology and Hydrogeology (**application document 6.2.10**), which supports the application for development consent under the Planning Act 2008.

1.1.3 This appendix has close alignment with ES Appendix 10.1: Geology Baseline and Risk Assessment (**application document 6.3.10.1**). It describes the groundwater (hydrogeology) baseline within and in the vicinity of the Order Limits, based on a desk study of available information. It also includes the groundwater risk assessment that has been completed to support ES Chapter 10: Geology and Hydrogeology (**application document 6.2.10**).

1.2 Study Area

1.2.1 The groundwater study area is defined as the Order Limits with a 1km buffer. This buffer allows for the identification of receptors outside the Order Limits that could be impacted by activities such as change in groundwater flows or quality. These in turn may support receptors such as groundwater dependent terrestrial ecosystems (GWDTE) or provide baseflow to watercourses.

1.3 Sources of Information

1.3.1 The baseline appendix is informed by a desk study which comprises available information, including maps, geological data, data collected from historical ground investigations and publicly available data. The following is a list of the key sources of information used to inform the desk study:

- Geological maps and borehole logs available on British Geological Survey (BGS) Geoindex Website (2022);
- BGS Hydrogeological Map of Southern East Anglia (BGS,1981);
- The Physical Properties of Minor Aquifers in England and Wales (BGS, 2000);
- The Physical Properties on Major Aquifers in England and Wales (BGS, 1997);
- Department for Environment, Food and Rural Affairs (Defra) mapped information, via Magic.gov.uk (Defra, 2021c) for Source Protection Zones (SPZ), aquifer designations, hydrological features, groundwater vulnerability, drinking water safeguard zones and statutory designated sites;
- Licenced groundwater abstraction data provided by the Environment Agency (2020),

- Data on unlicenced private water supplies provide by relevant planning authorities (Babergh and Mid Suffolk District Council, 2021) (Braintree District, 2021); and
- Ground investigation undertaken by Catsurveys Group Limited (2013a; 2013b), Card Geotechnics Limited (2022) and Structural Soils Ltd (2022).

2. Existing Baseline

2.1 Geology and Ground Conditions

2.1.1 Details of the anticipated geology across the route are presented within ES Appendix 10.1: Geology Baseline and Preliminary Risk Assessment (**application document 6.3.10.1**).

2.2 Groundwater Bodies

2.2.1 The Order Limits traverse four Water Framework Directive groundwater bodies (Environment Agency, 2022), which are shown in Table 2.1 and included on ES Figure 9.2: Water Framework Directive Waterbody Status (**application document 6.4**). These are all classified by the Environment Agency (2022) as poor, either because of their poor chemical quality, due to exceedances of certain chemical compounds (in these cases due to rural land management practices), or because of detrimental change to the resource flow or quantity.

Table 2.1 – Groundwater Bodies Crossed by the Order Limits

Groundwater Body	Areas Encountered	Quantitative Class	Chemical Class	Overall Class
Waveney and East Suffolk Chalk and Crag	Present from Hintlesham to Bramford, underlying an overhead section of the project.	Poor	Poor	Poor
North Essex Chalk	River Stour valley, around Leavenheath, River Brett valley, and east of Hadleigh, crossed by overhead and underground cable section of the project.	Poor	Poor	Poor
Essex Gravels	Extensive areas between Twinstead and Hadleigh, including the valleys of the Rivers Stour, Box and Brett.	Good	Poor	Poor
North Essex Lower London Tertiaries	Narrow bands in the main river valleys and located within areas of overhead and underground cable sections.	Poor	Good	Poor

2.2.2 The hydrogeology is classified by the Environment Agency (Defra, 2022) as follows:

- Principal aquifers: Red Crag and underlying White Chalk subgroup;
- Secondary A aquifers: Thanet Formation and Lambeth Group (Undifferentiated), Thanet sands and Woolwich and Reading Formations; Alluvium, River Terrace Deposits and Glacial and Fluvial Sands and Gravels; and
- Unproductive strata: Lowestoft Formation and the London Clay Formation.

2.2.3 Details from the physical properties of minor aquifers (BGS, 2000) and major aquifers (BGS, 1997) indicate that the Red Crag is a complex aquifer with numerous clay and silt layers which strongly influence the permeability of the formation which can impede the vertical movement of water from one horizon to another. Groundwater flow within the Red

Crag is dominated by intergranular flow and pumping tests suggest that the Red Crag is consistently a productive aquifer.

2.2.4 The Chalk outcrops to the north of the study area in a broad band through Cambridgeshire and West Suffolk (BGS, 2000) and is noted to be highly variable and can change significantly over short distances. Groundwater flow within the Chalk is generally via solution fissures and fractures and the transmissivity is usually higher in river valleys where fissures are enhanced due to groundwater movement, than in the interfluve areas. The chalk matrix tends to have very limited permeability. Where the top part of the Chalk forms a chalk marl, this can restrict the vertical movement of groundwater between the Chalk and the overlying units.

2.2.5 The Fluvioglacial Sands and Gravels, Kesgrave Sands and Gravels and potentially the Red Crag Formation (at depth) are characterised as a confined aquifer in Section AB: Bramford Substation/Hintlesham and the western areas of Section C: Brett Valley due to the overlying clay-rich superficial deposits.

2.2.6 The underlying London Clay and (where clay beds persist laterally within them) the Woolwich and Reading beds, can act as an aquiclude, restricting the downwards migration of shallow groundwater (and mobile contaminants, if present) to deeper groundwater resources.

2.2.7 The regional flow direction within the Chalk aquifer is broadly towards the southeast, away from the outcrop area (BGS, 1981). There is a significant inflection in the piezometric surface under the River Stour valley and smaller inflections under the Rivers Box and Brett valleys. It is likely that there are upwards gradients and potentially flows from the Chalk into the superficial strata within these valleys. In the case of the River Stour which has incised down into the Chalk, through the superficial deposits, there may be discharges from the Chalk to the River.

2.2.8 At the River Stour the piezometric surface within the Chalk is approximately 18m Above Ordnance Datum (AOD), which is similar to ground level at the crossing point.

2.3 Groundwater Vulnerability

2.3.1 Groundwater vulnerability is mapped as low or medium across much of the study area (Defra, 2022), where superficial deposits are clayey or are underlain by London Clay. In some areas this rises to medium-high, where clay cover is thin or absent. These include the Stour Valley and an area immediately east of it, a narrow strip in the valley of the River Box, the area north of Polstead, and the Brett Valley, which also includes a narrow strip of high vulnerability groundwater where the Lambeth Group is exposed.

2.3.2 The Order Limits are located within a groundwater SPZ 3 and they also cross two SPZ 2, in the Brett Valley near Upper Layham and in the Stour Valley near Lamarsh. These are shown on ES Figure 10.4: Hydrogeology (**application document 6.4**). The Order Limits also fall within a SPZ 1 within Section C: Brett Valley and Section G: Stour Valley. However, the SPZ1 is in a location of a temporary access route where no penetrative works are anticipated other than soil stripping for the route.

2.3.3 The Order Limits do not fall within a Drinking Water Safeguard zone for groundwater.

2.4 Groundwater Strikes and Depths

2.4.1 Ground investigation has been undertaken for the project in 2013 by Catsurveys Group Limited (2013a; 2013b) within Section E: Dedham Vale Area of Outstanding Natural Beauty (AONB), Section F: Leavenheath/Assington and Section G: Stour Valley. Further ground investigation was undertaken in 2021 within Section AB: Bramford Substation/ Hintlesham, Section D: Polstead, Section E: Dedham Vale AONB, Section F: Leavenheath/Assington and Section G: Stour Valley (Card Geotechnics Limited, 2021).

2.4.2 Ground investigation has also been undertaken at the grid supply point (GSP) substation in 2021 (Jacobs, 2021). Further ground investigation was undertaken within Section G: Stour Valley in the area of the proposed trenchless crossings at the River Stour and Ansell's Grove in 2022 by Structural Soils Ltd (2022). At the time of writing, ground investigation had not been undertaken within Section C: Brett Valley. Further details of the ground investigation results can be found in ES Appendix 10.1: Geology Baseline and Preliminary Risk Assessment (**application document 6.3.10.1**).

2.4.3 Table 2.2 summarises groundwater encountered during the historical ground investigation (Catsurveys Group Limited, 2013a; 2013b; Card Geotechnics Limited, 2021). Groundwater was not encountered during drilling within the 2022 ground investigation (Structural Soils Ltd, 2022). The table gives the depth at which groundwater was struck, during drilling, and the standing depth after a period of 20 minutes had elapsed where this was available.

Table 2.2 – Groundwater Depths Encountered during Ground Investigation

Section	Location	Groundwater Depth Strike (m below ground level (bgl))	Groundwater Standing Depth (m bgl)
Section AB: Bramford Substation/Hintlesham	RB017	11.80	11.20
Section D: Polstead	Western end of the Section	4.4 – 14.6	3.7 - 13.8
Section E: Dedham Vale AONB	River Box west bank	1.9 - 15	1.2 - 3
	River Box east bank	1.3 – 9.4	0.8 – 8.3
	Approximately 70m from River Box	12.8	3.0
	Away from River Box (Dollops Wood Area in area of Overhead Line Removal)	2.0 - 16.7	0.8 - 15.8
Section F: Leavenheath/ Assington	East of the Section around the cable sealing end (CSE) substation	4.7 – 12.5	3.9 – 11.2
Section G: Stour Valley	In the Vicinity of the River Stour and Sudbury Branch Railway Line	1.0 – 13.6	0.9 – 6.7
	West of Section, around Ansell's Grove	5.0 – 11.8	2.3 – 10.3

2.4.4 Table 2.2 shows that in sections where undergrounding is required (Section E: Dedham Vale AONB and Section G: Stour Valley), the average opencut trench depth of approximately 1.1m is unlikely to intercept groundwater. The exceptions to this are in the vicinity of the River Box, River Stour and the Sudbury Branch Railway Line where the groundwater has been identified at depths less than 1.1m bgl.

2.4.5 Groundwater level monitoring following installation of groundwater monitoring wells was undertaken during the 2022 ground investigation by Structural Soils (2022). Table 2.3 shows the results of the monitoring information. Groundwater monitoring at the River Stour was undertaken on four occasions in four locations and groundwater monitoring at Ansell's Grove was undertaken on four occasions in two locations.

Table 2.3 – Groundwater Monitoring Undertaken at Trenchless Crossing Locations

Location of Trenchless Crossing	Water Depth (m bgl)	Water Elevation (m AOD)
River Stour	0.57 – 5.69	18.5 – 13.35
Ansell's Grove	0.27 – 4.63	42.49 – 39.15

2.4.6 Four trenchless crossings are proposed on the project, as described in ES Chapter 4: Project Description (**application document 6.2.4**). For the purposes of the ES, it is assumed that the trenchless crossings would be constructed using horizontal directional drilling (HDD) which would not require dewatering itself. However, the launch and reception pits may intercept groundwater and therefore further assessment has been undertaken to assess the effects of this in Chapter 3 of this appendix at these locations.

2.4.7 The groundwater level was also identified as being at potentially less than 1.1m bgl at Dollops Wood which is a location where the 132kV overhead line would be removed. Therefore, groundwater is unlikely to be intercepted during these construction works.

2.5 Groundwater Dependent Terrestrial Ecosystems

2.5.1 A list of GWDTE that have been identified within the wider study area and their locations and groundwater dependency score can be found in ES Appendix 7.1: Habitats Baseline Report (**application document 6.3.7.1**). All GWDTE were identified as having a Low or Moderate groundwater dependency.

2.6 Groundwater Abstractions

Licences and Deregulated Groundwater Abstractions

2.6.1 Data describing licenced groundwater abstractions and deregulated groundwater abstractions have been provided by the Environment Agency in response to a data request (received March 2021).

2.6.2 Table 2.4 identifies the licensed groundwater abstractions and Table 2.5 identifies deregulated groundwater abstractions within the study area (Environment Agency, 2021), the locations of which are also shown on ES Figure 10.4: Hydrogeology (**application document 6.4**).

Table 2.4 – Licenced Groundwater Abstractions within the Study Area

Licence Number	Point Name	Purpose and Use	Licenced Quantity (m^3)	Aquifer
7/35/09/*G/0031	Well – Fen Farm, Burstall	Agriculture – Fish Farm/Cress Pond Throughflow	12,700	Glacial Sands/Gravels
7/35/09/*G/0029	Seepage Res Hillside Nurseries	Agriculture – Spray Irrigation Direct	2,300	Glacial Sands/Gravels
7/35/09/*G/0030	Bore at Hintlesham Hall	Agriculture – Spray Irrigation Direct	10,000	Chalk
8/36/19/*G/0081	Chartwell Nurseries, Hintlesham	Agriculture – Spray Irrigation Direct	2,300	Glacial Sands/Gravels
8/36/16/*G/0043	Borehole Hill Farm, Boxford	Industrial, Commercial and Public Services – Water Bottling, Process Water, General Washing/Process Washing	20,430	Chalk
8/36/16/*G/0007	Borehole Hill Farm, Boxford	Agriculture – General Farming & Domestic	2,270	Chalk
8/36/15/*G/0104	Honey Tye FM, Boxford	Agriculture – Spray Irrigation Direct, General Farming & Domestic	9,090	Chalk
8/36/15/*G/0143	Willow Tree Farm, Assington	Agriculture – Spray Irrigation Direct	9,200	Glacial Sands/Gravels
8/36/15/*G/0126	Dawes Hall, Lamarsh	Amenity – Make-up or Top Up Water	33,000	Fluvial Sands/Gravels
8/36/15/*G/0047	King's Farm, Pebmarsh	Agriculture – General Farming & Domestic	14,547	Chalk

Table 2.5 – Deregulated Groundwater Abstractions within the Study Area

Licence Number	Location	Borehole/Well	Purpose and Use
7/35/*G/0021	Bore at Brook Fm, Flowton	Borehole	Agriculture – General Farming & Domestic
7/38/08/*G/0209	Borehole at Burstall Hall Farm	Borehole	Agriculture – General Farming & Domestic
7/35/08/*G/0153	Bore at White House FM, Burst'l	Borehole	Agriculture – General Farming & Domestic
7/35/09/*G/0007	Bore at Hill Fm, Hintlesham	Borehole	Agriculture – General Farming & Domestic
7/35/09/*G/0012	Well of Hintlesham Priory	Well	Agriculture – General Farming & Domestic
8/36/19/*G/0040	Vauxhall, GT, Wenham	Borehole	Agriculture – General Farming & Domestic
8/36/17/*G/0101	Well at Holbecks, Hadleigh	Well	Agriculture – General Farming & Domestic

Licence Number	Location	Borehole/Well	Purpose and Use
8/36/17/*G/0037	Hill Farm, Hadleigh	Borehole	Agriculture – General Farming & Domestic
8/36/17/*G/0015	Waterhouse Farm, Layham	Borehole	Agriculture – General Farming & Domestic
8/36/17/*G/0028	Netherbury Hall, Layham	Borehole	Agriculture – General Farming & Domestic
8/36/17/*G/0003	Wyncoll's Farm, Layham	Borehole	Agriculture – General Farming & Domestic
8/36/16/*G/0017	The Bower Close, Nr Polstead	Borehole	Agriculture – General Farming & Domestic
8/36/16/*G/0018	High Trees, Polstead	Borehole	Agriculture – General Farming & Domestic
8/36/16/*G/0010	Newhouse Farm, Polstead	Borehole	Agriculture – General Farming & Domestic
8/36/16/*G/0003	Peyton Hall, Boxford	Borehole	Agriculture – General Farming & Domestic
8/36/16/*G/0008	Assington Hse Fm, Assington	Borehole	Agriculture – General Farming & Domestic
8/36/15/*G/0161	Well at Little Cornard	Well	Agriculture – General Farming & Domestic
8/36/15/*G/0006	Grove Farm, Gt, Henny	Well	Agriculture – General Farming & Domestic
8/36/16/*G/0096	Grove Farm, Gt, Henny	Well	Agriculture – General Farming & Domestic
8/36/15/*G/0112	Boutells Farm, Lamarsh	Borehole	Agriculture – General Farming & Domestic
8/36/15/*G/0048	The Valley Farm, Lamarsh	Borehole	Agriculture – General Farming & Domestic
8/36/15/*G/0063	Hill Farm, Twinstead	Borehole	Agriculture – General Farming & Domestic
8/36/15/*G/0024	Tymperley Farm, Gt, Henny	Borehole	Agriculture – General Farming & Domestic
8/36/15/*G/0025	Lower Goulds Fm, Alphanstone	Borehole	Agriculture – General Farming & Domestic
8/36/16/*G/0015	Well at Gentry's Farm, Lt, Henny, Sudbury	Well	Agriculture – General Farming & Domestic
8/36/15/*G/0001	Weel, Pelham Hall Est, Twinstead	Well	Agriculture – General Farming & Domestic
8/36/15/*G/0016	Old Roses Farm, Twinstead	Borehole	Agriculture – General Farming & Domestic

2.6.3 No groundwater abstractions or deregulated groundwater abstractions have been identified within the Order Limits.

Private Water Supplies

2.6.4 Data describing private water supplies has been provided by the relevant planning authorities in response to a data request (Babergh and Mid Suffolk District Council, 2021 and Braintree District Council, 2021). The information received is presented in Tables 2.6 and 2.7 and the locations presented on ES Figure 10.4: Hydrogeology (**application document 6.4**). No private water supplies have been identified within the Order Limits.

Table 2.6 – Babergh and Mid Suffolk District Council Private Water Supplies within Study Area

Reference	Address	Water Source	Class of Supply
PW/000000017	Rotormotive Ltd, Hill Farm, Burstall Lane, Sproughton, Ipswich, IP8 3DJ	SPR3	Single Domestic Dwelling
PW/000000199	The Firs, Church Land, Copdock and Washbrook, Ipswich, Suffolk, IP8 3HG	WAS1	Small Supply
PW/000000013	The Lindens, Church Land, Copdock and Washbrook, Ipswich, Suffolk, IP8 3HG	WAS11	Single Domestic Dwelling
PW/000000033	Mill Farm Cottage, Priory Road, Hintlesham, Ipswich, Suffolk, IP8 3NX	BUR3	Small Supply
PW/000000268	The Lost Garden Retreat, Camp Site at Home Wood, Hintlesham Hall Park, George Street, Hintlesham, Ipswich, Suffolk	-	Large Domestic Supply
PW/000000010	Doves Cottage, Mill Lane, Chattisham, Ipswich, Suffolk, IP8 3PX	CHA4	Single Domestic Dwelling
PW/000000049	Chattisham Hall, Mill Lane, Chattisham, Ipswich, Suffolk, IP8 3PX	CHA1	Single Domestic Dwelling
PW/000000242	The Suffolk Escape, Northlands Farm, Priory Road, Hintlesham, Ipswich, Suffolk, IP8 3NX	-	Large Commercial Supply
PW/000000029	Ramsey Farm, Pond Hall Road, Hadleigh, Ipswich, Suffolk, IP7 5PR	HAD22	Single Domestic Dwelling
PW/000000047	JR Smith & Co, Kates Hill Farm, Pond Hall Road, Hadleigh, Ipswich, Suffolk, IP7 5PP	HAD13	Single Domestic Dwelling
PW/000000063	Hill Farm, Overbury Hall Road, Layham, Ipswich, Suffolk, IP7 5RR	Lay11	Single Domestic Dwelling
PW/000000151	Layham Lodge, Rands Road, Layham, Ipswich, Suffolk, IP7 5RW	Lay12	Singe Domestic Dwelling
PW/000000179	Wyncolls Farm, Wyncolls Lane, Layham, Ipswitch, Suffolk, IP7 5RJ	Lay14	Large/commercial supply
PW/000000178	Ivy Tree Farm, Polstead Road, Shelley, Ipswich, Suffolk, IP7 5RE	SHE1	Large/ Commercial Supply
PW/000000105	High Trees Farm, Holt Road, Polstead, Colchester, Essex, CO6 5BU	POL5	Small Supply
PW/000000097	Peyton Hall, Stone Street, Boxford, Sudbury, Suffolk, CO10 5NS	BOF1	Single Domestic Dwelling

Reference	Address	Water Source	Class of Supply
PW/000000094	Konings Juices and Drinks Limited, Walkers Snacks Foods Ltd, Hill Farm, Brick Kiln Hill, Polstead, Colchester, Essex, CO10 5NY	BOF4	Large/ commercial supply
PW/000000118	Hullbacks Farm, Dead Lane, Nayland with Wissington, Colchester, Essex, CO6 4LY	NAY6	Single Domestic Dwelling
PW/000000103	Sawyers Farm, Slough Lane, Bures St Mary, Colchester, Suffolk CO10 ONY	BSM2	Single Domestic Dwelling

Table 2.7 – Braintree District Council Private Water Supplies (Groundwater) within the Study Area

Eastings	Northings	Point Name	Type
589602	235340	-	Well
588037	236759	Valley Farm	Borehole
588016	237542	Grove Farm	Borehole
587891	232496	Caldecott	Spring
587322	235840	Ansell's Farm	Well
587169	235691	Moorcot	Well
587340	234192	Lower Gaulds Farm	Borehole
586876	234863	Abbots	Well
586876	234863	Applecroft	Well
586575	235511	Cobbs Farm	Well
586317	238356	Ryes Farm	Well
586300	233961	Le Mote Hall	Well
585767	234590	Matson Lodge	Well
585132	236514	Pelham Hall Farm	Well
584586	235053	Ivycombe	Well
584256	234799	Collins Farm	Borehole
583674	237401	Butlers Hall	Borehole
583283	237094	Bullocks Hall	Well

3. Groundwater Risk Assessment

3.1 Methodology

3.1.1 The risk assessment for groundwater has been based on standard industry guidance provided within the Construction Industry Research and Information Association (CIRIA) report C552, Contaminated Land Risk Assessment (CIRIA, 2001). To determine the risk to the identified receptor, both the probability (see Table 3.1) and the degree of harm to a potential receptor (consequence – see Table 3.2) are used and the risk estimated using the matrix in Table 3.3. The risk classifications are defined in Table 3.4.

Table 3.1 – Classification of Probability (Based on CIRIA, 2001)

Classification	Definition
High likelihood	There is a pollution linkage and an event either appears very likely in the short-term and almost inevitable over the long-term, or there is already evidence at the receptor of harm / pollution.
Likely	There is a pollution linkage, and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place and is less likely in the shorter-term.
Unlikely	There is a pollution linkage, but circumstances are such that it is improbable that an event would occur even in the very long-term.

Table 3.2 – Classification of Consequence (Based on CIRIA, 2001)

Classification	Examples
Severe	Controlled water effect - short-term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. Equivalent to Environment Agency Category 1 incident (persistent and/or extensive effects on water quality leading to closure of potable abstraction point or loss of amenity, agriculture or commercial value. Major fish kill. Ecological effect - short-term exposure likely to result in a substantial adverse effect.
Medium	Controlled water effect - equivalent to Environment Agency Category 2 incident requiring notification of abstractor Ecological effect - short-term exposure may result in a substantial adverse effect
Mild	Controlled water effect - equivalent to Environment Agency Category 3 incident (short lived and/or minimal effects on water quality) Ecological effect - unlikely to result in a substantial adverse effect
Minor	Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems.

Table 3.3 – Classification of Risk (Based on CIRIA, 2001)

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very High	High	Moderate	Low
	Likely	High	Moderate	Moderate	Low
	Low Likelihood	Moderate	Moderate	Low	Very low
	Unlikely	Low	Low	Very low	Very low

Table 3.4 – Risk Rating Definitions (Based on CIRIA, 2001)

Risk Classification	Description
Very high	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability.
High	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild.
Low	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very low	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

3.2 Overhead Line

3.2.1 Dewatering and discharges are not expected to be required within the overhead lines sections therefore there is not expected to be a risk to changes in groundwater levels or flow pathways. The small overall footprint of the pylon base (approximately 10m by 10m) and potential piles means there is likely to be negligible risk to sensitive receptors.

3.2.2 Ground disturbance during construction could create new groundwater flow pathways, where permeable materials or flow routes are introduced through piling or through permeable backfill material, allowing movement of existing contamination or mixing of aquifers. However, as shown in ES Appendix 10.1: Geology Baseline and Preliminary Risk Assessment (**application document 6.3.10.1**) a worst case, low risk of contamination is expected within the Order Limits. Therefore, there is considered to be a very low risk of mobilising any contamination through ground disturbance.

3.2.3 Good practice measure GH06 in the Code of Construction Practice (CoCP) (**application document 7.5.1**) requires an assessment to be undertaken at all locations where piling is proposed, and therefore risks associated with creation of new flow/contamination pathways are expected to be very low.

3.2.4 Effects on infiltration and recharge of groundwater may arise if the permeability of the ground surfaces is changed. However, the project only requires small areas of new hardstanding, and these would be designed to meet existing drainage standards as provided for in good practice measure W12 in the CoCP (**application document 7.5.1**). The small overall footprint of the pylon bases (potentially constructed using piles) means there is likely to be no change on infiltration and recharge, and very low risk to waterbodies supported by groundwater recharge, or groundwater flow pathways.

3.3 Underground Cables (Opencut Method)

3.3.1 Groundwater levels are expected to be below the base of the opencut trenches such that no dewatering or discharges (that would have the potential to reduce the groundwater level or affect flows) would be required during construction of these areas. Therefore, there would be no risk to sensitive receptors that could be affected by changes to groundwater flow or levels.

3.3.2 Ground disturbance during construction could create new groundwater flow pathways, where permeable materials or flow routes are introduced through trenches or through permeable backfill material, allowing movement of existing contamination or mixing of aquifers. However, as shown in ES Appendix 10.1: Geology Baseline and Preliminary Risk Assessment (**application document 6.3.10.1**) a worst case, low risk of contamination is expected within the Order Limits, therefore there is considered to be a low risk of mobilising any contamination through ground disturbance. In addition, the opencut trench depth would be above groundwater levels and therefore the risk of mixing aquifers is expected to be very low.

3.4 Underground Cables (Trenchless Crossings)

Introduction

3.4.1 Four trenchless crossings are proposed on the project, as described in ES Chapter 4: Project Description (**application document 6.2.4**). These comprise a crossing underneath the River Box, two adjacent trenchless crossings to install the underground cables beneath the River Stour and Sudbury Branch Railway Line and a further trenchless crossing to avoid habitats to the south of Ansell's Grove. For the purposes of the ES, it is assumed that the trenchless crossings would be constructed using HDD.

River Box

Description

3.4.2 The assessment assumes that the trenchless crossing underneath the River Box would be drilled in one section and that the drill section would be approximately 100m long. It is assumed that the HDD would reach a depth of up to 6m bgl, and the launch and reception pits would be approximately 1.2m deep.

3.4.3 The HDD technique does not require dewatering itself, however there is the potential for dewatering to be required at the launch and reception pits either side of the River Box, depending on groundwater levels

Baseline

3.4.4 The BGS geological mapping indicates that the Thanet Formation and Lambeth Group (Undifferentiated) is present underlying the superficial deposits. The superficial deposits comprise Alluvium overlying Head Deposits.

3.4.5 During the 2013 (Catsurveys Group Limited, 2013a; 2013b) and 2021 (Card Geotechnics, 2021) ground investigation works, boreholes were undertaken within the vicinity of the River Box and generally confirmed the anticipated geological profile. Details of the geology encountered within the boreholes in the route of the trenchless crossing are presented in Table 3.5 and shown on ES Figure 10.5: Cross Section of the River Box (**application document 6.4**).

Table 3.5 – Encountered Geology within River Stour Trenchless Crossing Route

Geological Unit	Brief Description	Depth to Base (m bgl)	Thickness (m)
Topsoil	Firm brown sandy silty CLAY	0.2 to 0.6	0.2 to 0.6
Superficial Deposits	Granular: Loose grey to orange fine to medium SAND and subrounded GRAVEL.	3.1 to 8.3	3.1 to 8.3
	Cohesive: Soft green, grey SILT with layers of PEAT up to 0.5m thick		
Bedrock	Firm to stiff brown silty CLAY with occasional layers of sand.	>14.0	>10.7

3.4.6 Groundwater, as shown in Table 2.2, was encountered within the vicinity of the River Box crossing between 1.3m and 12.8m bgl, with the standing depth, following a period of 20 minutes between 0.8m and 8.3m bgl.

3.4.7 The aquifer designation mapping indicates that the crossing spans Secondary A aquifers (Alluvium and the Thanet Formation, and Lambeth Group (Undifferentiated)).

Assessment

3.4.8 Historical ground investigation confirms that shallow groundwater is likely to be present, and therefore the water table is likely to be intercepted during construction of the trenchless crossings. HDD methods do not require dewatering to facilitate installation, with the exception of the launch/reception pit. Therefore, dewatering may be required at the launch/receptor pits which could impact groundwater levels.

3.4.9 The superficial deposits and bedrock predominantly comprise cohesive clay layers, interbedded with granular layers. The clay layers would act as a barrier to flow between the granular layers, and low permeability riverbed material in the bed of the River Box would also act to prevent any potential contamination from impacting the river.

3.4.10 ES Figure 10.5: Cross Section of the River Box (**application document 6.4**) indicates that with an installation depth of 6.5m bgl, the cables are anticipated to be constructed mainly within the bedrock, but may also intercept the superficial strata in some locations.

3.4.11 Dewatering may be required at the launch and reception pits that are required to facilitate the drilling of the HDD. The dewatering is likely to exceed 100 days, however groundwater abstractions have not been identified within 500m of the potential dewatering locations and therefore a radius of influence for dewatering has not been calculated. In addition, Bushy Park Wood County Wildlife Site was identified as being a potential GWDTE, but as the groundwater dependency has been assessed by ES Appendix 7.1: Habitats Baseline Report (**application document 6.3.7.1**) as 3, Low and not groundwater dependent, further dewatering assessment has not been undertaken.

3.4.12 Ground disturbance during construction could create new groundwater flow pathways, where permeable materials or flow routes are introduced through piling, drilling, or through permeable backfill material allowing movement of existing contamination or mixing of aquifers. However, as shown from ES Appendix 10.1: Geology Baseline and Preliminary Risk Assessment (**application document 6.3.10.1**) a worst case, low risk of contamination is expected within the Order Limits, therefore there is considered to be a very low risk of mobilising any contamination through ground disturbance during trenchless crossing construction.

3.4.13 Assuming an HDD technique, the cable is also likely to be sealed with bentonite during drilling therefore new flow pathways are unlikely to be formed and aquifer mixing would not occur. In addition, in accordance with good practice measure GH07 in the CoCP (**application document 7.5.1**), if the construction method proposes the use of bentonite or other drilling agents, then an assessment of the potential risk would be undertaken once detailed design and construction techniques are finalised, and prior to construction commencing. Where the assessment identifies an unacceptable risk to groundwater or surface water quality, then alternative methods and/or additives shall be proposed, assessed and used. The hydrogeological risk assessment would be submitted to the Environment Agency for information prior to construction.

3.4.14 Following installation, a large portion of the underground cable would lie below the water table at this crossing. The cross-sectional area of the trenchless HDD crossings would be small and is therefore considered to have a very low risk to impeding groundwater flow.

River Stour and Sudbury Branch Railway Line

Description

3.4.15 The trenchless crossings at this location are anticipated to be as follows:

- Eastern crossing section – This would be drilled within the floodplain between the River Stour and the railway line, where the launch/reception pit would be located, to the eastern side of the B1508 where another launch/reception pit would be located. This drill section would be approximately 525m long and would go underneath the River Stour and the B1508 reaching a depth of approximately 6m bgl; and
- Western crossing section – This would be located underneath the Sudbury Branch Railway Line and Henny Road. The eastern launch/reception pit would be located adjacent to the western section launch/reception pit for the eastern crossing, located between the River Stour and the Sudbury Branch Railway Line. The western launch/reception pit would be located to the western side of Henny Road. This drill section would be approximately 415m long and reach a depth of approximately 6m bgl.

3.4.16 The launch/reception pits are anticipated to be approximately 1.2m deep and the locations of these are shown on ES Figure 10.6: Cross Section of the River Stour and Sudbury Branch Railway Line (**application document 6.4**). The HDD technique does not require dewatering itself, however there is the potential for dewatering to be required at the launch and reception pits located between the River Stour and the railway, dependent on groundwater levels.

Baseline

3.4.17 The BGS geological mapping indicates that the Lewes Nodular Chalk Formation and Seaford Chalk Formation (undifferentiated) is present, underlying the superficial deposits, at the base of the River Stour.

3.4.18 The BGS geological mapping indicates that the superficial deposits comprise Alluvium, overlying River Terrace Deposits.

3.4.19 At the edges of the river valley, in the location of the B1508, superficial Head Deposits can be found which overly the Lambeth Group.

3.4.20 During the 2013 ground investigation works, boreholes were undertaken within the vicinity of the River Stour and generally confirmed the anticipated geological profile. Additional ground investigation was undertaken at this location in 2022 and further confirms the anticipated ground conditions. Details of the geology encountered within the boreholes in the route of the trenchless crossing are presented in Table 3.6. A cross section has been undertaken for this crossing and is presented on ES Figure 10.6: Cross Section of the River Stour and Sudbury Branch Railway Line (**application document 6.4**).

Table 3.6 – Encountered Geology within River Stour and Sudbury Branch Railway Line Trenchless Crossing Route

Geological Unit	Brief Description	Depth to Base (m bgl)	Thickness (m)
Topsoil	Firm to stiff brown topsoil	0.3 - 0.4	0.3 - 0.4
Superficial deposits	Clay/Silt: Soft grey clayey SILT or silty CLAY with beds of Peat described as very soft, fibrous to amorphous clayey or silty Peat up to 2.65m thick.	5.5 – 12.4	5.1 – 10.8
	Sand/Gravel: Loose to medium dense orangish brown fine to medium gravelly, silty, clayey SAND		
Chalk	Structureless Chalk described as very soft sandy gravelly SILT or Weak to moderately strong white CHALK as fine to medium angular gravel in a putty chalk matrix (Structureless Chalk) OR Moderately strong, white fractured CHALK recovered as fine to medium angular chalk gravel. (Structured Chalk)	>20.0	>10.0 - >17.0

3.4.21 At the eastern most point of the HDD crossing, within the valley sides, the bedrock, likely of the Lambeth Group and Thanet Sands was encountered, underlying the superficial deposits.

3.4.22 Groundwater, as shown in Table 2.2, was encountered within the vicinity of the River Stour and Sudbury Branch Railway Line between 1.0m and 13.6m bgl, with the standing depth following a period of 20 minutes recorded between 0.9m and 6.7m bgl. Groundwater level monitoring undertaken during the 2022 ground investigation (presented in Table 2.3) indicated a variable groundwater depth between 0.57m and

5.69m bgl. From the exploratory hole records, groundwater was often encountered at the interface between the clay/silt and more granular sand/gravel superficial materials, or at the top of the Chalk, and in some instance was confined by overlying clay/silt rich layers.

3.4.23 The aquifer designation mapping indicates that the crossing spans a Secondary A aquifer (River Terrace Gravels, Alluvium and Lambeth Group) and Secondary Undifferenced aquifer (Head Deposits), with the Chalk bedrock classified as a Principal Aquifer.

Assessment

3.4.24 Ground investigation confirms that shallow groundwater is likely to be present in the area of this trenchless crossing, and therefore the water table is likely to be intercepted during construction. HDD methods do not require dewatering to facilitate installation, with the exception of the launch/reception pit. Therefore, dewatering may be required at the launch/receptor pits which could impact groundwater levels.

3.4.25 During periods of heavy rainfall and associated high groundwater levels, groundwater may be present at shallower depths at the launch/reception pits located between the River Stour and the railway line than encountered during the ground investigations. Therefore, dewatering may be required at this location. The far eastern and western launch/reception pits are at higher elevations (as shown on ES Figure 10.6: Cross Section of the River Stour and Sudbury Branch Railway Line (**application document 6.4**)), above anticipated groundwater levels, and therefore unlikely to encounter groundwater when excavated and dewatering is considered unlikely.

3.4.26 The Chalk and superficial deposits are likely to be in hydrogeological continuity with each other as there is no lower permeability material separating them. However, where chalk marl (structureless chalk) is present this may act as a barrier to vertical flow between the structured chalk and the superficial deposits.

3.4.27 The Chalk hydrogeological map shows the Chalk piezometric surface contours which are based on data from 1976. This map shows an upwards hydraulic gradient from the Chalk, showing that the River Stour valley and Sudbury Branch Railway Line are within a Chalk groundwater discharge zone. The map shows the Chalk piezometric surface is at 18m AOD, which is higher than the depth to which the cables would be installed.

3.4.28 ES Figure 10.6: Cross Section of the River Stour and Sudbury Branch Railway Line (**application document 6.4**) indicates that with an installation depth of 6m bgl, the cables would mostly intercept the superficial deposits. The depth to the Chalk was found to be extremely variable during the ground investigation and therefore there is the potential for the Chalk to be intercepted by the cable route at some discrete locations. The exploratory hole records indicate that there is a zone of Chalk marl present, over the structured chalk, and therefore where the cables may intercept the Chalk, it is likely to be within this lower permeability zone.

3.4.29 The presence of chalk marl and upwards hydraulic gradients would act to limit any potential contamination introduced by the cable installation from impacting on the Chalk aquifer.

3.4.30 In addition, at this location, ground investigation indicates a layer of lower permeability clay/silt rich material (superficial deposits), overlying and, in places, confining the sand/gravel rich granular material (superficial deposits) and the Chalk. The presence of this clay/silt rich material and, where present, low permeability riverbed material in the bed of the River Stour would act to prevent any potential contamination from impacting the river.

3.4.31 Dewatering may be required at the launch and reception pits located between the River Stour and the railway line. This dewatering is also likely to exceed 100 days and a groundwater abstraction has been identified within 500m of the potential dewatering location. Therefore, to assess the potential effects of any dewatering, the radius of influence for dewatering has been calculated.

3.4.32 For the calculation, the hydraulic conductivity of silty sand has been used within the calculation, as described by Freeze and Cherry (1979), which quotes a hydraulic conductivity of between 10^{-7}m/s and 10^{-3}m/s. As a sensitivity test the median of 10^{-5}m/s as well as the highest and lowest extents published have been selected.

3.4.33 The expected maximum groundwater level has been assumed to be at ground level, which is considered an absolute worst-case situation. This means that the drawdown of the groundwater level, in this situation, would be 1.2m which is the maximum anticipated depth of the pits. A conservative depth of 2m has been used in the assessment below to allow for any variations within the launch/reception pit depths.

3.4.34 Table 3.7 presents the inputs and results of the radius of influence calculations.

Table 3.7 – Input and Results for Calculating the Radius of Influence at the River Stour Trenchless Crossing

Parameter	Highest Hydraulic Conductivity	Median Hydraulic Conductivity	Lowest Hydraulic Conductivity
Expected groundwater level (m bgl)	0	0	0
Hydraulic Conductivity, K, (m/s)	1×10^{-7}	1×10^{-5}	1×10^{-3}
Drawdown, s (m)	2	2	2
Factor, C	2000	2000	2000
Total radius of influence, R_0 (m)	**1.26**	**12.65**	**126.49**

3.4.35 The nearest receptor is a licenced groundwater abstraction (licence number 8/36/15/*G/0126) located approximately 460m to the northwest of the launch/reception pit, which abstracts water from the fluvial sands/gravels. As the total radius of influence, even on the most conservative hydraulic conductivity (and using worst case groundwater levels and pit depths), is significantly less than the distance from the pit to the receptor, there is unlikely to be any risk to the groundwater abstraction identified.

3.4.36 Ground disturbance during construction could create new groundwater flow pathways, where permeable materials or flow routes are introduced through piling, drilling, or through permeable backfill material allowing movement of existing contamination or mixing of aquifers. However, as shown from ES Appendix 10.1: Geology Baseline and Preliminary Risk Assessment (**application document 6.3.10.1**) a worst case, low risk of contamination is expected within the Order Limits, therefore there is considered to be a very low risk of mobilising any contamination through ground disturbance.

3.4.37 Assuming an HDD technique, the cable is also likely to be sealed with bentonite during drilling therefore new flow pathways are unlikely to be formed and aquifer mixing would not occur. In addition, in accordance with good practice measure GH07 in the CoCP (**application document 7.5.1**), if the construction method proposes the use of bentonite or other drilling agents, then an assessment of the potential risk would be undertaken once detailed design and construction techniques are finalised, and prior to construction commencing. Where the assessment identifies an unacceptable risk to groundwater or surface water quality, then alternative methods and/or additives shall be proposed, assessed and used. The hydrogeological risk assessment would be submitted to the Environment Agency for information prior to construction.

3.4.38 Following installation, a large portion of the underground cable would lie below the water table at this crossing. The cross-sectional area of the trenchless HDD crossings would be small and is therefore considered to have a very low risk to impeding groundwater flow.

South of Ansell's Grove

Description

3.4.39 The assessment assumes that the trenchless crossing to the south of Ansell's would be drilled in one section. The drill section would be approximately 600m long reaching a depth of approximately 6m bgl. The launch and reception pits for the HDD would be approximately 1.2m deep.

3.4.40 The HDD technique does not require dewatering itself and the groundwater in this area is unlikely to be intercepted by the launch and reception pits and therefore dewatering is unlikely to be required to facilitate the excavation of the pits.

Baseline

3.4.41 The BGS geological mapping indicates that the London Clay Formation is present underlying the superficial deposits. The superficial deposits comprise the Lowestoft Formation and the Kesgrave Catchment Subgroup. In parts of the area the superficial deposits are also shown to be absent.

3.4.42 The Lambeth Group and White Chalk Subgroup are anticipated to be underlying the London Clay Formation.

3.4.43 During the 2013 ground investigation works, boreholes were undertaken within the vicinity of the trenchless crossing and confirmed the geological profile identified from the geological mapping. Additional ground investigation was undertaken at this location in 2022 to further confirm the anticipated ground conditions. Details of the geology encountered within the boreholes in close proximity to the route of the trenchless crossing are presented in Table 3.8. A cross section is presented for this crossing location and is shown on ES Figure 10.7: Cross Section to the South of Ansell's Grove (**application document 6.4**).

Table 3.8 – Encountered Geology Close to Ansell's Grove

Geological Unit	Brief Description	Depth to Base (m bgl)	Thickness (m)
Topsoil	Soft brown sandy silt.	0.25 – 0.3	0.25 – 0.3

Geological Unit	Brief Description	Depth to Base (m bgl)	Thickness (m)
Superficial deposits	Clay/silt: Soft to firm brown sandy silt/clay with occasional medium subrounded gravel and sand partings.	6.4 – 10.7	4.95 – 10.45
	Sand/gravel: Loose to very dense orange, brown silty fine to medium SAND and subrounded to subangular GRAVEL of flint.		
London Clay Formation	Firm to very stiff blue grey sandy silt/clay.	>10.5 – >20.0	>4.1 – >9.3

3.4.44 Groundwater, as shown in Table 2.2, was encountered within the vicinity of Ansell's Grove between 5.0m and 11.8m bgl, with the standing depth, following a period of 20 minutes, found to be between 2.3m and 10.3m bgl. Groundwater level monitoring undertaken during the 2022 ground investigation (shown in Table 2.3) indicated a variable groundwater depth between 0.27m and 4.63m bgl. However, this monitoring was undertaken at the eastern end of the proposed trenchless crossing which is at a much lower elevation than the western end and may not therefore be representative of the groundwater levels in the whole crossing. Groundwater was not encountered along the western end of the trenchless crossing during drilling. From the exploratory hole records, it can be seen that the groundwater was encountered within granular material in multiple strata.

3.4.45 The aquifer designation mapping indicates that the crossing is located within a Secondary A aquifer (Kesgrave Catchment Subgroup, Unproductive strata (Lowestoft Formation and London Clay Formation) and Principal Aquifer (White Chalk Subgroup).

Assessment

3.4.46 Ground investigation suggests that the groundwater could be intercepted by this trenchless crossing in some areas. HDD methods do not require dewatering to facilitate installation, with the exception of the launch/reception pit. Therefore, dewatering may be required at the launch/receptor pits which could impact groundwater levels. It is considered, based on the data available, that groundwater is likely to be intercepted at the eastern end of the crossing and therefore dewatering of the proposed launch/reception pits may be required. Groundwater was not encountered in the location of the western launch/reception pits and therefore it is considered that dewatering is unlikely to be required at this location.

3.4.47 If dewatering is required at the eastern launch and reception pit it is also likely to exceed 100 days and a groundwater abstraction has been identified within 500m of the potential dewatering location. Therefore, to assess the potential effects of any dewatering, the radius of influence for dewatering has been calculated.

3.4.48 For the calculation, the hydraulic conductivity of silty sand, which also overlaps with a clean sand, has been used within the calculation, as described by Freeze and Cherry (1979), which quotes a hydraulic conductivity of between 10-7m/s and 10-3m/s. As a sensitivity test the median of 10-5m/s as well as the highest and lowest extents published have been selected.

3.4.49 The expected maximum groundwater level has been assumed to be at the highest point recorded of 0.27m, which is considered a worst-case approach. A conservative depth of the launch/reception pit of 2m has been used in the assessment below to allow for any variations within the launch/reception pit depths. This means that the drawdown of the groundwater level, in this situation, would be 1.73m which is the maximum depth of the pits.

3.4.50 Table 3.9 presents the inputs and results of the radius of influence calculations

Table 3.9 – Input and Results of Calculating the Radius of Influence at Ansell's Grove

Parameter	Highest Hydraulic Conductivity	Median Hydraulic Conductivity	Lowest Hydraulic Conductivity
Expected groundwater level (m bgl)	0.27	0.27	0.27
Hydraulic Conductivity, K, (m/s)	1×10^{-7}	1×10^{-5}	1×10^{-3}
Drawdown, s (m)	1.73	1.73	1.73
Factor. C	2000	2000	2000
Total radius of influence, R_0 (m)	**1.09**	**10.94**	**109.41**

3.4.51 The nearest receptor is a private water supply (Caldecott) located approximately 440m to the south of the launch/reception pit. As the total radius of influence, even on the most conservative hydraulic conductivity (and using the worst-case groundwater level and pit depth), is significantly less than the distance from the pit to the receptor, there is unlikely to be any risk to the groundwater abstraction identified. GWDTE 7 is also located approximately 200m to the south of the launch/reception pit. However, as the groundwater dependency score based on ES Appendix 7.1: Habitats Baseline Report (**application document 6.3.7.1**) was 2 (moderate) and based on the calculations in Table 3.9, this is unlikely to be affected by the dewatering.

3.4.52 As seen on ES Figure 10.7: Cross Section to the South of Ansell's Grove (**application document 6.4**), with a drilling depth of 6m bgl the route is likely to be predominantly within the superficial deposits. The route may also intercept the Kesgrave Catchment Subgroup. However, the London Clay Formation would act as a barrier to vertical flow between the superficial deposits and the underlying Chalk.

3.4.53 Ground disturbance during construction could create new groundwater flow pathways, where permeable materials or flow routes are introduced through piling, drilling, or through permeable backfill material allowing movement of existing contamination or mixing of aquifers. However, as shown from ES Appendix 10.1: Geology Baseline and Preliminary Risk Assessment (**application document 6.3.10.1**) a worst case, low risk of contamination is expected within the Order Limits, therefore there is considered to be a very low risk of mobilising any contamination through ground disturbance.

3.4.54 Assuming an HDD technique, the cable is also likely to be sealed with bentonite during drilling therefore new flow pathways are unlikely to be formed and aquifer mixing would not occur. In addition, in accordance with good practice measure GH07 in the CoCP (**application document 7.5.1**), if the construction method proposes the use of bentonite or other drilling agents, then an assessment of the potential risk would be undertaken once detailed design and construction techniques are finalised, and prior to construction commencing. Where the assessment identifies an unacceptable risk to groundwater or surface water quality, then alternative methods and/or additives shall be proposed, assessed and used. The hydrogeological risk assessment would be submitted to the Environment Agency for information prior to construction.

3.4.55 The cross-sectional area of the trenchless crossings would be small and therefore considered to have a very low risk to groundwater flow.

3.5 GSP Substation and CSE Compounds

3.5.1 Dewatering and discharge are not expected to be required at the GSP substation or CSE compounds therefore there is not likely to be a risk to groundwater flow pathways. In addition, the small overall diameter of any potential piles means there is likely to be a very low risk of changes to groundwater flow pathways.

3.5.2 Ground disturbance during construction could create new groundwater flow pathways, where permeable materials or flow routes are introduced through piling or through permeable backfill material, allowing movement of existing contamination or mixing of aquifers. A potential source of contamination has not been identified at these locations, as shown in ES Appendix 10.1: Geology Baseline and Preliminary Risk Assessment (**application document 6.3.10.1**), therefore there is considered to be a very low risk of mobilising contamination through ground disturbance.

3.5.3 Good practice measure GH06 in the CoCP (**application document 7.5.1**) requires an assessment to be undertaken at all locations where piling is proposed, and therefore risks associated with creation of new flow/contamination pathways are expected to be very low.

3.5.4 Effects on infiltration and recharge of groundwater may arise if the permeability of the ground surfaces is changed. However, the project only requires small areas of new hardstanding, and these would be designed to meet existing drainage standards as provided for in good practice measure W12 from the CoCP (**application document 7.5.1**). The small overall footprint of any new hardstanding at the GSP substation or at CSE compounds means there is likely to be no change to infiltration and recharge, and very low risk to waterbodies supported by groundwater recharge, or groundwater flow pathways.

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