11.6 Potential Impacts

11.6.1 Introduction

A range of potential impacts on water resources and hydrology have been identified which may occur during the construction or operation/maintenance of the proposed cable route. Impacts will be varied and include the effects of construction on local fluvial geomorphology due to increased potential for watercourse erosion and destabilisation from temporary culvert and outfall installations. Also, there is potential for increased watercourse pollution due to discharge of entrained sediments and chemicals along cable easements or in runoff from the working area, haul roads and converter station, compacted soils and other impermeable areas. There is also the potential for impact to existing water and wastewater assets during the construction phase of the works, with potentially numerous conflicts with underground sewage and water distribution networks. There is potential for the works to impact flood risk from a range of sources during construction and operation, this includes the potential need for dewatering of HDD tunnelling locations and trenches.

There are no anticipated effects during normal operation of the underground cable. Any repair or maintenance activities required during the operational life of the underground cable will result in impacts similar to those identified during construction but limited to the area of works.

All the effects identified are considered to be negative and adverse, unless stated otherwise. These potential impacts on hydrology and people, property and infrastructure receptors as a result of the English Onshore Scheme are described below.

11.6.2 Mitigation by Design

Where possible embedded mitigation measures, or mitigation by design, have been incorporated into the preliminary scheme design such that they inform its detailed design and/or how it shall be constructed. Through iterative assessment, potential impacts have been predicted and opportunities to mitigate them identified with the aim of preventing or reducing impacts as much as possible. The approach provided the opportunity to prevent or reduce adverse impacts from the outset. Where possible, the design has sought to avoid impacts to hydrology receptors through use of HDD, bridge crossings, considerate placement and design of culverts and construction features to avoid areas at risk of flooding or protected areas or sensitive watercourses including those of good ecological or high morphological status.

Although no drainage strategy has been produced as part of this planning application, an outline drainage design is included with this submission and therefore it is considered that the drainage strategy and surface water management plan are embedded mitigations. These documents will be produced at a later stage during detailed design or by the works contractor. Measures, principles, or practices considered a necessary part of the design or construction methodology for a particular element are outlined below. These would therefore meet the CIRIA SuDS Manual Standards.

The design includes good industry practice for this type of development, in addition to the below measures and assumptions. These will be implemented through the adoption of a Construction Environmental Management Plan (CEMP) which will be finalised in agreement with the relevant local planning authority. The minimum measures to be adopted during construction are set out in **Chapter 18: Outline Construction Environmental Management Plan**.

HHD crossings below watercourses

- All temporary construction compounds (launch and retrieval pits) associated with trenchless techniques will be dammed and on-site water management protocols would be incorporated to manage off site flows/runoff (e.g., mud filters or sediment/pollutant capture mechanism to nearby attenuation ponds). Discharge will be pumped/gravity fed to local watercourse utilising a flow control device or via soakaway into the ground. Thus, ensures all discharge is controlled in terms of quality and volume;
- Surface water abstraction may be required for mixing/cable installation at HDD sites. Where abstraction is necessary, permits will be obtained in agreement with the appropriate regulator in accordance with the Catchment Abstraction Management Strategy and be for less than 28-day duration per water body;

- Depth between hard channel bed level and top of trench/cable bore is to be agreed on a case by case basis with the relevant regulatory stakeholders (EA/IDB/LLFA) and will therefore avoid any potential for obstruction to flow or risk of damage from any typical in-channel maintenance activities;
- There may be a potential need for dewatering operations to be undertaken at HDD locations and trenches in areas identified as being at flood risk from groundwater. Groundwater, if encountered, will be managed through pumping, storage, treatment and then discharged at a controlled rate which is to be agreed with the relevant regulator.

Open cut across watercourses:

- Open cut trenches will be dammed (assuming a complete channel width barrier) and entire flow from the watercourse over-pumped around the trench. Where required, over-pumping capacity will be determined on a case by case basis by the temporary works designer in consultation with the relevant stakeholder as part of the detailed design ensuring flow rates are sufficient to ensure no upstream hydrological regime changes and using fish friendly pumps as needed. On-site water management protocols would be incorporated to manage off site flows/runoff (e.g. mud filter or sediment/pollutant capture mechanism to nearby attenuation ponds) from within the working area. Discharge will be pumped/gravity fed via attenuation ponds to remove sediment and potential contaminants before discharging (to local watercourse or infiltration) at a controlled rate which is to be agreed with the relevant regulator. This ensures discharge is controlled in terms of quality and volume;
- Groundwater encountered while excavating trenches will be managed through suitable pumping arrangements, storage, pollution control measures and a controlled discharge which is to be agreed with the relevant regulator. Temporary dams would also be provided to limit below ground flows via the trench;
- Surface water abstraction may be required at watercourses for mixing/cable installation. Where abstraction is necessary, permits will be obtained in agreement with the appropriate regulator in accordance with the Catchment Abstraction Management Strategy and be for less than a 28-day duration per water body;
- Depth between hard channel bed level and top of cable trench is to be agreed on a case by case basis with the relevant regulatory stakeholders (EA/IDB/LLFA) and will therefore avoid any potential for obstruction to flow or risk of damage from any in-channel maintenance activities post works.

Open cut direct lay or ducting on land (near watercourse/flow path/floodplain)

- Open cut trenches will be dammed and any water within pumped/gravity fed via attenuation ponds to remove sediment and potential contaminants before discharging at a pre-agreed controlled rate(to local watercourse or infiltration). This ensures discharge is controlled in terms of quality and volume.

Construction compounds

- Construction compounds and access tracks will increase the impermeable area. An appropriate temporary drainage system would be incorporated to manage off site flow/runoff, ensuring waters are controlled in quality and volume. This will comprise attenuation ponds and/or subbase storage beneath compounds where possible Discharge will be pumped/gravity fed to local watercourse or via soakaway at a controlled rate which is to be agreed with the relevant regulator;
- There will be an independently managed foul drainage system at the construction compounds with the foul water contained on site, regularly pumped, emptied, and transported off site. Therefore, there is no requirement for any formal piped foul drainage on site or any offsite connection;
- Construction compounds will include bunded/sump areas with proprietary treatment for re-fuelling, wheel washing and oil separator areas to prevent runoff of these liquids into surface waters. Any site discharge will be pumped/gravity fed via attenuation ponds to remove sediment and potential contaminants before discharging (to local watercourse or infiltration) at a controlled rate which is to be agreed with the relevant regulator.
- Construction compounds will be placed in area at lowest risk of flooding, were practicable.

Haul road and water crossings

- An appropriate drainage system will be incorporated to manage surface water and sediment runoff. This will include header and filter drains, use of sandbags either side of the haul road at watercourse crossings and ensure runoff is directed into attenuation ponds to remove sediment and potential contaminants before discharging (to local watercourse or infiltration) at a controlled rate which is to be agreed with the relevant regulator;
- In general, the haul road will comprise a circa 0.5 m deep layer of unbound granular material with the potential for geogrid layers to be used for stabilisation. Where the haul road will be built up, pipes will be installed to ensure natural drainage pathways are maintained across the haul road;
- Some temporary accesses will be constructed over a pre-installed culvert pipe in the watercourse. The pipe will be of suitable size to accommodate the natural water regime (volumes and flows), in accordance with DMRB standards. For the majority of watercourses, the temporary culvert will be sat at hard bed level and orientated with flows to limit obstruction and potential for scour. These will allow free passage for fish and eels and be sited to avoid spawning habitat/morphological bar and riffle features. In some cases, temporary culverts may be above hard bed level, however this is limited to channels which are balanced systems with little flow and no concern for fish and eel passage. These will be determined on a case by case basis with the relevant stakeholder;
- All temporary accesses will be removed at the end of the construction programme. It is assumed culverts will be in place for the complete duration of the construction works (up to five years);
- All hard banks and bed added during construction will be temporary and the bankside will be returned to its original stabilised state after construction, including re-grading where required and re-vegetating/seeding;
- Some temporary accesses to cross larger or ecologically sensitive watercourses will be via a temporary bridge, thereby avoiding impacts associated with culverting. It is assumed these will be in place for the complete duration of the construction works (up to five years). Temporary bridges will be clear span, with no bed or bank reinforcements, and foundations set well back from the bank edge. The soffits will be >0.6m higher than bank tops with no change to surrounding ground level profiles surrounding the crossing. They will be sited to avoid tree/root loss and cross at straight reaches, perpendicular to flow where practicably possible.

Outfall and headwall installations:

- Headwall installations will occur at nearest watercourses. Details of individual outfalls and headwall construction will take into account localised catchments and upstream conditions. Precise locations will be determined at detailed design but will in general include:
  - No part of the outfall structure will protrude significantly beyond the existing line of the bank. This includes headwalls, wingwalls and protection aprons;
  - Discharge will be with the direction of flow, ideally the outfall pipe should be angled at 45° to the direction of flow; and
  - Sited to avoid tree loss or banks experiencing significant scour.
- All hard banks and bed added during construction will be temporary and the bankside will be returned to its original state after construction;
- Design details for outfalls into watercourses will need to be reviewed and confirmed through consultation with the respective regulating authority.

Converter station

- An outline drainage design has been produced which includes partial sub-base storage and attenuation pond for flood storage and treatment of site runoff. This will ensure waters are controlled in quality and volume during construction and at operational stage. Discharge will be pumped/gravity fed to a local watercourse at a controlled rate which is to be agreed with the relevant regulator;
- Converter station platform area has been reduced from 6 ha to 5 ha to reduce volume of material introduced into the flood plain. Options to provide flood plain compensation have been explored with the Environment Agency.

General construction

- Areas with prevalent runoff (overland flow) are to be identified and drainage actively managed, e.g. through bunding and/or temporary drainage as part of the development of the drainage strategy;
- All drainage will be consistent with CIRIA guidance (C532) (Ref 11-26) and developed so as to promote effective management of water resources and reduce potential for impacts to the external water environment. The converter station will be provided with permanent surface water drainage designs consistent with local and national regulatory requirements;
- Management of construction works to comply with the necessary standards and consent conditions as identified by the EA;
- Disturbance to areas close to watercourses reduced to the minimum necessary for the work. A minimum 15 m separation will be maintained from watercourses unless where crossed or discharged into;
- During installation of the cable (over land) drainage measures and provision for water management is included within the planning application boundary;
- Stockpiles will have measures in place to prevent erosion, and thus mitigate potential for sediment laden runoff (as per the Soil Management Plan, **Chapter 12: Agriculture and Soils**, **Appendix 12B**);
- All discharges to be attenuated to at most greenfield runoff rates unless otherwise agreed with the relevant regulatory stakeholder;
- Temporary diversions during works may be required where under-drainage infrastructure is directly encountered. These diversions would be short term and only for the duration of the works at that particular location unless otherwise agreed. The most appropriate method is to be proposed for each field and any works will be undertaken in agreement with the appropriate stakeholder;
- The English Onshore Scheme, where possible, has been located in areas at low risk of flooding so as to avoid flood risk;
- Maintenance of the drainage systems will ensure the systems remain effective for the life of the English Onshore Scheme;
- The risk of pollution to the water environment during construction will be reduced through the adoption of good working practice. Although withdrawn in 2015, the Pollution Prevention Guidelines (Ref 11-26) provide environmental good practice guidance. Replacements for certain aspects have subsequently been updated in the form of the Guidance for Pollution Prevention and therefore considered in the creation of the Construction Environmental Management Plan (CEMP). In addition, CIRIA construction guidance also contains details for pollution prevention best practise, specifically CIRIA C532, C648 (Ref 11-26 and Ref 11-28), and C786F (Ref 11-29). The method to be provided for management of construction impacts will be included in the CEMP and will meet the requirements of the DMRB guidelines. As such pollution management may include, but not be limited to:
    - Erosion and sediment control management procedures;
    - Water discharge management;
    - Invasive non-native species procedure;
    - Emergency incident response procedure;
    - Spill kits; and
    - High standards of equipment and vehicle hygiene.

This mitigation by design has been taken into account when evaluating the significance of the potential impacts discussed in Sections 11.6.3 and 11.6.4. Residual impacts described in Section 11.8 are those which remain taking into account any further proposed project specific mitigation as described in Section 11.7. See Section 11.6.2 for further information on the approach to mitigation taken in this document.

11.6.3 Assessment of Potential Impacts: Construction Phase

This section of the report considers the potential effects that the construction of the English Onshore Scheme could have on the water environment. The main potential impacts relating to construction are:

- Increased surface water runoff through increases in impermeable or compacted areas;
- Mobilisation of fine sediment affecting water quality through runoff or scour;
- Temporary impacts to local fluvial geomorphology;
- Mobilisation of oils, cement or other chemicals affecting water quality;
- Displacement of flood water from the introduction of the converter station platform in the floodplain;
- Obstructions from open cut, ducting and culverting affecting flow regime; and
- Severance or disturbance to underground field/land drainage infrastructure.

These impacts are discussed in further detail in the sections below.

11.6.3.1 Section 1 – Landfall to Bainton

Impacts of open cut techniques on water resources

Construction via open cut techniques and associated machinery could lead to an increase in soil erosion creating sediment laden runoff from the construction area, construction vehicles, and access roads. Discharge of fine sediments will reduce light penetration of the water column and reduce dissolved oxygen by smothering aerating morphological features. The discharge could also contain spillages or leaks of fuels and oils, or other pollutants that could affect water bodies directly crossed or surrounding water features physico-chemical water quality elements. The impacts from runoff are predicted to be of local spatial extent, short term duration, intermittent occurrence and highly reversible.

Embedded mitigation as discussed in Section 11.6.2 includes measures to ensure that incidental release of sediments or runoff is minimised and that surface water discharge is fully controlled in terms of water quality and volume before entering the receiving water feature. Within Section 1 there are six water bodies that are proposed to be potentially crossed by open cut techniques, all of which are ordinary watercourses maintained by IDBs with an additional 19 water bodies within the study area which may be indirectly affected by runoff (due to open cut construction within their drainage catchments) consisting of main rivers, WFD designated water courses, a coastal water body and IDB maintained channels, and therefore have a sensitivity value of medium. The magnitude of change will be **negligible**, resulting in a **negligible** significance and considered **not significant**. In addition, there are three watercourses within the study area with a receptor sensitivity value of high due to their status as SSSI or a chalk stream including Kelk Beck, Nafferton Beck, and West Beck (River Hull). In consideration of embedded mitigation, indirect runoff impacts would therefore result in a **negligible** magnitude of change which is a **negligible/minor** significance and considered **not significant**. Furthermore, there are 19 water bodies proposed to be crossed by open cut techniques, all of which are minor drains with an additional 27 standing water bodies and numerous other minor drainage channels that are not designated nor maintained by the IDB which therefore have a sensitivity value of low. In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** magnitude of change which is a **negligible** significance and considered **not significant**.

Open cut methodologies will also include flow bypasses by over-pumping at temporary dams which have the potential to obstruct fish and eel passage and also alter flow regime and limit sediment transport. Within Section 1 there are 25 watercourses that are proposed or potential to be crossed by open cut techniques, all of which are ordinary watercourses or minor drains and are not designated WFD nor other statutory or non-statutory. Six are IDB maintained ordinary watercourses and therefore have a sensitivity value of medium. Although these works will not be undertaken directly on any water bodies designated under the WFD, these will be undertaken on headwater or feeder channels. In particular, White Dyke and White Dyke branch which are known to contain fish, and form part of the headwater channel network associated with Kelk Beck and the River Hull. This will obstruct fish and eel passage for the duration of the works and lead to a temporary loss of spawning habitat. Over-pumping will alter the flow regime and limit natural sediment transport for the duration of the works and may lead to depletion of coarse sediments downstream and aggradation upstream. Impact will be greatest at White Dyke where morphological diversity was greatest of these six watercourses. Any impoundments will be temporary (approximately 10 days) and can be further mitigated by measures included in the CEMP (including but not limited to) using fish friendly pumps and ensuring over-pumping flow rates are sufficient to ensure no upstream hydrological regime changes. Impacts will be short term and normal flow conditions will naturally recover once works are complete and the obstruction is removed. Therefore, obstruction of flows will constitute a **low** magnitude of change which is **minor** significance and considered **not significant**. The remaining 19 minor drains have a sensitivity value of low, resulting in a **low** magnitude of change which is **negligible** significance, and considered **not significant**.

Installation of the below ground cable within agricultural fields via open cut techniques has the potential to cause severance, disturbance, or blockage to the underground field/land drainage infrastructure. These receptors have a sensitivity value of low. Alteration of the drainage infrastructure has the potential to result in drying out or waterlogging of the agricultural fields. Embedded mitigation includes the addition of temporary diversions during works which may be required where under-drainage infrastructure is directly encountered. These diversions would be short term and only for the duration of the works at that particular site/field. The most appropriate method is to be proposed for each field and any works undertaken in agreement with the appropriate stakeholder. This will result in a **low** magnitude of change which is **negligible** significance and considered **not significant**.

There may also be impacts from water abstraction from nearby watercourses to use onsite. Locations of potential abstractions have not yet been confirmed as they are subject to the findings of the ground investigation and the design of the appointed Contractor but it is assumed these may be required. Over abstraction from watercourses within the study area has the potential to result in downstream loss of water quantity leading to habitat loss in surface water dependent habitat at Kelk Beck, West Beck (River Hull) and Nafferton Beck. In addition, reduced water quantity may be available for licensed/unlicensed surface water abstractions.

Embedded mitigation includes permitting in agreement with appropriate regulator in accordance with the Catchment Abstraction Management Strategy. As such, the impact will result in a **negligible/minor** magnitude of change to People, Property and Infrastructure and water dependent habitat and considered **not significant**.

Impacts from trenchless techniques on water resources

Within Section 1 there are 16 watercourses proposed to be crossed by trenchless techniques comprising five main rivers of which three are designated SSSI or chalk streams and four are WFD designated and 11 crossed ordinary watercourses of which three are WFD designated, two are IDB maintained and seven are minor drains.

Trenchless techniques will avoid any direct effect on the structure of the watercourse by drilling beneath the bed. This would also eliminate any longer term affects to fluvial geomorphology as flows, movement of sediment and fish migration will be unaffected. However temporary compounds (including launch and receptor pits) would be required either side of the watercourses, in addition to construction vehicles and access roads nearby. These activities could lead to an increase in soil erosion resulting in sediment laden runoff. This discharge could also contain spillages or leaks of fuels and oils, or other pollutants that could affect nearby watercourses or standing water quality. Discharge of fine sediments will reduce light penetration of the water column and reduce dissolved oxygen by smothering aerating morphological features thus negatively impacting local fluvial geomorphology, ecological and physio-chemical water quality therefore causing a reduction in the WFD classification.

The impacts from runoff are predicted to be of local spatial extent, short term duration, intermittent occurrence and highly reversible. Embedded mitigation as discussed in Section 11.6.2 includes measures to ensure that incidental release of sediments or runoff is minimised and that surface water discharge is fully controlled in terms of water quality and volume before entering the receiving water feature. Permits would be obtained with agreement with the relevant regulatory stakeholder for depth of cable and distance of excavations from the watercourse edge.

Within Section 1 three watercourses are proposed to be crossed by trenchless techniques with a receptor sensitivity value of high due to their status as a SSSI or a chalk stream including Kelk Beck, Nafferton Beck, and West Beck (River Hull) which are also WFD designated watercourses In consideration of embedded mitigation, fluvial geomorphological and runoff impacts would therefore result in a **negligible** magnitude of change which is a **negligible/minor** significance and considered **not significant**. In addition, there are six watercourses proposed to be crossed by trenchless techniques of which two are main river (Driffield Canal and Nafferton Drain), four are WFD designated water courses and/or IDB maintained channels (Auburn Beck, Gransmoor Drain, Northfield Beck and Wanlass Drain) with a sensitivity value of medium. The magnitude of change will be **negligible** which is **negligible** significance and considered **not significant**. Furthermore, there are seven water bodies proposed to be crossed by trenchless techniques, all of which are minor drains which therefore have a sensitivity value of low. In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** magnitude of change which is a **negligible** significance and considered **not significant**.

There may also be impacts from water abstraction from nearby watercourses to use onsite. Locations of potential abstractions have not yet been confirmed as they are subject to the findings of the ground investigation and the design of the appointed Contractor. Over abstraction from watercourses within the study area has the potential to result in downstream loss of water quantity leading to habitat loss in surface water dependent habitat at Kelk Beck, West Beck (River Hull) and Nafferton Beck. In addition, reduced water quantity may be available for licensed/unlicensed surface water abstractions.

Embedded mitigation includes permitting in agreement with appropriate regulator in accordance with the Catchment Abstraction Management Strategy. As such, the impact will result in a **negligible/minor** magnitude of change to People, Property and Infrastructure and water dependent habitat and considered **not significant**.

Impacts from haul road, accesses, and watercourse crossings on water resources

Numerous heavy vehicle movements on the haul road have the potential to temporarily mobilise soil, dust and pollutants (from fuel spills, oils, lubricants, wear from tyres and brakes) which would be captured in runoff on the road surface. At sufficient concentration this would lead to a reduction in water quality including effects that could result in the smothering or poisoning of animals and plants within local watercourses and standing water bodies. The impacts from runoff are predicted to be of local spatial extent, short term duration, intermittent occurrence and highly reversible. Embedded mitigation includes a layer of granular material along with geogrids to provide stability and minimise soil erosion from traffic. Silt management measures will be employed to reduce the risk of sediment runoff which will be included within the CEMP. Within Section 1, three watercourses within the study area have a receptor sensitivity value of high due to their status as a SSSI or a chalk stream including Kelk Beck, Nafferton Beck, and West Beck (River Hull). In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** magnitude of change which is a **negligible/minor** significance and considered **not significant**. In addition, there are 12 watercourses which are main river, WFD designated and/or IDB maintained channels with a sensitivity value of medium. There are also a further 14 water bodies within the study area which may be indirectly affected by runoff consisting of main rivers, WFD designated water courses and IDB maintained channels, and therefore have a sensitivity value of medium. The magnitude of change will be **negligible** which is **negligible** significance and considered **not significant**. Furthermore, there are 26 water bodies, all of which are minor drains with an additional 27 standing water bodies and numerous other minor drainage channels that are not designated nor maintained by the IDB which therefore have a sensitivity value of low. In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** magnitude of change which is a **negligible** significance and considered **not significant**.

Nafferton Beck, Nafferton Drain, and Kelk Beck are proposed to be crossed by a temporary bridge. The bridge structures have potential to create a narrowing or constriction of flows during flood flows. Their final designs are to be developed by the appointed contractor, however, will include measures to reduce or eliminate these impacts including clear-span, with soffit above surrounding bank levels. Loss of morphological features is avoided by design by avoiding in-channel supports. The addition of the bridge structure in a location suffering from scour will force additional load onto banks which has the potential to exacerbate destabilisation and bank collapse. Equally, locating the structure on a meander bend may lead to flows directed towards the supports. This may exacerbate fine sediment delivery in the short term into the channel as banks may be destabilised leading to bed structure and substrate changes locally from smothering of bed and morphological features downstream. The precise locations for bridge crossings are to be designed by the appointed Contractor and in consultation with the relevant stakeholder and will be situated to avoid areas of scour and be perpendicular to flow thereby avoiding impacts.

Construction of the bridge structures have potential for disturbance to channel bed and bank, loss of riparian and marginal vegetation resulting in loss of invertebrate and fish spawning habitat. However, the design of the bridge is such that it will be clear span without bed or bank reinforcement. Temporary bridges were selected over culvert installations so as to avoid any in-channel impacts. Any loss of vegetation on banks will be minimal as placement will be considered to avoid losses within the planning application boundary, in particular bridges will avoid tree loss where possible. In addition, there is potential for shading due to the span of the bridge structure across the channels. Kelk Beck and Nafferton Beck are chalk streams and therefore support fish and invertebrate species. By design, the bridge structures are narrow and sat above bank tops therefore any shading will be minimal and move throughout the day.

In consideration of the embedded mitigation, impacts from temporary bridges will result in a **negligible** magnitude of change. The receptors have a sensitivity value of high, therefore resulting in a **negligible/minor** significance which is **not significant**.

Where temporary bridge crossings are not used, temporary culverts will be installed to cross watercourses. Culverting will result in straightening and hard banks of a section of channel (circa 6 m wide). In addition to the removal of bed substrate, this may also lead to changes in flow dynamics and patterns of erosion at the structure which will also impact the transfer of sediment downstream. It is expected a loss of velocity and reduced sediment transport will lead to material deposition upstream of culvert and material deficit and scour downstream of structure due to velocity increase through/off culvert. However, these channels are already straightened as are designated artificial or heavily modified and works will constitute a very small section of any overall water body. Therefore, impacts are expected to be minor and localised.

The addition of temporary culvert and hard banks will result in the direct loss of habitat within the bed and banks due to loss of natural substrate, and also prevent natural recolonisation while the structure is in place. This will also result in loss of fish spawning habitats and therefore impacts may also be to downstream WFD water bodies as a result of this loss. Fish passage through the structure may be limited reducing access and leading to stranding. However, this bed and bank loss is localised, and the channel bed of all crossed WFD watercourses are classed as heavily modified or artificial. Majority of channel bed sediments observed were silts, receiving large fine sediment inputs from runoff from local areas and erosion to banks. The loss of bed sediments will therefore result in a minor localised reduction in quality of aquatic environment.

During construction, any tree loss may exacerbate fine sediment delivery in the short term into the channel as banks may be destabilised leading to bed structure and substrate changes locally from smothering of bed and morphological features downstream. Post construction, banks would be stabilised which will eliminate these effects.

Embedded mitigation as discussed in Section 11.6.2 includes measures for culvert dimensions to accommodate the natural water regime, with the temporary culvert sat at hard bed level and orientated with flows to limit obstruction and potential for scour. These will allow free passage for fish and eels and be sited to avoid spawning habitat/morphological features where present. In some cases, temporary culverts may be sat above hard bed level, however this is limited to channels which are balanced systems with little flows so would be unlikely to be used by fish and eel. These will be determined on a case-by-case basis with the relevant stakeholder (EA, LLFA, IDB). All hard banks and bed added during construction will be temporary and the bankside will be returned to its original stabilised state after construction, including re-grading were required and re-vegetating/seeding to replace any lost habitat and vegetation or trees.

Within Section 1 there are nine watercourses crossed with temporary culverts which are all ordinary watercourses designated WFD or maintained by the IDB. As such these have a sensitivity value of medium. The magnitude of change will be **negligible** which is **negligible** significance and considered **not significant**.

Impacts from construction compounds (landfall, primary, secondary, and tertiary compounds) on water resources

Use of construction compounds by heavy machinery and storage of loose material could lead to an increase in soil erosion or increased sediment laden runoff from compacted ground entering nearby water bodies through existing surface water flow paths. Discharge of fine sediments will reduce light penetration of the water column and reduce dissolved oxygen by smothering aerating morphological features thus negatively impacting local fluvial geomorphology, ecological and physio-chemical water quality therefore causing a reduction in the WFD classification. The discharge could also contain spillages or leaks of fuels and oils, or other pollutants that could affect water bodies directly crossed or surrounding water features physico-chemical water quality elements. The impacts from runoff are predicted to be of local spatial extent, short term duration, intermittent occurrence and highly reversible. Embedded mitigation as discussed in Section 11.6.2 includes installation of a temporary drainage system to treat runoff from the site, in addition to bunded areas to prevent runoff of chemicals. The temporary drainage system would manage the quality and volume of water prior to its controlled discharge into nearby watercourses.

Within Section 1, there are 12 water bodies within a 250 m direct hydraulic link of construction compounds. These are main river or ordinary watercourses maintained by the IDB and/or WFD designated, and a coastal WFD water body, and therefore have a sensitivity value of medium. The magnitude of change will be **negligible** which is **negligible** significance and considered **not significant.** In addition, there are three watercourses within the 2 km study area with a receptor sensitivity value of high due to their status as SSSI or a chalk stream including Kelk Beck, Nafferton Beck, and West Beck (River Hull). In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** impact which is a **negligible/minor** significance and considered **not significant**. Furthermore, there are 53 water bodies within the study area, of which 27 are standing water bodies and 26 minor drainage channels that are not designated nor maintained by the IDB which therefore have a sensitivity value of low. In consideration of embedded mitigation, indirect runoff impacts would therefore result in a **negligible** magnitude of change which is a **negligible** significance and considered **not significant**.

There may also be impacts from water abstraction from nearby watercourses to use onsite. Locations of potential abstractions have not yet been confirmed as they are subject to the findings of the ground investigation and the design of the appointed Contractor. Over abstraction from watercourses within the study area has the potential to result in downstream loss of water quantity leading to habitat loss in main river Driffield Canal, and WFD water bodies Auburn Beck and Gransmoor Drain which are considered medium sensitivity. In addition, reduced water quantity may be available for licensed/unlicensed surface water abstractions.

Embedded mitigation includes permitting in agreement with appropriate regulator in accordance with the Catchment Abstraction Management Strategy. As such, the impact will result in a **negligible** magnitude of change to People, Property and Infrastructure which is of low sensitivity value and WFD water bodies which is of medium value, and therefore considered **not significant**.

Impacts from outfall and headwall installations in watercourse banks

Outfall and headwall installations are primarily to the nearest ordinary watercourse or minor land drainage water feature and will convey discharges from construction within the working area and construction compounds. These installations will lead to a direct loss of natural banks leading to reduced bank roughness and potential for increased scour downstream of structures thereby negatively impacting fluvial geomorphology locally. Impacts would also result in a direct loss of bankside/riparian habitat in the immediate location of the structure. In addition, increased flow entering the channels collected as runoff, could lead to increased scour to channel banks and bed that would lead to additional fine sediment transferred downstream. Details of individual outfalls and headwall construction will take into account localised catchments and upstream conditions, as such embedded mitigation includes installation in-line of the bank to reduce the risk of turbulence and localised scour. Discharge will be with the direction of flow, ideally angled at 45° to the direction of flow. Outfalls will be sited to avoid any tree loss and avoid bank areas under existing scour. Installations will also be small, less than <300 mm. These impacts would be temporary, and as a worst case for the duration of the construction phase only, and the bankside will be returned to its original state after drainage is no-longer required.

There are two outfalls located in Nafferton Beck, which has a receptor sensitivity value of high due to its status as a chalk stream. In consideration of embedded mitigation, this would result in a **negligible** magnitude of change resulting in a **negligible/minor** significance, which is considered **not significant**.

There are seven outfalls entering three watercourses with a receptor sensitivity value of medium. One of these is designated WFD and two are IDB maintained watercourses (Auburn Beck, Earl's Dyke and Burton Drain). In consideration of embedded mitigation, this would result in a **negligible** magnitude of change resulting in a **negligible** magnitude of change which is considered **not significant**.

In addition, there are 38 outfalls into watercourses with a receptor sensitivity value of low in Section 1. These have potential to convey fluvial geomorphological impact downstream to more sensitive water bodies. In consideration of embedded mitigation, this would limit any impacts at source and therefore result in a **negligible** magnitude of change resulting in a **negligible** impact which would be **not significant**.

Impacts which may affect flood risk

Locations for any temporary culvert installation have not yet been confirmed as they are subject to the findings of the ground investigation and the design of the appointed Contractor, therefore this assessment has been completed on the assumption that installation will be included for watercourses and surface water flood paths caused by haul roads. There are 41 watercourses, including five main rivers, identified as being crossed by the English Onshore Scheme English Onshore Scheme in Section 1 of which 35 will be crossed with temporary culverts. The installation of temporary culverts may impact upon the existing flow regime and may cause an increase in flows with risk of flooding to the surrounding land. People, property and infrastructure has a low sensitivity value. With embedded mitigation, such as suitable culvert pipe size to accommodate natural flow regimes, magnitude of change is **low** resulting in a **negligible** impact which would be **not significant**.

There are three proposed temporary bridge crossings of watercourses within Section 1. Currently exact locations of these watercourse crossings are not known though the structures will be placed within the planning application boundary. These temporary bridge crossings have the potential to impact on existing flow regimes and thus cause flooding to surrounding land. Of these crossings, two are located within the extents of Flood Zone 3. These receptors have a sensitivity of medium. Embedded mitigation would result in a **low** magnitude of change resulting in a **negligible** impact which would be **not significant**.

The crossing of field drains, included in the 44 watercourses proposed to be crossed by the English Onshore Scheme in Section 1, could cause flow to back up on surrounding field drains and in turn increase risk to people, property and infrastructure flood risk receptors. These receptors are considered to have a sensitivity value of low. Embedded mitigation would result in a **low** magnitude of change resulting in **a negligible** impact which would be **not significant**.

Installation of the below ground DC cable has the potential to cause severance, disturbance, or blockage to the underground field/drainage infrastructure. Though data supplied by Yorkshire Water indicated that they had no records of sewers or drains in the near vicinity of Section 1 of the English Onshore Scheme. The sensitivity of these receptors is low. Embedded mitigation would result in a **low** magnitude of change, resulting in a **negligible** impact which would be **not significant**.

The English Onshore Scheme English Onshore Scheme cable route intersects with areas of Flood Zone 3 at 13 locations within Section 1. Approximate lengths of intersection are 40 m, 145 m, 700 m, 560 m, 50 m, 60 m, 20 m, 40 m, 15 m, 30 m, 40 m, 310 m and 70 m respectively. There is a risk of flooding at these locations though these crossings are located in predominantly rural areas and so the people, property and infrastructure receptors sensitivity is considered to be low. Embedded mitigation would result in a **low** magnitude of change, resulting in **a negligible** impact which would be **not significant**.

Three of the eight proposed construction compounds within Section 1; compounds 1, 2 and 6 overlap with areas of high risk surface water and may result in an increase in surface water runoff, compound 4 is an area of medium risk and compounds 5, 7 and 8 are at low risk of surface water flooding. The areas at risk are mostly small proportions of these construction compounds and are not shown to affect a majority of the compound area. These compounds have a low sensitivity value, with embedded mitigation meaning magnitude of change is **negligible** resulting in **a negligible** impact which would be **not significant**.

None of the proposed construction compounds in Section 1 overlap with Flood Zone 2 or 3.

Two of the committed HDD pits are within areas at high risk of surface water flooding; the entry pit of HDD 14 and the exit pit of HDD 21. Two of the committed HDD pits are in areas at medium risk of surface water flooding; the exit pit of HDD 20 and the entry pit of HDD 21. Two confirmed HDD pits are in areas at low risk of surface water flooding; the entry pits of HDD 12 and HDD 20.

Four of the committed HDD pit locations are shown to be partially within areas of Flood Zone 3. These are; the exit pits of HDD 14,15 and both the entry and exit pits of HDD 21. Two HDD pit locations overlap Flood Zone 2, the entry pits of HDD 12 and HDD 14.

Six of the HDD pits with potential to open cut watercourses are in areas at high risk of surface water flooding. These are; the exit pits of HDD 1 and HDD 4, both the entry and exit pits of HDD 6, the exit pit of HDD 13 and the entry pit of HDD 17. Two HDD pits with the potential to open cut watercourses are in areas at medium risk of surface water flooding; the exit pit of HDD 9 and the exit pit of HDD 19. Four of this type of HDD pit are located in areas at low risk of surface water flooding; the entry pit of HDD 3 and HDD 10, and both the entry and exit pits of HDD 16.

Two of the HDD pit locations with the potential to open cut watercourses are shown partially within Flood Zone 3; the entry pit of HDD 3 and the exit pit of HDD 4. Three pit locations are in Flood Zone 2; the entry and exit pits of HDD 1, and the entry pit of HDD 4

The maximum sensitivity values for the HDD pits are medium. With embedded mitigation, magnitude of change is **negligible** resulting in a **negligible** impact which would be **not significant**

Two proposed joint bays are located within areas at medium risk of surface water flooding and two in areas of low risk of surface water flooding. Additionally, one of the proposed joint bays is located in Flood Zone 3. The location of these joint bays is to be finalised at the detailed design stage and so the locations currently given are only indicative of their location. As the infrastructure of these joint bays is to be buried; with soil and grass placed on the concrete pad, the sensitivity value is low. With embedded mitigation meaning magnitude of change is **low** resulting in a **negligible** impact which would be **not significant**.

11.6.3.2 Section 2 – Bainton to Market Weighton

Impacts of open cut techniques on water resources

Construction via open cut techniques and associated machinery could lead to an increase in soil erosion leading to sediment laden runoff from the construction area, construction vehicles, and access roads. Discharge of fine sediments will reduce light penetration of the water column and reduce dissolved oxygen by smothering aerating morphological features. The discharge could also contain spillages or leaks of fuels and oils, or other pollutants that could affect water bodies directly crossed or surrounding water features physico-chemical water quality elements. The impacts from runoff are predicted to be of local spatial extent, short term duration, intermittent occurrence and highly reversible.

Embedded mitigation as discussed in Section 11.6.2 includes measures to ensure that incidental release of sediments or runoff is minimised and that surface water discharge is fully controlled in terms of water quality and volume before entering the receiving water feature. Within Section 2 there are five water bodies proposed to be crossed by open cut techniques, all of which are ordinary watercourses considered as minor drainage channels with an additional 22 standing water bodies and numerous other minor drainage channels within the study area that may be indirectly affected. None of these are maintained by IDBs or are WFD designated and therefore have a sensitivity value of low. In consideration of embedded mitigation, runoff magnitude of change will be **negligible** which is **negligible** significance and considered **not significant**. Furthermore, there are four water bodies within the study area which may be indirectly affected by runoff consisting of a main river and WFD designated water courses, and therefore have a sensitivity value of medium. The magnitude of change will be **negligible** which is **negligible** significance and considered **not significant**.

The crossed channels are minor drains and not within 2 km upstream to a WFD water body and therefore considered to be **no impact** to flow regime or fish passage.

Installation of the below ground cable within agricultural fields via open cut techniques has the potential to cause severance, disturbance, or blockage to the underground field/land drainage infrastructure. These receptors have a sensitivity value of low. Alteration of the drainage infrastructure has the potential to result in drying out or waterlogging of the agricultural fields. Embedded mitigation includes the addition of temporary diversions during works which may be required where under-drainage infrastructure is directly encountered. These diversions would be short term and only for the duration of the works at that particular site/field. The most appropriate method is to be proposed for each field and any works undertaken in agreement with the appropriate stakeholder. This will result in a **low** magnitude of change which is **negligible** significance and considered **not significant**.

There may also be impacts from water abstraction from nearby watercourses to use onsite. Locations of potential abstractions have not yet been confirmed as they are subject to the findings of the ground investigation and the design of the appointed Contractor. Over abstraction from watercourses within the study area has the potential to result in downstream loss of water quantity leading reduced water quantity available for licensed/unlicensed surface water abstractions.

Embedded mitigation includes permitting in agreement with appropriate regulator in accordance with the Catchment Abstraction Management Strategy. As such, the impact will result in a **negligible** magnitude of change to People, Property and Infrastructure which is low sensitivity and considered **not significant**.

Impacts from trenchless techniques on water resources

Within Section 2, there are no watercourses proposed to be crossed by trenchless techniques, however there are other infrastructure proposed to be crossed by trenchless techniques in the vicinity of several hydrology receptors.

Construction via trenchless techniques could lead to an increase in soil erosion resulting in sediment laden runoff from the construction area, construction vehicles, temporary compounds (launch and receptor pits), and access roads. This discharge could also contain spillages or leaks of fuels and oils, or other pollutants that could affect nearby watercourses or standing water quality, entering nearby water bodies through existing surface water flow paths. Discharge of fine sediments will reduce light penetration of the water column and reduce dissolved oxygen by smothering aerating morphological features thus negatively impacting local fluvial geomorphology, ecological and physio-chemical water quality therefore causing a reduction in the WFD classification.

The impacts from indirect runoff are predicted to be of local spatial extent, short term duration, intermittent occurrence and highly reversible. Embedded mitigation as discussed in Section 11.6.2 includes measures to ensure that incidental release of sediments or runoff is minimised and that surface water discharge is fully controlled in terms of water quality and volume before entering the receiving water feature. Permits would be obtained with agreement with the relevant regulatory stakeholder for distance of excavations from the watercourse edge.

Within Section 2 there are four water bodies within the study area which may be indirectly affected by runoff consisting of main rivers and WFD designated water courses, and therefore have a sensitivity value of medium. The magnitude of change will be **negligible** which is **negligible** significance and considered **not significant**. Furthermore, there are five water bodies, all of which are minor drains with an additional 22 standing water bodies that are not designated nor maintained by the IDB which therefore have a sensitivity value of low. In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** magnitude of change which is a **negligible** significance and considered **not significant**.

There may also be impacts from water abstraction from nearby watercourses to use onsite. Locations of potential abstractions have not yet been confirmed as they are subject to the findings of the ground investigation and the design of the appointed Contractor. Over abstraction from watercourses within the study area has the potential to result in downstream loss of water quantity leading reduced water quantity available for licensed/unlicensed surface water abstractions. Embedded mitigation includes permitting in agreement with appropriate regulator in accordance with the Catchment Abstraction Management Strategy. As such, the impact will result in a **negligible** magnitude of change to People, Property and Infrastructure which is low sensitivity, and considered **not significant**.

Impacts from haul road, accesses, and watercourse crossings on water resources

Numerous heavy vehicle movements on the haul road have the potential to temporarily mobilise soil, dust and pollutants (from fuel spills, oils, lubricants, wear from tyres and brakes) which would be captured in runoff on the road surface. At sufficient concentration this would lead to a reduction in water quality including effects that could result in the smothering or poisoning of animals and plants within local watercourses and standing water bodies. The impacts from runoff are predicted to be of local spatial extent, short term duration, intermittent occurrence and highly reversible. Embedded mitigation includes a layer of granular material along with geogrids to provide stability and minimise soil erosion from traffic. Silt management measures will be employed to reduce the risk of sediment runoff which will be included within the CEMP. Within Section 2, there are four watercourses within the study area which are a main river and WFD designated channels, which have a receptor sensitivity value of medium. In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** magnitude of change which is a **negligible** significance and considered **not significant**. Furthermore, there are five water bodies, all of which are minor drains with an additional 22 standing water bodies and numerous other minor drainage channels that are not designated nor maintained by the IDB which therefore have a sensitivity value of low. In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** magnitude of change which is a **negligible** significance and considered **not significant**.

Temporary culverts will be installed to cross the five ordinary watercourses. Culverting will result in straightening and hard banks of a section of channel (circa 6 m wide). In addition to the removal of bed substrate, this may also lead to changes in flow dynamics and patterns of erosion at the structure which will also impact the transfer of sediment downstream. It is expected a loss of velocity and reduced sediment transport will lead to material deposition upstream of culvert and material deficit and scour downstream of structure due to velocity increase through/off culvert. However, these channels are already straightened or modified and works will constitute a very small section of any overall water body. Therefore, impacts are expected to be negligible as they are highly localised.

The addition of culvert and hard banks will result in the direct loss of habitat within the bed and banks due to loss of natural substrate, and also prevent natural recolonisation while the structure is in place. The crossed channels are minor drains and not within 2 km upstream to a WFD water body and therefore considered to be **no impact** to flow or fish passage.

Embedded mitigation as discussed in Section 11.6.2 includes measures size to accommodate the natural water regime, with the temporary culvert sat at hard bed level and orientated with flows to limit obstruction and potential for scour. In some cases, temporary culverts may be sat above hard bed level, however this is limited to channels which are balanced systems with little flows so would be unlikely to be used by fish and eel. These will be determined on a case-by-case basis with the relevant stakeholder (EA, LLFA, IDB). All hard banks and bed added during construction will be temporary and the bankside will be returned to its original stabilised state after construction, including re-grading were required and re-vegetating/seeding to replace any lost habitat and vegetation or trees.

Within Section 2 there are five watercourses crossed with temporary culverts which are all minor drains. As such these have a sensitivity value of low. The magnitude of change will be **negligible** which is **negligible** significance and considered **not significant**.

Impacts from construction compounds (primary, secondary, and tertiary compounds) on water resources

Use of construction compounds by heavy machinery and storage of loose material could lead to an increase in soil erosion or increased sediment laden runoff from compacted ground entering nearby water bodies through existing surface water flow paths. Discharge of fine sediments will reduce light penetration of the water column and reduce dissolved oxygen by smothering aerating morphological features thus negatively impacting local fluvial geomorphology, ecological and physio-chemical water quality therefore causing a reduction in the WFD classification. The discharge could also contain spillages or leaks of fuels and oils, or other pollutants that could affect water bodies directly crossed or surrounding water features physico-chemical water quality elements. The impacts from runoff are predicted to be of local spatial extent, short term duration, intermittent occurrence and highly reversible. Embedded mitigation as discussed in Section 11.6.2 includes installation of a temporary drainage system to treat runoff from the site, in addition to bunded areas to prevent runoff of chemicals. The temporary drainage system would manage the quality and volume of water prior to its controlled discharge into nearby watercourses.

Within Section 2, there are no water features proposed to be crossed by a construction compound, however there are four water bodies which are main river or ordinary watercourses and therefore have a sensitivity value of medium. The magnitude of change will be **negligible** which is **negligible** significance and considered **not significant.** Furthermore, there are 31 water bodies within the study area, of which 22 are standing water bodies and five minor drainage channels that are not designated nor maintained by the IDB which therefore have a sensitivity value of low. In consideration of embedded mitigation, indirect runoff impacts would therefore result in a **negligible** magnitude of change which is a **negligible** significance and considered **not significant**.

There may also be impacts from water abstraction from nearby watercourses to use onsite. Locations of potential abstractions have not yet been confirmed as they are subject to the findings of the ground investigation and the design of the appointed Contractor. Over abstraction from watercourses within the study area has the potential to result in downstream loss of water quantity leading reduced water quantity available for licensed/unlicensed surface water abstractions. Embedded mitigation includes permitting in agreement with appropriate regulator in accordance with the Catchment Abstraction Management Strategy. As such, the impact will result in a **negligible** magnitude of change to People, Property and Infrastructure which is of low sensitivity, and considered **not significant**.

Impacts from outfall and headwall installations in watercourse banks

Outfall and headwall installations are primarily to the nearest ordinary watercourse or minor land drainage water feature and will convey discharges from construction within the working area and construction compounds. These installations will lead to a direct loss of natural banks leading to reduced bank roughness and potential for increased scour downstream of structures thereby negatively impacting fluvial geomorphology locally. Impacts would also result in a direct loss of bankside/riparian habitat in the immediate location of the structure. In addition, increased flow entering the channels collected as runoff, could lead to increased scour to channel banks and bed that would lead to additional fine sediment transferred downstream. Details of individual outfalls and headwall construction will take into account localised catchments and upstream conditions, as such embedded mitigation includes installation in-line of the bank to reduce the risk of turbulence and localised scour. Discharge will be with the direction of flow, ideally angled at 45° to the direction of flow. Outfalls will be sited to avoid any tree loss and avoid bank areas under existing scour. Installations will also be small, less than <300 mm. These impacts would be temporary for the duration of the construction phase only, as the bankside will be returned to its original state after drainage is no-longer required.

There are seven outfalls into watercourses with a receptor sensitivity value of low in Section 2. In consideration of embedded mitigation this would result in a **negligible** magnitude of change resulting in a **negligible** impact which would be **not significant**.

Impacts which may affect flood risk

Locations for any temporary culvert installation have not yet been confirmed with the scheme design, therefore this assessment has been completed on the assumption that installation will be included for watercourses and surface water flood paths caused by haul roads. There are five watercourses identified as proposed to be crossed by culverts in Section 2 of the English Onshore Scheme. The installation of temporary culverts may impact upon the existing flow regime and may cause an increase in flows with risk of flooding to the surrounding land. People property and infrastructure has a low sensitivity value. Magnitude of change is **low** resulting in a **negligible** impact which would be **not significant**.

The crossing of field drains, included in the five watercourses proposed to be crossed by the English Onshore Scheme in Section 2, could cause flow to back up on surrounding field drains and in turn increase risk to people, property and infrastructure flood risk receptors. These receptors are considered to have a sensitivity value of low. Embedded mitigation would result in a **low** magnitude of change resulting in a **negligible** impact which would be **not significant**.

Installation of the below ground DC cable has the potential to cause severance, disturbance, or blockage to the underground field/drainage infrastructure. Though data supplied by Yorkshire Water indicated that they had no records of sewers or drains in the near vicinity of Section 2 of the English Onshore Scheme. The sensitivity of these receptors is low. Embedded mitigation would result in a **low** magnitude of change, resulting in a **negligible** impact with would be **not significant**.

The English Onshore Scheme cable route does not intersect with areas of either Flood Zone 3 or 2 within Section 2. The sensitivity value of property, people and infrastructure at these crossings is low. Magnitude of change is **low** resulting in a **negligible** impact which would be **not significant**.

None of the proposed construction compounds overlap with areas identified as being Flood Zone 2 or 3. One of the proposed construction compounds; compound 11 is located partially in an area at high risk of surface water flooding. Two of the proposed construction compounds; compounds 9 and 12 are located in areas at low risk of surface water flooding. These compounds have a low sensitivity value, with embedded mitigation meaning magnitude of change is **negligible** resulting in a **negligible** impact which would be **not significant**.

None of the HDD pit locations, committed or with the potential to open cut watercourses are shown to be within areas of Flood Zone 3 or 2. Similarly none of the HDD pits are at risk of surface water flooding.

None of the proposed joint bays within section 2 are located within Flood Zone 2 or 3 or within areas of surface water risk.

11.6.3.3 Section 3 – Market Weighton to River Ouse

Impacts of open cut techniques on water resources

Construction via open cut techniques and associated machinery could lead to an increase in soil erosion leading to sediment laden runoff from the construction area, construction vehicles, and access roads. Discharge of fine sediments will reduce light penetration of the water column and reduce dissolved oxygen by smothering aerating morphological features. The discharge could also contain spillages or leaks of fuels and oils, or other pollutants that could affect water bodies directly crossed or surrounding water features physico-chemical water quality elements. The impacts from runoff are predicted to be of local spatial extent, short term duration, intermittent occurrence and highly reversible.

Embedded mitigation as discussed in Section 11.6.2 includes measures to ensure that incidental release of sediments or runoff is minimised and that surface water discharge is fully controlled in terms of water quality and volume before entering the receiving water feature. Within Section 3 there are seven water bodies proposed or potential to be crossed by open cut techniques, all of which are ordinary watercourses maintained by IDBs (Holme Main Drain, Black Dyke, Asselby Marsh Drain, Asselby Marsh Lane Drain, Seave Carr, Lowfield and Bank Field Drains) with an additional 21 water bodies within the study area which may be indirectly affected by runoff (due to open cut construction within their drainage catchments) consisting of main rivers, WFD designated water courses and IDB maintained channels, and therefore have a sensitivity value of medium. The magnitude of change will be **negligible** which is **negligible** significance and considered **not significant**. In addition, there are two receptors within the study area with a sensitivity value of high due to their status as SSSI (River Derwent SSSI and Black Dyke at Barn Hill Meadows SSSI). In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** magnitude of change which is a **negligible/minor** significance and considered **not significant**. Furthermore, there are 31 water bodies proposed to be crossed by open cut techniques, all of which are minor drains with an additional 44 standing water bodies and numerous other minor drainage channels that are not designated nor maintained by the IDB which therefore have a sensitivity value of low. In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** magnitude of change which is a **negligible** significance and considered **not significant**.

Open cut methodologies will also include flow bypasses by over-pumping at temporary dams which have the potential to obstruct fish and eel passage and also alter flow regime and limit sediment transport. Within Section 3 there are 38 watercourses proposed to be crossed by open cut techniques, all of which are ordinary watercourses or minor drains and are not designated WFD nor other statutory or non-statutory. Seven are IDB maintained ordinary watercourses and therefore have a sensitivity value of medium. However, these watercourses proposed to be crossed by open cut technique are all headwater channels that are part of WFD water body catchments and impacts therefore not directly to the WFD water bodies but may indirectly lead to temporary obstruction and loss of spawning habitats. Over-pumping will alter the flow regime and limit natural sediment transport for the duration of the works and may lead to depletion of coarse sediments downstream and aggradation upstream. Any impoundments will be temporary (approximately 10 days) and can be further mitigated by measures included in the CEMP (including but not limited to) using fish friendly pumps and ensuring over-pumping flow rates are sufficient to ensure no upstream hydrological regime changes. Impacts will be short term localised to these headwater and feeder channels and normal conditions will naturally recover once works are complete and the obstruction is removed. Therefore, obstruction of flows will constitute a **low** magnitude of change which is **minor** significance and considered **not significant**. The remaining 31 minor drains have a sensitivity value of low, resulting in a **low** magnitude of change which is **negligible** significance, and considered **not significant**.

Installation of the below ground cable within agricultural fields via open cut techniques has the potential to cause severance, disturbance, or blockage to the underground field/land drainage infrastructure. The sensitivity value of these receptors is low. Alteration of the drainage infrastructure has the potential to result in drying out or waterlogging of the agricultural fields. Embedded mitigation includes the addition of temporary diversions during works which may be required where under-drainage infrastructure is directly encountered. These diversions would be short term and only for the duration of the works at that particular site/field. The most appropriate method is to be proposed for each field and any works undertaken in agreement with the appropriate stakeholder. This will result in a **low** magnitude of change which is **negligible** significance and considered **not significant**.

There may also be impacts from water abstraction from nearby watercourses to use onsite. Locations of potential abstractions have not yet been confirmed as they are subject to the findings of the ground investigation and the design of the appointed Contractor. Over abstraction from watercourses within the study area has the potential to result in downstream loss of water quantity leading to habitat loss in surface water dependent habitat at River Derwent and Barn Hill Meadows at Black Dyke. In addition, reduced water quantity may be available for licensed/unlicensed surface water abstractions.

Embedded mitigation includes permitting in agreement with appropriate regulator in accordance with the Catchment Abstraction Management Strategy. As such, the impact will result in a **negligible** magnitude of change to People, Property and Infrastructure which is low sensitivity, and water dependent habitat which is high sensitivity, and therefore considered **not significant**.

Impacts from trenchless techniques on water resources

Within Section 3 there are 12 watercourses proposed to be crossed by trenchless techniques comprising two main rivers and six ordinary watercourses that are IDB maintained channels. Of these, three are also WFD designated. These are described in further detail within this section.

Trenchless techniques will avoid any direct effect on the structure of the watercourse by drilling beneath the bed. This would also eliminate any longer term affects to fluvial geomorphology as flows, movement of sediment and fish migration will be unaffected. However temporary compounds (including launch and receptor pits) would be required either side of the watercourses, in addition to construction vehicles and access roads nearby. These activities could lead to an increase in soil erosion resulting in sediment laden runoff. This discharge could also contain spillages or leaks of fuels and oils, or other pollutants that could affect nearby watercourses or standing water quality. Discharge of fine sediments will reduce light penetration of the water column and reduce dissolved oxygen by smothering aerating morphological features thus negatively impacting local fluvial geomorphology, ecological and physio-chemical water quality therefore causing a reduction in the WFD classification.

The impacts from runoff are predicted to be of local spatial extent, short term duration, intermittent occurrence and highly reversible. Embedded mitigation as discussed in Section 11.6.2 includes measures to ensure that incidental release of sediments or runoff is minimised and that surface water discharge is fully controlled in terms of water quality and volume before entering the receiving water feature. Permits would be obtained with agreement with the relevant regulatory stakeholder for depth of cable and distance of excavations from the watercourse edge.

Within Section 3, there are 12 watercourses proposed to be crossed by trenchless techniques of which two are main rivers (Back Delfin/Market Weighton Canal and River Ouse) that are also WFD designated, in addition to a further six ordinary watercourses that are IDB maintained channels (River Foulness, Egremont Drain, Dunns Drain, Featherbed Drain, Carr/Bishopsoil, and New Drain) of which only River Foulness is also WFD designated, and therefore have a sensitivity value of medium. There are also a further 14 water bodies within the study area which may be indirectly affected by runoff consisting of main river, WFD designated water courses and IDB maintained channels, and therefore have a sensitivity value of medium. In consideration of embedded mitigation, fluvial geomorphological and runoff impacts would therefore result in a **negligible** magnitude of change which is **negligible** significance and considered **not significant**. Within the study area there are two receptors with a sensitivity value of high due to SSSI designations (River Derwent and Barn Hill Meadows at Black Dyke). Downstream conveyance of runoff impacts, in consideration of embedded mitigation will have a **negligible** magnitude of change which is a **negligible/minor** significance and considered **not significant**. Furthermore, there are four water bodies proposed to be crossed by trenchless techniques, all of which are minor drains with an additional 44 standing water bodies and numerous other minor drainage channels that are not designated nor maintained by the IDB which therefore have a sensitivity value of low. In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** magnitude of change which is a **negligible** significance and considered **not significant**.

There may also be impacts from water abstraction from nearby watercourses to use onsite. Locations of potential abstractions have not yet been confirmed as they are subject to the findings of the ground investigation and the design of the appointed Contractor. Over abstraction from watercourses within the study area has the potential to result in downstream loss of water quantity leading to habitat loss in surface water dependent habitat at River Derwent and Barn Hill Meadows at Black Dyke. In addition, reduced water quantity may be available for licensed/unlicensed surface water abstractions.

Embedded mitigation includes permitting in agreement with appropriate regulator in accordance with the Catchment Abstraction Management Strategy. As such, the impact will result in a **negligible** magnitude of change to People, Property and Infrastructure which is low sensitivity, and water dependent habitat which is high sensitivity, and therefore considered **not significant**.

Impacts from haul road, accesses, and watercourse crossings on water resources

Numerous heavy vehicle movements on the haul road have the potential to temporarily mobilise soil, dust and pollutants (from fuel spills, oils, lubricants, wear from tyres and brakes) which would be captured in runoff on the road surface. At sufficient concentration this would lead to a reduction in water quality including effects that could result in the smothering or poisoning of animals and plants within local watercourses and standing water bodies. The impacts from runoff are predicted to be of local spatial extent, short term duration, intermittent occurrence and highly reversible. Embedded mitigation includes a layer of granular material along with geogrids to provide stability and minimise soil erosion from traffic. Silt management measures will be employed to reduce the risk of sediment runoff which will be included within the CEMP. Within Section 3, two receptors within the study area with a receptor sensitivity value of high due to their status as a SSSI including River Derwent and Barn Hill Meadows at Black Dyke which are water dependent habitats. In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** magnitude of change which is a **negligible/minor** significance and considered **not significant**. In addition, there are 16 water bodies which are main river, WFD designated and/or IDB maintained channels with a sensitivity value of medium. There are also a further 10 water bodies within the study area which may be indirectly affected by runoff consisting of main rivers, WFD designated water courses and IDB maintained channels, and therefore have a sensitivity value of medium. The magnitude of change will be **negligible** which is **negligible** significance and considered **not significant**. Furthermore, there are 35 water bodies, all of which are minor drains with an additional 44 standing water bodies and numerous other minor drainage channels that are not designated nor maintained by the IDB which therefore have a sensitivity value of low. In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** impact which is a **negligible** significance and considered **not significant**.

River Foulness and Back Delfin/Market Weighton Canal are proposed to be crossed by a temporary bridge. The bridge structures have potential to create a narrowing or constriction of flows during flood flows. Their final designs are to be developed by the appointed contractor, however will include measures to reduce or eliminate these impacts including clear-span, with soffit above surrounding bank levels. Loss of morphological features is avoided by design by avoiding in-channel supports. The addition of the bridge structure in a location suffering from scour will force additional load onto banks which has the potential to exacerbate destabilisation and bank collapse. Equally, locating the structure on a meander bend may lead to flows directed towards the supports. This may exacerbate fine sediment delivery in the short term into the channel as banks may be destabilised leading to bed structure and substrate changes locally from smothering of bed and morphological features downstream. The precise location for bridge crossings are to be designed by the appointed Contractor and in consultation with the relevant stakeholder, and will be situated to avoid areas of scour and be perpendicular to flow thereby avoiding impacts.

Construction of the bridge structures have potential for disturbance to channel bed and bank, loss of riparian and marginal vegetation resulting in loss of invertebrate and fish spawning habitat. However, the design of the bridge is such that it will be clear span without bed or bank reinforcement. Temporary bridges were selected over temporary culvert installations so as to avoid any in-channel impacts. Any loss of vegetation on banks will be minimal as placement will be considered to avoid losses within the limit of deviation, in particular bridges will avoid tree loss where possible. In addition, there is potential for shading due to the span of the bridge structure across the channels. By design, the bridge structures are narrow and sat above bank tops therefore any shading will be minimal and move throughout the day.

In consideration of the embedded mitigation, impacts from temporary bridges will result in a **negligible** magnitude of change. The sensitivity value of the receptors is medium, resulting in a **negligible** significance which is **not significant**.

Where temporary bridge crossings are not used, temporary culverts will be installed to cross watercourses. Culverting will result in straightening and hard banks of a section of channel (approximately 6 m wide). In addition to the removal of bed substrate, this may also lead to changes in flow dynamics and patterns of erosion at the structure which will also impact the transfer of sediment downstream. It is expected a loss of velocity and reduced sediment transport will lead to material deposition upstream of culvert structure and material deficit and scour downstream of structure due to velocity increase through/off culvert. However, these channels are already straightened or modified for drainage and works will constitute a very small section of any overall water body. Therefore, impacts are expected to be minor and localised.

The addition of culvert and hard banks will result in the direct loss of habitat within the bed and banks due to loss of natural substrate, and also prevent natural recolonisation while the structure is in place. Although these works will not be undertaken directly on any water bodies designated under the WFD, these will be undertaken on headwater or feeder channels. This may result in loss of fish spawning habitats.

During construction, any tree loss may exacerbate fine sediment delivery in the short term into the channel as banks may be destabilised leading to bed structure and substrate changes locally from smothering of bed and morphological features downstream. Post construction, banks would be stabilised which will eliminate these effects.

Embedded mitigation as discussed in Section 11.6.2 includes measures size to accommodate the natural water regime, with the culvert sat at hard bed level and orientated with flows to limit obstruction and potential for scour. These will allow free passage for fish and eels and be sited to avoid spawning habitat/morphological features where present. In some cases, temporary culverts may be sat above hard bed level, however this is limited to channels which are balanced systems with little flows so would be unlikely to be used by fish and eel. These will be determined on a case-by-case basis with the relevant stakeholder (EA, LLFA, IDB). All hard banks and bed added during construction will be temporary and the bankside will be returned to its original stabilised state after construction, including re-grading were required and re-vegetating/seeding to replace any lost habitat and vegetation or trees.

Within Section 3 there are 10 watercourses crossed with temporary culverts which are all ordinary watercourses maintained by the IDB and form part of the headwaters or drain within the catchment of designated WFD water bodies. As such these have a sensitivity value of medium. The magnitude of change will be **negligible** which is **negligible** significance and considered **not significant**.

Impacts from construction compounds (primary, secondary, and tertiary compounds) on water resources

Use of construction compounds by heavy machinery and storage of loose material could lead to an increase in soil erosion or increased sediment laden runoff from compacted ground entering nearby water bodies through existing surface water flow paths. Discharge of fine sediments will reduce light penetration of the water column and reduce dissolved oxygen by smothering aerating morphological features thus negatively impacting local fluvial geomorphology, ecological and physio-chemical water quality therefore causing a reduction in the WFD classification. The discharge could also contain spillages or leaks of fuels and oils, or other pollutants that could affect water bodies directly crossed or surrounding water features physico-chemical water quality elements. The impacts from runoff are predicted to be of local spatial extent, short term duration, intermittent occurrence and highly reversible. Embedded mitigation as discussed in Section 11.6.2 includes installation of a temporary drainage system to treat runoff from the site, in addition to bunded areas to prevent runoff of chemicals. The temporary drainage system would manage the quality and volume of water prior to its controlled discharge into nearby watercourses.

Within Section 3, there are no water features proposed to be crossed by a construction compound, however there are four within a 250 m hydraulic link and impacts of runoff would be direct. These four water bodies are main river Back Delfin/Market Weighton Canal and Black Dyke, New Drain and River Foulness ordinary watercourses maintained by the IDB and/or WFD designated and therefore have a sensitivity value of medium. In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** magnitude of change which is **negligible** significance and considered **not significant.** In addition, there are two water features within the 2 km study area with a receptor sensitivity value of high due to their status as SSSI including River Derwent and Barn Hill Meadows at Black Dyke. In consideration of embedded mitigation, runoff impacts would therefore result in a

negligible impact which is a **negligible/minor** significance and considered **not significant**. Furthermore, there are 89 water bodies within the study area, of which 44 are standing water bodies and 35 minor drainage channels that are not designated nor maintained by the IDB which therefore have a sensitivity value of low. In consideration of embedded mitigation, indirect runoff impacts would therefore result in a **negligible** magnitude of change which is a **negligible** significance and considered **not significant**.

There may also be impacts from water abstraction from nearby watercourses to use onsite. Locations of potential abstractions have not yet been confirmed as they are subject to the findings of the ground investigation and the design of the appointed Contractor. Over abstraction from watercourses within the study area has the potential to result in downstream loss of water quantity leading to habitat loss in main river Back Delfin/Market Weighton Canal, and WFD water body River Foulness, which are considered medium sensitivity. In addition, reduced water quantity may be available for licensed/unlicensed surface water abstractions. Embedded mitigation includes permitting in agreement with appropriate regulator in accordance with the Catchment Abstraction Management Strategy. As such, the impact will result in a **negligible** magnitude of change to People, Property and Infrastructure which is low sensitivity, and WFD water bodies which is medium sensitivity, and therefore considered **not significant**.

There may also be impacts from water abstraction from nearby watercourses to use onsite. Locations of potential abstractions have not yet been confirmed as they are subject to the findings of the ground investigation and the design of the appointed Contractor. Over abstraction from watercourses within the study area has the potential to result in downstream loss of water quantity leading to habitat loss in surface water dependent habitat at River Derwent and Barn Hill Meadows at Black Dyke. In addition, reduced water quantity may be available for licensed/unlicensed surface water abstractions. Embedded mitigation includes permitting in agreement with appropriate regulator in accordance with the Catchment Abstraction Management Strategy. As such, the impact will result in a **negligible/minor** magnitude of change to People, Property and Infrastructure which is low sensitivity, and water dependent habitat which is high sensitivity, and therefore considered **not significant**.

Impacts from outfall and headwall installations in watercourse banks

Outfall and headwall installations are primarily to the nearest ordinary watercourse or minor land drainage water feature and will convey discharges from construction within the working area and construction compounds. These installations will lead to a direct loss of natural banks leading to reduced bank roughness and potential for increased scour downstream of structures thereby negatively impacting fluvial geomorphology locally. Impacts would also result in a direct loss of bankside/riparian habitat in the immediate location of the structure. In addition, increased flow entering the channels collected as runoff, could lead to increased scour to channel banks and bed that would lead to additional fine sediment transferred downstream. Details of individual outfalls and headwall construction will take into account localised catchments and upstream conditions, as such embedded mitigation includes installation in-line of the bank to reduce the risk of turbulence and localised scour. Discharge will be with the direction of flow, ideally angled at 45° to the direction of flow. Outfalls will be sited to avoid any tree loss and avoid bank areas under existing scour. Installations will also be small, less than <300 mm. These impacts would be temporary for the duration of the construction phase only, as the bankside will be returned to its original state after drainage is no-longer required.

There are 13 outfalls entering seven water bodies with a receptor sensitivity value of medium. Two of these water bodies are designated WFD (Back Delfin/Market Weighton Canal and River Foulness), and the remaining 11 are IDB maintained watercourses. In consideration of embedded mitigation, this would result in a **negligible** magnitude of change resulting in a **negligible** impact which is considered **not significant**.

In addition, there are 53 outfalls into watercourses with a receptor sensitivity value of low in Section 3. These have potential to convey fluvial geomorphological impact downstream to more sensitive water bodies. In consideration of embedded mitigation, this would limit any impacts at source and therefore result in a **negligible** magnitude of change resulting in a **negligible** impact which would be **not significant**.

Impacts which may affect flood risk

Locations for any temporary culvert installation have not yet been confirmed with the scheme design, therefore this assessment has been completed on the assumption that installation will be included for watercourses and surface water flood paths caused by haul roads. There are 45 watercourses proposed as being crossed by culverts in Section 3. The installation of temporary culverts may impact upon the existing flow regime and may cause an increase in flows with risk of flooding to the surrounding land. People property and infrastructure has a low sensitivity value. Embedded mitigation means magnitude of change is **low** resulting in a **negligible** impact which would be **not significant**.

There are two proposed temporary bridge crossings of watercourses within Section 3. Currently exact locations of these watercourse crossings are not able to be provided though the structures will be placed within the planning application boundary. These temporary bridge crossings have the potential to impact on existing flow regimes and thus cause flooding to surrounding land. These areas of within the extent of Flood Zone 3 with one also being within areas of flow surface water risk. Flood risk receptors have a sensitivity of medium. Embedded mitigation would mean magnitude of change is **low** resulting in a **negligible** impact which would be **not significant**.

The crossing of field drains, included in the 50 watercourses crossed by the English Onshore Scheme in Section 3, could cause flow to back up on surrounding field rains and in turn increase risk to people, property and infrastructure flood risk receptors. These receptors are considered to have a sensitivity value of low. Embedded mitigation would result in a **low** magnitude of change resulting in a **negligible** impact which would be **not significant**.

Installation of the below ground DC cable has the potential to cause severance, disturbance, or blockage to the underground field/drainage infrastructure. Though data supplied by Yorkshire Water indicated that they had no records of sewers or drains in the near vicinity of the English Onshore Scheme in Section 3. The sensitivity of these receptors is low. Embedded mitigation would result in a **low** magnitude of change, resulting in a **negligible** impact with would be **not significant**.

The English Onshore Scheme cable route intersects with areas of Flood Zone 3 at 14 locations within Section 3, approximate lengths of intersection are 65 m, 527 m, 8 m, 330 m, 340 m, 145 m, 325 m, 860 m, 127 m, 2.1 km, 95 m, 30 m, 1.5 km and 2.2 km. These intersections are located within predominantly rural areas away from major population centres though there are isolated farms within near proximity to these crossings. The intersections are, in some locations, extensive and include the width of the planning application boundary. People, property and infrastructure has a medium sensitivity value here, with embedded mitigation meaning magnitude of change is **low** here resulting in a **negligible** impact which would be **not significant**.

One of the proposed construction compounds, compound 13 is partially within Flood Zone 3. Compound 14 is located in Flood Zone 2. All other proposed compounds in this Section are entirely outside of Flood Zones. Both of these compounds and compound 15 are also partially within areas at low risk of surface water flooding, meaning that these locations are at potential risk of flooding. Additionally compound 13, 16 and 17 are also within the maximum extents for Environment Agency “wet day” reservoir inundation flood mapping, which assumes a worst case scenario of reservoirs failing on a “wet day” when local rivers had already overflowed their banks. The data represents a credible worst case scenario, however it is unlikely that any flood would be as large as shown and the data gives no indication of likelihood or probability of such an occurrence. These compounds have a low sensitivity value, with embedded mitigation meaning magnitude of change is **negligible** resulting in a **negligible** impact which would be **not significant**.

Six of the committed HDD pit locations are located in Flood Zone 3; the exit pit of HDD 27, the entry and exit pits of HDD 30, the entry pit of HDD 31, and the entry pit of HDD 41. Three committed HDD pit locations are located in Flood Zone 2; the entry pit of HDD 27 and the entry and exit pit of HDD 34. Additionally, one of the committed HDD pit locations; the entry pit of HDD 30 at medium risk of surface water flooding. Three committed HDD pits are at low risk of surface water flooding; the entry pit of HDD 30 and the entry and exit pits of HDD 34. Additionally, eleven of the committed HDD pit locations are shown to be at risk of flooding from “wet day” reservoir failure. These are the entry and exit pits of HDD 27, HDD 30, HDD 32, HDD 34 and HDD 38 as well as the entry pit of HDD 4. The maximum sensitivity values of the HDD pits are medium. With embedded mitigation magnitude of change is **low** resulting in a **negligible** impact which would be **not significant**.

Eight of the HDD pit locations with the potential to open cut watercourses are located in areas of Flood Zone 3; the entry and exit pits of HDD 29, HDD 37, HDD 39 and HDD 40. Similarly, four of these type of HDD pit locations are in Flood Zone 2; the exit pit of 28, the entry and pits of HDD 33 and the entry pit of HDD 35. Additionally, two of these type of HDD pit locations I areas at low risk of surface water flooding; the entry pits of HDD 28 and HDD 39. Additionally, ten of these type of HDD pit locations are shown to be at risk of flooding from "wet day" reservoir failure. These are; the entry and exit pits of HDD 33, HDD 35, HDD 37, HDD 39 and HDD 40. The maximum sensitivity values of the HDD pits are medium. With embedded mitigation magnitude of change is **low** resulting in a **negligible** impact which would be **not significant**.

Seven of the proposed joint bays within Section 3 are located within Flood Zone 3 with three within Flood Zone 2. Additionally, two of the bays are within areas of low surface water. Seven of the joint bays are located in areas at risk of flooding due to reservoir failure. The location of these joint bays is to be finalised at the detailed design stage and so the locations currently given are only indicative of their location. As the infrastructure of these joint bays is to be buried; with soil and grass placed on the concrete pad, the sensitivity value is low. With embedded mitigation meaning magnitude of change is **low** resulting in a **negligible** impact which would be **not significant**.

11.6.3.4 Section 4 – River Ouse to Drax Substation

Impacts of open cut techniques on water resources

Construction via open cut techniques and associated machinery could lead to an increase in soil erosion leading to sediment laden runoff from the construction area, construction vehicles, and access roads. Discharge of fine sediments will reduce light penetration of the water column and reduce dissolved oxygen by smothering aerating morphological features. The discharge could also contain spillages or leaks of fuels and oils, or other pollutants that could affect water bodies directly crossed or surrounding water features physico-chemical water quality elements. The impacts from runoff are predicted to be of local spatial extent, short term duration, intermittent occurrence and highly reversible.

Embedded mitigation as discussed in Section 11.6.2 includes measures to ensure that incidental release of sediments or runoff is minimised and that surface water discharge is fully controlled in terms of water quality and volume before entering the receiving water feature. Within Section 4 there are three water bodies crossed by open cut techniques which are ordinary watercourses maintained by IDBs with an additional 43 water bodies within the study area which may be indirectly affected by runoff (due to open cut construction within their drainage catchments) consisting of main rivers, WFD designated water courses and IDB maintained channels, and therefore have a sensitivity value of medium. The magnitude of change will be **negligible** which is **negligible** significance and considered **not significant**. Furthermore, there is one water body crossed by open cut techniques, which is a minor drain, with an additional 9 standing water bodies and numerous other minor drainage channels that are not designated nor maintained by the IDB which therefore have a sensitivity value of low. In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** impact which is a **negligible** significance and considered **not significant**.

Open cut methodologies will also include flow bypasses by over-pumping at temporary dams which have the potential to obstruct fish and eel passage and also alter flow regime and limit sediment transport. Within Section 4 there are four watercourses crossed by open cut or ducting techniques, all of which are ordinary watercourses or minor drains and are not designated WFD nor other statutory or non-statutory. Three are IDB maintained ordinary watercourses and therefore have a sensitivity value of medium. Although these works will not be undertaken directly on any water bodies designated under the WFD, these will be undertaken on headwater or feeder channels and may indirectly lead to temporary obstruction and loss of spawning habitats. Over-pumping will alter the flow regime and limit natural sediment transport for the duration of the works and may lead to depletion of coarse sediments downstream and aggradation upstream. Any impoundments will be temporary (approximately 10 days) and can be further mitigated by measures included in the CEMP (including but not limited to) using fish friendly pumps and ensuring over-pumping flow rates are sufficient to ensure no upstream hydrological regime changes. Impacts will be short term localised to these headwater and feeder channels and normal conditions will naturally recover once works are complete and the obstruction is removed. Therefore obstruction of flows will constitute a **low** magnitude of change which is **minor** significance and considered **not significant**. The remaining drain has a sensitivity value of low, resulting in a **low** magnitude of change which is **negligible** significance, and considered **not significant**.

Installation of the below ground DC cable within agricultural land via open cut techniques has the potential to cause severance, disturbance, or blockage to the underground field/land drainage infrastructure. The sensitivity value of these receptors is low. Alteration of the drainage infrastructure has the potential to result in drying out or waterlogging of the agricultural fields. Embedded mitigation includes the addition of temporary diversions during works which may be required where under-drainage infrastructure is directly encountered. These diversions would be short term and only for the duration of the works at that particular site/field. The most appropriate method is to be proposed for each field and any works undertaken in agreement with the appropriate stakeholder. This will result in a **low** impact which is **negligible** significance and considered **not significant**.

There may also be impacts from water abstraction from nearby watercourses to use onsite. Locations of potential abstractions have not yet been confirmed as they are subject to the findings of the ground investigation and the design of the appointed Contractor. Over abstraction from watercourses within the study area has the potential to result in downstream loss of water quantity leading to reduced water quantity may be available for licensed/unlicensed surface water abstractions. Embedded mitigation includes permitting in agreement with the appropriate regulator in accordance with the Catchment Abstraction Management Strategy. As such, the impact will result in a **negligible** magnitude of change to People, Property and Infrastructure which is low sensitivity and considered **not significant**.

Impacts from Trenchless Techniques on water resources

Within Section 4, there are two watercourses proposed to be crossed by trenchless techniques of which one is main river (River Ouse) and is also WFD designated, in addition to Back Lane Drain ordinary watercourses that is IDB maintained channel with a sensitivity value of medium.

Trenchless techniques will avoid any direct effect on the structure of the watercourse by drilling beneath the bed. This would also eliminate any longer term affects to fluvial geomorphology as flows, movement of sediment and fish migration will be unaffected. However temporary compounds (including launch and receptor pits) would be required either side of the watercourses, in addition to construction vehicles and access roads nearby. These activities could lead to an increase in soil erosion resulting in sediment laden runoff. This discharge could also contain spillages or leaks of fuels and oils, or other pollutants that could affect nearby watercourses or standing water quality. Discharge of fine sediments will reduce light penetration of the water column and reduce dissolved oxygen by smothering aerating morphological features thus negatively impacting local fluvial geomorphology, ecological and physio-chemical water quality therefore causing a reduction in the WFD classification.

The impacts from runoff are predicted to be of local spatial extent, short term duration, intermittent occurrence and highly reversible. Embedded mitigation as discussed in Section 11.6.2 includes measures to ensure that incidental release of sediments or runoff is minimised and that surface water discharge is fully controlled in terms of water quality and volume before entering the receiving water feature. Permits would be obtained with agreement with the relevant regulatory stakeholder for depth of cable and distance of excavations from the watercourse edge.

There are also a further 43 water bodies within the study area which may be indirectly affected by runoff consisting of main river, WFD designated water courses and IDB maintained channels, and therefore have a sensitivity value of medium. In consideration of embedded mitigation, fluvial geomorphological and runoff impacts would therefore result in a **negligible** magnitude of change which is **negligible** significance and considered **not significant**. Furthermore, there are an additional 44 standing water bodies and numerous other minor drainage channels that are not designated nor maintained by the IDB which therefore have a sensitivity value of low. In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** impact which is a **negligible** significance and considered **not significant**.

There may also be impacts from water abstraction from nearby watercourses to use onsite. Locations of potential abstractions have not yet been confirmed as they are subject to the findings of the ground investigation and the design of the appointed Contractor. Over abstraction from watercourses within the study area has the potential to result in downstream loss of water quantity leading to reduced water quantity may be available for licensed/unlicensed surface water abstractions. Embedded mitigation includes permitting in agreement with appropriate regulator in accordance with the Catchment Abstraction Management Strategy. As such, the impact will result in a **negligible** magnitude of change to People, Property and Infrastructure, which is low sensitivity, and considered **not significant**.

Impacts from haul road, accesses, and watercourse crossings on water resources

Numerous heavy vehicle movements on the haul road have the potential to temporarily mobilise soil, dust and pollutants (from fuel spills, oils, lubricants, wear from tyres and brakes) which would be captured in runoff on the road surface. At sufficient concentration this would lead to a reduction in water quality including effects that could result in the smothering or poisoning of animals and plants within local watercourses and standing water bodies. The impacts from runoff are predicted to be of local spatial extent, short term duration, intermittent occurrence and highly reversible. Embedded mitigation includes a layer of granular material along with geogrids to provide stability and minimise soil erosion from traffic. Silt management measures will be employed to reduce the risk of sediment runoff which will be included within the CEMP. Within Section 4, 46 water features within the study area which are a main river or IDB maintained channels with a receptor sensitivity value of medium. In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** impact which is a **negligible** significance and considered **not significant**. Furthermore, there are nine standing water bodies and numerous other minor drainage channels that are not designated nor maintained by the IDB which therefore have a sensitivity value of low. In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** impact which is a **negligible** significance and considered **not significant**.

Culverts will be installed to cross the four ordinary watercourses. Culverting will result in straightening and hard banks of a section of channel (circa 6 m wide). In addition to the removal of bed substrate, this may also lead to changes in flow dynamics and patterns of erosion at the structure which will also impact the transfer of sediment downstream. It is expected a loss of velocity and reduced sediment transport will lead to material deposition upstream of culvert and material deficit and scour downstream of structure due to velocity increase through/off culvert. However, these channels are already straightened or modified for drainage and works will constitute a very small section of any overall water body. Therefore, impacts are expected to be minor and localised.

The addition of culvert and hard banks will result in the direct loss of habitat within the bed and banks due to loss of natural substrate, and also prevent natural recolonisation while the structure is in place. This may result in loss of fish spawning habitats and therefore impacts may also be to downstream WFD water bodies as a result of this loss.

During construction, any tree loss may exacerbate fine sediment delivery in the short term into the channel as banks may be destabilised leading to bed structure and substrate changes locally from smothering of bed and morphological features downstream. Post construction, banks would be stabilised which will eliminate these effects.

Embedded mitigation as discussed in Section 11.6.2 includes measures size to accommodate the natural water regime, with the temporary culvert sat at hard bed level and orientated with flows to limit obstruction and potential for scour. These will allow free passage for fish and eels and be sited to avoid spawning habitat/morphological features where present. In some cases, temporary culverts may be sat above hard bed level, however this is limited to channels which are balanced systems with little flows so would be unlikely to be used by fish and eel. These will be determined on a case-by-case basis with the relevant stakeholder (EA, LLFA, IDB). All hard banks and bed added during construction will be temporary and the bankside will be returned to its original stabilised state after construction, including re-grading were required and re-vegetating/seeding to replace any lost habitat and vegetation or trees.

Within Section 4 there are three watercourses crossed with temporary culverts which are all ordinary watercourses maintained by the IDB and form part of the headwaters or drain within the catchment of designated WFD water body River Ouse. As such these have a sensitivity value of medium. The impact will be **negligible** which is **negligible** significance and considered **not significant**.

Impacts from construction compounds on water resources

Use of construction compounds by heavy machinery and storage of loose material could lead to an increase in soil erosion or increased sediment laden runoff from compacted ground entering nearby water bodies through existing surface water flow paths. Discharge of fine sediments will reduce light penetration of the water column and reduce dissolved oxygen by smothering aerating morphological features thus negatively impacting local fluvial geomorphology, ecological and physio-chemical water quality therefore causing a reduction in the WFD classification. The discharge could also contain spillages or leaks of fuels and oils, or other pollutants that could affect water bodies directly crossed or surrounding water features physico-chemical water quality elements. The impacts from runoff are predicted to be of local spatial extent, short term duration, intermittent occurrence and highly reversible. Embedded mitigation as discussed in Section 11.6.2 includes installation of a temporary drainage system to treat runoff from the site, in addition to bunded areas to prevent runoff of chemicals. The temporary drainage system would manage the quality and volume of water prior to its controlled discharge into nearby watercourses.

Within Section 4, there are no water features directly crossed by a construction compound, however there are five within a 250 m hydraulic link and impacts of runoff would be direct. These five water bodies are the River Ouse (main river) and four ordinary watercourses maintained by the IDB (Black Tom Drain, Unnamed drains and Back Lane Drain) and therefore have a sensitivity value of medium. In addition, there are also a further 41 water bodies in the study area that are also maintained by the IDB and have a sensitivity value of low. In consideration of embedded mitigation, runoff impacts would therefore result in a **negligible** impact which is **negligible** significance and considered **not significant.** Furthermore, there are 10 water bodies within the study area, of which nine are standing water bodies and one minor drainage channels that are not designated nor maintained by the IDB which therefore have a sensitivity value of low. In consideration of embedded mitigation, indirect runoff impacts would therefore result in a **negligible** impact which is a **negligible** significance and considered **not significant**.

There may also be impacts from water abstraction from nearby watercourses to use onsite. Locations of potential abstractions have not yet been confirmed as they are subject to the findings of the ground investigation and the design of the appointed Contractor. Over abstraction from watercourses within the study area has the potential to result in downstream loss of water quantity leading to reduced water quantity may be available for licensed/unlicensed surface water abstractions. Embedded mitigation includes permitting in agreement with appropriate regulator in accordance with the Catchment Abstraction Management Strategy. As such, the impact will result in a **negligible** magnitude of change to People, Property and Infrastructure, which is low sensitivity, and considered **not significant**.

Impacts from outfall and headwall installations in watercourse banks

Outfall and headwall installations are primarily to the nearest ordinary watercourse or minor land drainage water feature and will convey discharges from construction within the working area and construction compounds. These installations will lead to a direct loss of natural banks leading to reduced bank roughness and potential for increased scour downstream of structures thereby negatively impacting fluvial geomorphology locally. Impacts would also result in a direct loss of bankside/riparian habitat in the immediate location of the structure. In addition, increased flow entering the channels collected as runoff, could lead to increased scour to channel banks and bed that would lead to additional fine sediment transferred downstream. Details of individual outfalls and headwall construction will take into account localised catchments and upstream conditions, as such embedded mitigation includes installation in-line of the bank to reduce the risk of turbulence and localised scour. Discharge will be with the direction of flow, ideally angled at 45° to the direction of flow. Outfalls will be sited to avoid any tree loss where possible and avoid bank areas under existing scour. Installations will also be small, less than <300 mm. These impacts would be temporary for the duration of the construction phase only, as the bankside will be returned to its original state after drainage is no-longer required.

There are six outfalls entering six water bodies with a receptor sensitivity value of medium. One of these is main river and designated WFD (River Ouse), and the remaining five are IDB maintained watercourses. In consideration of embedded mitigation, this would result in a **negligible** magnitude of change resulting in a **negligible** impact which is considered **not significant**.

Impacts from installation of the converter station

Runoff from construction of the converter station and associated machinery on the construction site could lead to an increase in sediment laden runoff from the construction area, construction vehicles, temporary compounds, and access roads entering nearby water bodies through existing surface water flow paths. Discharge of fine sediments will reduce light penetration of the water column and reduce dissolved oxygen by smothering aerating morphological features thus negatively impacting local fluvial geomorphology, ecological and physio-chemical water quality therefore causing a reduction in the WFD classification. The discharge could also contain spillages or leaks of fuels and oils, or other pollutants that could affect water features physico-chemical water quality elements. At sufficient concentration, pollution will result in reduced water quality within local watercourses and standing water bodies.

Embedded mitigation will include a surface water management plan which will manage runoff volume and treat sediment and pollutant laden surface water. The temporary drainage system would manage the quality and volume of water prior to its controlled discharge into nearby watercourses.

Back Lane Drain is the receiving watercourse, which is an IDB maintained drain and therefore of medium sensitivity. In consideration of embedded mitigation, this would result in a **negligible** of impact resulting in **negligible** significance which is considered **not significant**.

Impacts which may affect flood risk

Locations for any temporary culvert installation have not yet been confirmed with the scheme design, therefore this assessment has been completed on the assumption that installation will be included for watercourses and surface water flood paths crossed by haul roads. There are six watercourses, including one main river (River Ouse), crossed by Section 4 of the English Onshore Scheme, however the River Ouse will not be crossed by the haul road. The installation of temporary culverts may impact upon the existing flow regime and may cause an increase in flows with risk of flooding to the surrounding land. People property and infrastructure has a low sensitivity value. Magnitude of change is **low** resulting in a negligible impact which would be **not significant**.

The crossing of field drains, included in the six watercourses crossed by Section 4 of the English Onshore Scheme, could cause flow to back up on surrounding field rains and in turn increase risk to people, property and infrastructure flood risk receptors. These receptors are considered to have a sensitivity value of low. Embedded mitigation would result in a **low** magnitude of change resulting in a **negligible** impact which would be **not significant**.

Installation of the below ground cable (both AC and DC) has the potential to cause severance, disturbance, or blockage to the underground field/drainage infrastructure. Though data supplied by Yorkshire Water indicated that they had no records of sewers or drains in the near vicinity of Section 4 of the English Onshore Scheme. The sensitivity of these receptors is low. Embedded mitigation would result in a **low** magnitude of change, resulting in a **negligible** impact with would be **not significant**.

The English Onshore Scheme cable route within Section 4 is entirely within Flood Zone 3. The cable passes through rural areas of land. The sensitivity value of property, people and infrastructure at these crossings is medium. With embedded mitigation meaning magnitude of change is **low** resulting in a **negligible** impact which would be **not significant**.

Both of the proposed construction compounds; compounds 18 and 19 are within Flood Zone 3 It is not possible to locate these particular compounds in an alternative location at lower risk of flooding. Additionally, this location benefits from the presence of flood defences. Compound 18 also partially overlaps an area at low risk of surface water flooding. Similarly, both compounds are shown to be at risk of flooding due to reservoir failure. These compounds have a low sensitivity value, with embedded mitigation meaning magnitude of change is **negligible** resulting in a **negligible** impact which would be **not significant**.

All five of the proposed HDD pit locations, both committed and potential to open cut watercourses included in Section 4 are wholly within Flood Zone 3. The exit pit of HDD 41 is also at low risk of surface water flooding. Similarly all HDD pit locations are at risk of flooding from reservoir failure. The maximum sensitivity values of the HDD pits is medium. With embedded mitigation magnitude of change is **low** resulting in a **negligible** impact which would be **not significant**.

The single proposed joint bay within Section 4 is located within both Flood Zone 3 and areas of low surface water risk, as well as being at risk of flooding due to reservoir failure. The location of these joint bays is to be finalised at the detailed design stage and so the locations currently given are only indicative of their location. As the infrastructure of these joint bays is to be buried; with soil and grass placed on the concrete pad, the sensitivity value is low. With embedded mitigation meaning magnitude of change is **low** resulting in a **negligible** impact which would be **not significant**.

11.6.4 Assessment of Potential Impacts: Operational Phase

This section of the report considers the potential effects that the operation of the English Onshore Scheme could have on the water environment. The main potential impact relating to operation is increased surface water runoff through increases in impermeable or compacted areas resulting from the converter station in Section 4. Otherwise, there are no anticipated effects during normal operation of the underground cable. Any repair or maintenance activities required during the operational life of the underground cable will result in impacts similar to those identified during construction but limited to the area of works.

11.6.4.1 Section 4 – River Ouse to Drax Substation

Impacts from the converter station to water quality

The converter station and associated access roads will increase the hardstanding in the area, impacting local receptors through an increase in runoff. Runoff may lead to increased sedimentation, and pollution entering the watercourses. Discharge of fine sediments will reduce light penetration of the water column and reduce dissolved oxygen by smothering aerating morphological features thus negatively impacting local fluvial geomorphology, ecological and physio-chemical water quality. The discharge could also contain spillages or leaks of fuels and oils, or other pollutants that could affect water bodies directly crossed or surrounding water features physico-chemical water quality elements. At sufficient concentration, pollution will result in reduced water quality within local watercourses and standing water bodies. Embedded mitigation will include a drainage strategy which will manage runoff volume and treat sediment and pollutant laden surface water. In addition, the platform will be partially permeable as stone chippings will be used as a base layer in some areas which will provide some mitigation through storage and filtration. Final layout and discharge rate is to be agreed with the LLFA and IDB.

Unnamed minor drainage channel of Back Lane Drain and Carr Lane Drain are the receiving waterbodies to this discharge and are IDB maintained drains and therefore have a medium sensitivity value. In consideration of embedded mitigation, runoff would result in a **negligible** magnitude of change resulting in **negligible** significance which will be **not significant**.

Impacts which may affect flood risk

Following the installation of the buried cables, no impacts on flood risk and people, property and infrastructure are anticipated. See **Appendix 11B** Flood Risk Assessment for further information.

The proposed converter station is within the modelled fluvial flood extents from nearby watercourses and is currently located within Flood Zone 3. Proposed ground raising at this location has the potential to increase risk elsewhere due to the fluvial source of flood risk to the converter station. The sensitivity of the receptor is medium. With embedded mitigation the magnitude of change is **low** resulting in a **negligible** impact which may be considered **not significant**.

The change in ground topography around the proposed converter station may affect the existing surface water pathways and areas of pooling thereby impacting on the existing level of surface water risk. With embedded mitigation the magnitude of change is **low** resulting in a **negligible** impact which may be considered **not significant**.

11.6.5 Assessment of Potential Impacts: Decommissioning Phase

The scale and nature of activities undertaken during decommissioning would be similar to those described previously for construction, and they would be temporary during the period of decommissioning activities on site. Following the removal of the structures and the reinstatement of the land there would be no further potential effects on hydrology and land drainage. The potential effects from decommissioning should therefore be regarded as the same as construction as described in greater detail above.

11.7 Project Specific Mitigation

11.7.1 Construction Phase Mitigation

The ground level at the proposed converter station in Section 4 is to be raised to ensure that the Finished Floor Level (FFLs) are at a level of 6.18 mAOD, which is the maximum modelled flood level in the 0.1% + 50% Climate Change AEP event. This is to ensure that the structure remains outside the modelled flood extents and depths from nearby watercourses to the 1% + 39% Climate Change AEP event, as required by the Environment Agency. In addition, this has potential to displace flood water into other areas if not mitigated, which result in an increase in local flood depths, hazards and time of inundation. Hydraulic modelling was undertaken to quantify this displaced flood water. This determined a de minimis (negligible) impact as a result of the development. As such is it expected that floodplain compensation will not be required for this scheme. High level calculations were undertaken to determine the available floodplain storage which was determined to be a 0.17% reduction. However, level-for-level volume-for-volume floodplain compensation requirements up to the 1% AEP + 50% CC event have been calculated should this be required by the regulator at 63,254m^3. As set out in the Hydraulic Modelling Technical note (Appendix 11-C) high-level calculations show that the baseline flood plain volume for the 1% AEP + 50% CC fluvial dominated event is 187,932,406m^3. The volume of the proposed land raising below the 1% AEP + 50% CC is 63,254m^3 as noted in the table above. This represents 0.03% of the available floodplain storage

11.7.2 Operational Phase Mitigation

No operational phase mitigation is proposed for Hydrology and Land Drainage due to the temporary nature of the construction phase impacts, and embedded mitigation within the scheme design as describe in Section 11.6.2.

11.8 Residual Effects

Due to the embedding of design, construction and operational mitigation into the planning application boundary the residual effects of the English Onshore Scheme will remain unchanged from the potential impacts outlined in Section 11.6 above. This is because all mitigation has been taken into account when assessing potential effects.

11.8.1 Assessment of Residual Effects: Construction Phase

The residual impacts during the construction phase are shown in **Table 11-23**. Residual effects of with a significance of moderate or above are considered significant.