

Appendix 9B: Water Framework Directive Screening Assessment

Humber Zero

Environmental Statement Volume II Appendix 9B: Water
Framework Directive: Screening Assessment

Phillips 66 and VPI Immingham

February 2023

Quality information

| <u>Prepared by</u> | <u>Checked by</u> | <u>Verified by</u> | <u>Approved by</u> |
|---|---|--|-----------------------------------|
| Charlie Dodd, Graduate Water Scientist | Kate Barnett Principal Water Scientist | Owen Tucker Associate Water Scientist | Kirsty Cobb Technical Director |

Revision History

| <u>Revision</u> | <u>Revision date</u> | <u>Details</u> | <u>Authorized</u> | <u>Name</u> | <u>Position</u> |
|-----------------|----------------------|----------------|-------------------|-------------|-----------------|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Distribution List

| <u># Hard Copies</u> | <u>PDF Required</u> | <u>Association / Company Name</u> |
|----------------------|---------------------|-----------------------------------|
| | | |
| | | |
| | | |
| | | |

Prepared for:

Phillips 66 and VPI Immingham

Prepared by:

AECOM Limited
Midpoint, Alencon Link
Basingstoke
Hampshire RG21 7PP
United Kingdom

T: +44(0)1256 310200
aecom.com

© 2023 AECOM Limited. All Rights Reserved.

This document has been prepared by AECOM Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM.

Table of Contents

| | | |
|-----------|---|-----------|
| 1. | Introduction..... | 5 |
| 1.1 | Background..... | 5 |
| 1.2 | Scheme Description | 6 |
| 1.3 | Purpose of this Report..... | 6 |
| 1.4 | Introduction of the Water Framework Directive | 7 |
| 1.5 | Study Area | 7 |
| 2. | Approach and Methodology | 9 |
| 2.1 | General Overview of Approach | 9 |
| 2.1.1 | Mitigation Commitments | 9 |
| 2.1.2 | Regulation 19 Derogation | 9 |
| 2.2 | Desk Study | 10 |
| 2.3 | Site Walkover..... | 10 |
| 2.4 | Limitations and Assumptions..... | 10 |
| 3. | Baseline Conditions and Desk Study | 12 |
| 3.1 | Catchment Characteristics..... | 12 |
| 3.1.1 | Topography, Land Use and Rainfall..... | 12 |
| 3.1.2 | Geology and Soils | 12 |
| 3.1.3 | Historic Modification | 12 |
| 3.1.4 | Biological Quality Elements..... | 13 |
| 3.1.5 | Physico-chemical Quality Elements..... | 14 |
| 3.1.6 | Hydromorphological Quality Elements..... | 15 |
| 3.2 | WFD Status | 18 |
| 3.2.1 | WFD Status – Surface Water Bodies..... | 18 |
| 3.2.2 | WFD Status – Coastal and Transitional Water Bodies..... | 18 |
| 3.2.3 | WFD Status – Groundwater Bodies..... | 19 |
| 4. | Application of the WFD..... | 20 |
| 5. | WFD Screening | 21 |
| 5.1 | Screening of WFD Water Bodies..... | 21 |
| 5.2 | Screening of Activities | 21 |
| 6. | Summary | 27 |

1. Introduction

1.1 Background

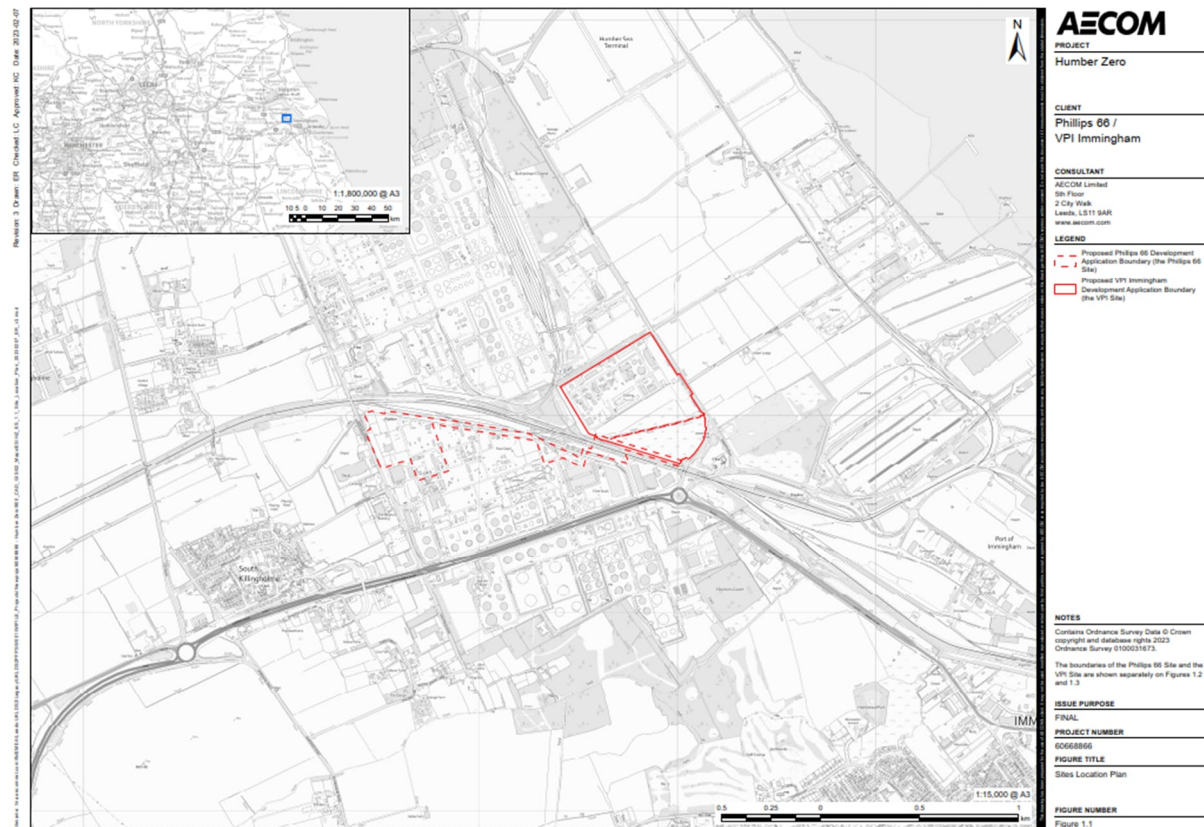
This Water Framework Directive (WFD) Screening Assessment has been produced in support of the Environmental Statement (ES) for the Humber Zero project. Specifically, it supports ES Chapter 9 Water Environment and Flood Risk (ES Volume I). It should be read alongside that chapter and the introductory chapters of this ES (Chapters 1 - 5), which contain further details of the Proposed Developments.

The Proposed Developments comprise two related schemes, which are being assessed in conjunction. Both developments are post-combustion carbon capture (PCC) plants:

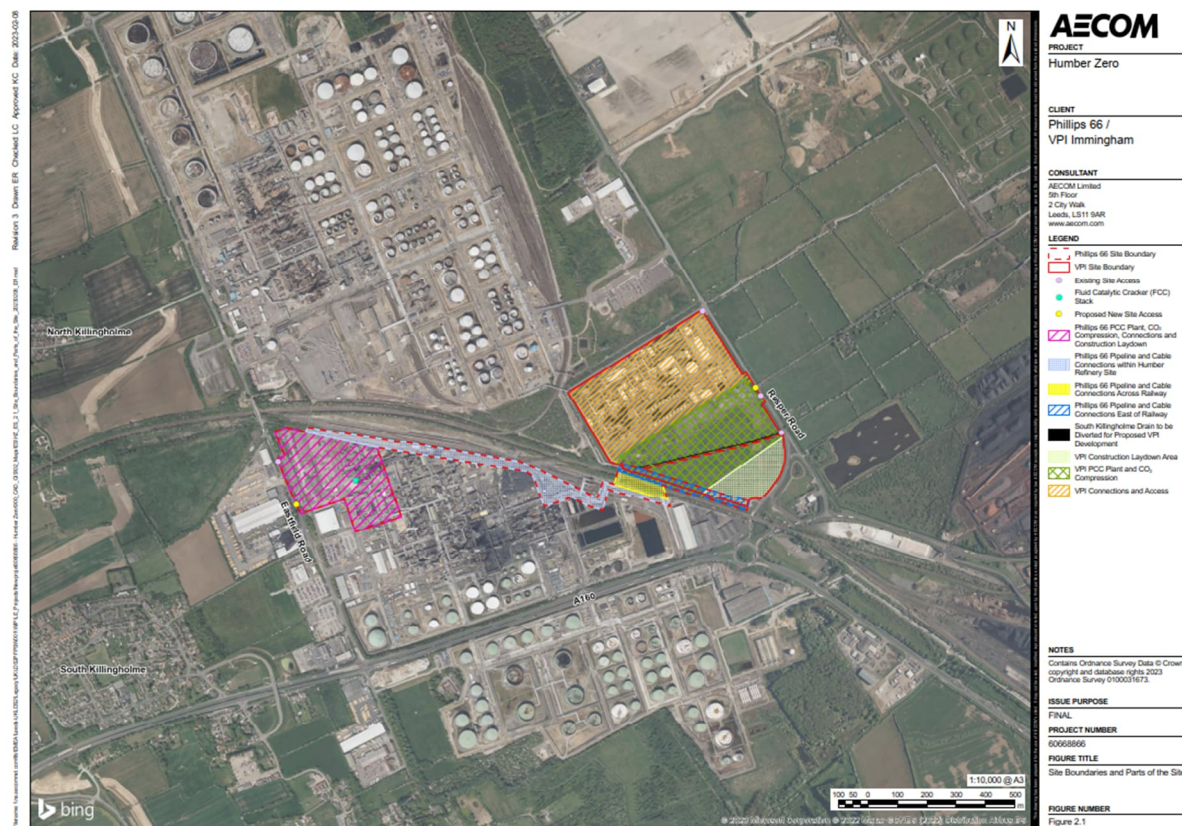
- One for the Fluid Catalytic Cracker (FCC) at the Humber Refinery ('the Proposed Phillips 66 Development'); and
- One for two gas turbines (GT1 and GT2) and two auxiliary boilers at the VPI Immingham Combined Heat and Power (CHP) Plant ('the Proposed VPI Development').

The Proposed Developments are located on and around land occupied by the existing VPI Immingham CHP Plant ('the CHP Plant'), and the Phillips 66 Ltd Humber Refinery ('the Refinery'). The planning application sites for each of the Proposed Developments are referred to as 'the VPI Site' and 'the Phillips 66 Site' (collectively, 'the Sites').

The Sites are approximately 1.6 km north of Immingham and 1.5 km west of the Humber Estuary, and largely in control of the Applicants (Phillips 66 Limited and VPI Immingham LLP), with the exception of a small area of Network Rail land within the Phillips 66 Site required for pipeline and cable crossings of the railway. The locations of the Sites, which are approximately centred on national grid reference TA 16819 17035 for the VPI Site, and TA 16188 16894 for the Phillips 66 Site, are shown in Figures 1.1 to 1.3 in ES Volume III, with Figure 1.3 reproduced below:



The Sites' boundaries are also shown overlaid on an aerial photograph in Figure 2.1 in ES Volume III, which clearly illustrates the heavily industrialised nature of the local area. Figure 2.1 is also reproduced below for ease of reference:



1.2 Scheme Description

The key components of the Proposed Developments are summarised as:

- Phillips 66 Flue Gas Pre-Treatment;
- Phillips 66 and VPI Carbon Capture and Associated Stacks;
- Phillips 66 and VPI CO₂ Treatment and Compression;
- Phillips 66 and VPI CO₂ Transport to CO₂ Gathering Network;
- Phillips 66 and VPI drainage systems;
- Phillips 66 and VPI internal access roads;
- Phillips 66 site new access from Eastfield Road;
- VPI new site access from Rosper Road; and
- Realignment of South Killingholme Drain through the VPI Site to facilitate the Proposed VPI Development.

Full details of the various components are provided in ES Volume I Chapter 3: Proposed Developments Description, Need and Alternatives Considered, and are not restated here.

1.3 Purpose of this Report

The purpose of this assessment is to determine whether there is a need for any WFD assessment of the Proposed Developments, and if so, to scope what that assessment should consider.

The Proposed Developments may interact with two surface WFD water bodies (one directly and one indirectly) and one groundwater body and thus it is necessary to consider the activities and constituent parts of the Proposed Developments to determine the potential for compliance with WFD objectives.

The potential for impacts on WFD water bodies includes the South Killingholme Drain realignment and the addition of infrastructure found within the existing site boundaries, as well as changes to surface water and effluent discharges to the South Killingholme Drain, and ultimately the Humber Estuary. However, the status of the South Killingholme Drain is not entirely clear and consultation with the Environment Agency will be needed to determine whether or not an assessment of WFD compliance on this watercourse is required.

1.4 Introduction of the Water Framework Directive

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, commonly referred to as the Water Framework Directive (WFD), aims to protect and enhance the water environment.

The WFD takes a holistic approach to sustainable management of the water environment by considering interactions between surface water, groundwater and water-dependent ecosystems. Ecosystem conditions are evaluated according to interactions between classes of biological, chemical, physico-chemical and hydromorphological elements known as 'Quality Elements'.

Under the WFD, 'water bodies' are the basic management units, defined as all or part of a river system or aquifer. Water bodies form part of a larger 'river basin district' (RBD), for which 'River Basin Management Plans' (RBMPs) are used to summarise baseline conditions and set broad improvement objectives. The current RBMPs at the date of this assessment are the 2019 Cycle 3 plans, which were published at the end of 2022.

In England, the Environment Agency is the competent authority for implementing the WFD, although many objectives are delivered in partnership with other relevant public bodies and private organisations, for example local planning authorities, water companies, rivers trusts, and private landowners and developers.

The Environment Agency is also responsible for managing flood risk and other activities on Main Rivers. Local planning authorities or drainage boards are responsible for consenting certain activities on Ordinary Watercourses. Local planning authorities are responsible for highways drains, and landowners are responsible for ditches and watercourses and also piped watercourses and culverts. While the Environment Agency is ultimately responsible for the WFD on any water body, local authorities are required to plan and consent WFD related activities on Ordinary Watercourses.

As part of its regulatory and statutory consultee role on planning applications and environmental permitting (under the Environmental Permitting Regulations (England and Wales) 2016), the Environment Agency and WFD-partnering organisations, must consider whether proposals for new developments have the potential to:

- Cause a deterioration of any quality element of a water body from its current status or potential; and/ or
- Prevent future attainment of good status or potential where not already achieved.

Regulation 17 of the Water Environment Regulations 2017 (i.e. the WFD) states that, like other public bodies, local authorities have a statutory duty to "*have regard to the River Basin Management Plan*" and "*any supplementary plans*" covering proposed activities when exercising its functions. Local authorities must therefore reflect water body improvement priorities as outlined in RBMPs.

In determining whether a development is compliant or non-compliant with the WFD objectives for a water body, the Environment Agency and partnering organisations must also consider the conservation objectives of any Protected Areas (i.e. SPAs, SACs, and water dependent Sites of Special Scientific Interest) and adjacent WFD water bodies, where relevant.

1.5 Study Area

The Sites are approximately 1.6 km north of Immingham and 1.5 km west of the Humber Estuary, on the eastern coast of England.

For the purposes of this assessment a general study area (i.e. Zone of Influence) of approximately 1 km from the Sites' boundaries has been considered in order to identify water bodies that are hydrologically connected to the Proposed Developments, and potential works associated with the Proposed Developments, that could cause direct impacts.

Given that impacts may propagate downstream, where relevant the assessment also considers a wider study area to as far downstream as a potential impact may influence the quality or quantity of the water body (which in this case is typically for a few kilometres). In this case, impacts may propagate along South Killingholme Drain for

approximately two kilometres after which the flow is into the Humber Estuary. The Humber Estuary is therefore included in the assessment. Given the size and scale of the Humber Estuary no other water features downstream need to be considered.

In summary, the study area falls across the following WFD surface and groundwater body catchments¹:

- North Beck Drain freshwater watercourse (GB104029067575);
- Humber Lower transitional water body (GB530402609201); and
- North Lincolnshire Chalk Unit groundwater body (GB40401G401500).

There are also several tributaries of the North Beck Drain present within the study area; these are predominantly Internal Drainage Board (IDB) managed drains, agricultural ditches, road ditches and springs, such as South Killingholme Drain.

It should be noted that WFD requirements apply equally to all watercourses regardless of whether they are WFD water bodies in their own right or the Environment Agency reportable reaches. The case for South Killingholme Drain is complex and is discussed in more detail later in advance of the WFD Screening Stage of assessment.

¹ <https://environment.data.gov.uk/catchment-planning>. Last accessed January 2023

2. Approach and Methodology

2.1 General Overview of Approach

Guidance on how to undertake WFD assessments can be found in the Environment Agency's 'Water Framework Directive risk assessment - How to assess the risk of your activity'² and the Planning Inspectorate's 'The Water Framework Directive - Advice note eighteen: The Water Framework Directive'. The PINS guidance was based on the Environment Agency document 'Clearing the Water's for All' (Environment Agency, 2016) that was specifically developed for estuarine and coastal waters³. Overall, these guidance documents have informed the approach taken in this screening exercise.

In accordance with the Planning Inspectorate's Advice Note Eighteen⁴, the overall approach to WFD assessment may adopt a three-stage approach:

- **Stage 1: WFD Screening** - Identification of the proposed work activities that are to be assessed and determination of which WFD water bodies could potentially be affected through identification of a Zone of Influence. This step also provides a rationale for any water bodies screened out of the assessment.
- **Stage 2: WFD Scoping** - For each water body identified in Stage 1, an assessment is carried out to identify the effects and potential risks to quality elements from all activities. The assessment is made taking into consideration embedded mitigation (measures that can reasonably be incorporated into the design of the proposed works) and good practice mitigation (measures that would occur with or without input from the WFD assessment process).
- **Stage 3: WFD Impact Assessment** - A detailed assessment of the water bodies and activities carried forward from the WFD screening and scoping stages.

This report presents the findings of a WFD screening exercise (the first stage in the WFD assessment process) which has been undertaken in relation to the Proposed Developments. It is recommended that the Environment Agency is consulted on the outcome of this assessment to determine whether a stage 2 scoping assessment, and potentially a stage 3 impact assessment, is required.

This assessment is based on a number of assumptions regarding the finalised design and measures that will be followed during the construction phase. Should the measures change from those assumed to date then consultation will be undertaken with the Environment Agency.

2.1.1 Mitigation Commitments

Proposed mitigation activities relied upon to demonstrate compliance at any of the stages of WFD assessment must be appropriately defined and sufficiently secured. Mitigation could be secured through planning conditions, Development Consent Orders, or other legally binding methods, depending on the nature of the planning permission sought.

2.1.2 Regulation 19 Derogation

Where the potential for deterioration of water bodies is identified, and it is not possible to mitigate the impacts to a level where deterioration can be avoided, additional assessment is needed in the context of WFD Regulation 19 which covers procedures for WFD derogation.

Regulation 19 is a 'last resort' planning and legal process, and it is a matter for the Secretary of State to consider whether derogation under Regulation 19 is justified. An applicant would be required to provide detailed and often complex evidence to justify its case that the following four stringent tests have been met:

- Test (a): All practicable steps are to be taken to mitigate the adverse impacts on the water body concerned.
- Test (b): the reasons for modifications or alterations are specifically set out and explained in the RBMP.

² <https://www.gov.uk/government/publications/water-framework-directive-how-to-assess-the-risk-of-your-activity> [Last accessed October 2022].

³ <https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters> [Last accessed February 2023].

⁴ <https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/> [Last accessed October 2022].

- Test (c)(1): There is an overriding public interest in the Humber Zero Project and/or Test (c)(2): its benefits outweigh the benefits of the WFD objectives (i.e. that the benefits of the project to human health, human safety or sustainable development outweigh the benefits of achieving the WFD objectives).
- Test (d): The benefits of the project cannot be achieved by a significantly better environmental option (that are technically feasible and do not lead to disproportionate cost).

In addition, the Development must not permanently exclude or compromise achievement of the WFD objectives in other bodies of water within the same RBD and must be consistent with the implementation of other environmental legislation. In applying Regulation 19, steps must also be taken to make sure that the new provisions guarantee at least the same level of protection as the existing legislation.

2.2 Desk Study

A desk-based study was carried out to capture information pertaining the Proposed Humber Zero Project that is not attainable through site survey. A review of relevant information relating to the study area was undertaken to develop a baseline for WFD catchments, watercourses and surrounding areas. The following data sources were used for the desk study:

- Environment Agency WFD data⁵;
- Ordnance Survey maps⁶;
- Geology⁷ and soil data⁸;
- Natural environment maps and designations on the MAGIC website⁹;
- Hydrological information¹⁰; and
- Met Office Climate Averages¹¹.

2.3 Site Walkover

A site walkover was carried out in cold, dry conditions on the 27th January 2023 by an Associate Water Scientist from AECOM. The walkover made visual and olfactory observations of water quality, hydromorphology and habitats of the South Killingholme Drain from the VPI Site effluent discharge along Rosper Road and towards the ABP Immingham Port (where access was prohibited). The survey also included the reach of South Killingholme Drain that is proposed to be realigned from Rosper Road to where it emerges from a culvert beneath the refinery. Lastly, the hydrological connectivity of South Killingholme Drain with the Rosper Roads Pools Local Wildlife Site (LWS) was also investigated.

2.4 Limitations and Assumptions

This WFD Screening exercise is based on baseline and Humber Zero design information available at the time of writing in January 2023 and based on information laid out in ES Volume I Chapter 3: Proposed Developments Description, Need and Alternatives Considered. Where there remain gaps or uncertainty in the design, assumptions have had to be made based on the precautionary principle. Any future material change to the design may mean that this assessment or later WFD assessments would need to be reviewed, verified as still valid or otherwise updated.

This assessment is limited to a screening assessment that seeks to determine whether a WFD assessment is needed. It is an initial indication based on current and projected design information of what impacts may occur and how they might be mitigated, and so further, more detailed assessment may be required.

The principal assumption regarding design information relates to the realignment of South Killingholme Drain as part of the Proposed VPI Development. A walkover was carried out in January 2023 but this watercourse has not been subject to a detailed on-site geomorphological assessment. The walkover, along with data from photographs, aerial imagery, previous reports and historic mapping appears to be a previously realigned and

⁵ <https://environment.data.gov.uk/catchment-planning/> [last accessed February 2023]

⁶ <https://www.bing.com/maps/> [last accessed February 2023]

⁷ <https://mapapps2.bgs.ac.uk/geoindex/home> [last accessed October 2022]

⁸ <https://www.landis.org.uk/soilscapes/>

⁹ <https://magic.defra.gov.uk/magicmap.aspx> [last accessed October 2022]

¹⁰ <https://www.ceh.ac.uk/data> [last accessed October 2022]

¹¹ <https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages> [last accessed October 2022]

heavily modified channel with little natural variation and geomorphological character, and low ecological value, and this is discussed in more detail later. It is proposed to replace the channel on a 'like for like' basis to ensure there is no long-term deterioration in the water body's habitat value. The new channel should be excavated offline and the flow transferred preferably during a period of low flow so as to minimise the risk of fine sediment re-suspension.

It is also noted at this stage that a detailed drainage strategy is yet to be confirmed. The Phillips 66 Site is to make use of the existing surface water management system at the Humber Refinery, and discharge to South Killingholme Drain via the Refinery's existing waste water treatment works (otherwise known as the Existing Treatment Plant or ETP). Surface water runoff from the VPI Site will make use of an attenuation lagoon, discharging to South Killingholme Drain at a greenfield runoff rate. Please refer to Chapter 9 of the ES and the introductory chapters (1-5) for further details of the proposed surface, foul and process water discharges.

3. Baseline Conditions and Desk Study

3.1 Catchment Characteristics

3.1.1 Topography, Land Use and Rainfall

Generally, the topography is flat, with elevations typically ranging from 4 mAOD westwards towards the Lincolnshire Wolds⁶. This is due to the Sites' proximity to the coast and the Humber Estuary, a Special Protection Area (SPA), Special Area of Conservation (SAC), Ramsar site and a Site of Special Scientific Interest (SSSI)⁹.

The surrounding land-use is dominated by large heavy industrial areas (including refineries, power stations and ports) around the villages of South and North Killingholme, and the town Immingham. This is mixed with interspersed pockets of flat open farmland, woodland, and natural coastal habitats.

The two nearest weather monitoring station to the study area are Cleethorpes, Haverstoe Park, which is located to the south-east of Grimsby on the Lincolnshire coast, and Manby, which is located approximately 8 km east from the town of Louth. Both stations have rainfall data from 1991-2020¹¹. The Cleethorpes station is subject to c.601 mm of rainfall per year and the Manby station demonstrates an average rainfall of 635 mm of rainfall per year, which are both much lower than the UK average annual rainfall value of c.1163 mm¹¹. This demonstrates that the area can be categorised as dry in comparison to most of the United Kingdom. Rainfall at both of the stations is highest from mid-autumn to winter; however, it is more wet during summer compared to the late winter and spring and generally peaking in November, with the least rainfall falling in March on average.

3.1.2 Geology and Soils

Bedrock geology beneath South Killingholme Drain and study area is composed of the Burnham Chalk Formation, which is sedimentary bedrock formed between 86.3 and 72.1 Mya during the Cretaceous period⁷. Some of the land to the east of the Sites, and the Humber Estuary itself is underlain by Flamborough Chalk Formation, which is also sedimentary bedrock from the Cretaceous.

Superficial deposits are in two clear longitudinal bands either side of the Sites. To the west, Diamicton Till (i.e. unsorted and unstratified mixture of clay, sand, gravel, and boulders) from the Quaternary Period are dominant, with Tidal Flat Deposits (i.e. unconsolidated layers of mud and sand flat deposits) found to the east between the Sites and the coast⁷.

A review of local borehole records⁷ suggests that the water of the chalk is c. 18 m below ground level (bgl) with relatively impermeable superficial deposits of tidal flats (clays and silt) and glacial till above.

As with superficial deposits, soils vary across two clear bands. Overlying the Tidal Flat Deposits to the east are loamy and clayey soils of coastal flats with naturally high groundwater, whereas in areas with Diamicton Till, soils are slowly permeable, seasonally wet, slightly acid but base-rich, loamy and clayey soils⁸. Both these soils are likely to be habitat to seasonally wet pastures and woodlands, with areas of moderate fertility and impeded drainage.

3.1.3 Historic Modification

A review of historic mapping suggests that the area has a long history of physical modification¹². The oldest available mapping from 1885 – 1900 shows watercourses to be straight and likely modified so as to allow for efficient drainage in agricultural areas. The replacement of arable fields with industrial complexes has ensured such modification has endured, with some watercourses diverted so as to flow along the margins of these industrial areas. South Killingholme Drain specifically has followed its current linear course since this at least 1885, and so was likely diverted some time before this.

According to the Humber Zero VPI-Immingham Post-Combustion Carbon Capture Project FEED Flood Risk Assessment (Worley, 2022), "*observations that have been made on the drain describe the bottom material as 50 mm to 75 mm of black sludge of organic material. Beneath this layer is soft sticky brown clay with some sand. This becomes firm between 25 mm and 50 mm and is assumed to be puddle clay. The base of the initial section of the drain within the project limits is described as hard and may be concrete lined.*" The presence of a liner

¹² <https://maps.nls.uk/>

would significantly reduce any interaction with groundwater and will influence the hydrological function of the channel.

3.1.4 Biological Quality Elements

The Environment Agency has not conducted any fish monitoring surveys within the North Beck Drain water body in the last 10 years. There is one station in the neighbouring water body: Skitter Beck / East Halton Beck water body (GB104029067655) that could be used as an indicative proxy. The station is on Skitter Beck at TA 12367 14871, approximately 4.5 km west of the Sites. This water body is classified as Bad for Fish, with surveys only recording three-spined stickleback (*Gasterosteus aculeatus*) and stone loach (*Barbatula barbatula*).

Regarding South Killingholme Drain, the potential for fish to be present is significantly limited by the small scale of the watercourse, poor flow regime and regular tidal locking, poor habitat and water quality. Although it cannot be ruled out that some small, pollution tolerant species are present (e.g. three spined stickleback as found in Skitter Beck) it is not expected that they will be present in large numbers, and no sightings were made during the site walkover. Access to the Port of Immingham had not been granted and so it is uncertain whether there are tidal flap gates on the outfall of South Killingholme Drain, which will reduce any potential for fish to travel between the drain and the estuary. This will be investigated once access has been granted.

There is one Environment Agency macroinvertebrate monitoring site on Habrough Marsh Drain, which is thought to be of similar condition to South Killingholme Drain and sits only 300 m south of the Sites. In two surveys in 2021, one in Spring and one in Autumn, WHPT (Whalley Hawkes Paisley Trigg) ASPT (Average Score Per Taxon) were 3.42 and 3.54, respectively, which both indicate Poor water quality.

Annual macroinvertebrate sampling is carried out on multiple locations along South Killingholme Drain by the refinery each year dating back to 1995. Phillips 66 Ltd have provided copies of the last five survey reports dated November 2018-21 and July 2022. The ecological status is assessed using macroinvertebrate indices such as the BMWP (Biological Monitoring Working Party) score and ASPT. Although BMWP has been superseded by WHPT, it is retained so that the long-term record of trends can be maintained. It should be noted that these metrics were designed primarily to assess the impact of organic pollution, although several factors may influence the biotic scores, for example dredging and channel clearance, toxic chemicals, flow conditions, the presence or absence of macrophytes (aquatic plants) and type/diversity of habitat types can all affect the macroinvertebrate community¹³. The following is a summary of the latest results¹³. Sampling took place at four locations in South Killingholme:

- One situated directly upstream of the oil refinery;
- Two sites at approximately 450 m (upstream of Rosper Road) and 1.1 km downstream of the refinery (off Humber Road); and
- A second control site located on an arm of the South Killingholme Drain (near Marsh Lane) that does not receive any effluent from the refinery.

The results for the 2022 survey state that:

- Macroinvertebrate communities downstream of the refinery are considerably less diverse than at either upstream of the refinery or at the control site, and consist almost entirely of the most pollution-tolerant taxa. BMWP scores were 14 and 37, and ASPT scores 3.5 and 3.7, respectively.
- Low abundances of macroinvertebrates were evident downstream of the refinery, with the macroinvertebrate communities at these sites being dominated by pollution-tolerant fly larvae (Chironomidae and Culicidae).
- In particular, the low abundance of organic pollution tolerant organisms such as Oligochaeta combined with the absence of Sphaeriidae may indicate inorganic contamination of the sediment.
- Oil was observed at the two sites downstream of the refinery during sampling and the invertebrate sample collected at the site just upstream of Rosper Road also had a noticeable odour of oil.
- Both of the sites downstream of the refinery exhibited very low dissolved oxygen levels (10-12% saturation) which is possibly an effect of the oil film on the water surface (and not the increase of around 10 °C downstream of the refinery as the control site was also warmer but had higher dissolved oxygen levels).

¹³ South Killingholme Drain Macroinvertebrate Survey 2022, Phillips 66 Ltd. APEM Ref: P00009922, Final Report: July 2022

- Settlement of oil in the sediment at the two downstream sites may account for the lower abundance of detritus and sediment feeders/dwellers found during this survey and also in the recent historical data (2017 – 2021).
- It is possible that intermittent events such as oil discharge into the watercourse is restricting the macroinvertebrate community development at downstream sites.
- The very slow-flowing nature of the South Killingholme Drain is also likely to reduce the flushing of effluent downstream, allowing heavy particulates to enter the sediment and lighter oils to persist on the water surface.

No macrophytes surveys have been carried out by the Environment Agency or the Project along South Killingholme Drain. Macrophytes are monitored by the Environment Agency at the same site on Habrough Marsh Drain in July 2021. Three taxa were found, all non-native and non-protected flowering plants: *Callitriche*, *Filipendula ulmaria*, and *Phragmites australis*. During the walkover there are short sections of the South Killingholme Drain upstream of Rosper Road where a filamentous green algae was observed (see Image 9B3.2 later in the report). However, elsewhere and downstream the bed is void of any macrophytes, which may be connected to periodic removal of sediments and channel clearing by the Internal Drainage Board.

3.1.5 Physico-chemical Quality Elements

There is an Environment Agency water quality monitoring on South Killingholme Drain, just upstream of its crossing at Rosper Road (TA 17125 17002). Table 9B3.1 shows results from this monitoring station for key indicators of water quality, from January 2015 – January 2020 (note that the majority of water quality data is from 2015-2017).

Table 9B3.1: Water quality indicators from South Killingholme Drain

| Determinand | Average | Minimum | Maximum |
|--|---------|---------|---------|
| pH | 8.22 | 7.96 | 8.50 |
| Temperature of Water (°C) | 19.5 | 9.0 | 27.8 |
| Conductivity at 25 °C (µs/cm) | 2621 | 1816 | 3263 |
| Biochemical Oxygen Demand (mg/l) | 3.04 | 1.03 | 8.30 |
| Chemical Oxygen Demand (mg/l) | 69 | 44 | 138 |
| Ammoniacal Nitrogen as N (mg/l) | 0.966 | 0.034 | 7.33 |
| Nitrogen, Total Oxidised as N (mg/l) | 15.6 | 5.0 | 31.4 |
| Nitrate as N (mg/l) | 15.4 | 4.8 | 31.1 |
| Solids, Suspended at 105 °C (mg/l) | 14 | 3 | 179 |
| Hardness, Total as CaCO ₃ (mg/l) | 451 | 183 | 889 |
| Alkalinity to pH 4.5 as CaCO ₃ (mg/l) | 657 | 476 | 848 |
| Sulphide as S (mg/l) | 0.011 | 0.010 | 0.016 |
| Orthophosphate, reactive as P (mg/l) | 0.404 | 0.138 | 1.06 |
| Oxygen, Dissolved, % Saturation (mg/l) | 84.2 | 31.3 | 132.3 |
| Oxygen, Dissolved as O ₂ (mg/l) | 7.67 | 2.92 | 11.40 |

Notes:

The Environment Agency sampling point and Rosper Road includes inputs of surface water and process effluent/surface water from VPI Immingham CHP Power Station, that enters South Killingholme Drain via two tidal flap gates. Results reported as less than the limit of detection have been entered as the limit of detection in calculating the average.

The data indicates that the water quality of South Killingholme Drain a relatively high pH, high alkalinity and high conductivity, likely due to the existing discharges to the watercourse (see Water Resources section below).

An Environmental Risk Assessment for South Killingholme Drain has been carried out for the permit for Phillips 66 (Wood, 2022). This was supported by monitoring undertaken in South Killingholme Drain towards the outfall to Humber Estuary. The results indicate that there may be some saline intrusion into the lower reaches of South Killingholme Drain, due to high chloride levels. Note that access into the port area has so far not been possible and

so the presence of any tidal valve on the outfall is not yet confirmed. The water quality results indicate that the current water quality exceeds Environmental Quality Standards (EQS) for some metals, PAHs, PFOS and other determinands. This indicates that the South Killingholme Drain is acting largely as an effluent channel and significant dilution of the existing effluent discharges does not take place until the flow meets the waters of the Humber at South Killingholme Haven.

3.1.6 Hydromorphological Quality Elements

Image 9B3.1 and 9B3.2 shows South Killingholme Drain to be a heavily modified, trapezoidal watercourse with little variation in flow and habitat type. The banks are well vegetated, but are steep and the channel over deep, and so there it is not expected that there would be any significant lateral connectivity between the channel and its floodplain. The channel modifications were most likely a consequence of past land drainage for agricultural activity.

According to online hydrology data, South Killingholme Drain has a catchment of c. 3.6 km², although other estimates suggest this may be as little as 2 km². However, the hydrological regime of the South Killingholme Drain is controlled by two major factors:

- Surface water runoff from impermeable areas that are part of the extensive industrial sites the essentially make up the majority of the upper catchment. It is estimated that as much as 97% of the flow in the South Killingholme Drain downstream of the Sites is made up of surface and treated process water from the Sites. This is corroborated by images 9B3.3 and 9B3.4 that show the channel upstream of the industrial sites and the A160 as being poorly defined, heavily modified and likely only flowing intermittently during wet weather.
- The drain is heavily influenced by the ebb and flow of the tidal Humber Estuary. During each approximately 12 hour tidal cycle the drain may become tide locked during which flow cannot discharge to the estuary. This results in a period of rising water levels and stagnant flow conditions. Separate tide flap gates are present on the arm of South Killingholme Drain that flows to the south and into the main channel from the refinery just before it goes beneath Rosper Road. When there is a high flow along the drains and the tide is preventing flows into the estuary, water levels may rise and if sufficient may flow over a shallow weir into Rosper Road Pools. Rosper Road Pools are a storage lagoon constructed in the 1970s and operated by the North East Lindsey Internal Drainage Board (who is also responsible for the management of South Killingholme Drain). Rosper Road Pools are also a Local Wildlife Site.

This modified form lacking in geomorphic features and diversity continues downstream alongside Humber Road towards the port, broken only by the occasional arch or box culvert (see image 9B3.5). It is believed based on aerial imagery, although not confirmed that the South Killingholme Drain flows out into the Humber Estuary within the port area via an engineered outfall (at approximately TA 18966 17221). It is expected that a tide flap gate is positioned on this outfall, although some tidal ingress up through the channel occurs.

Overall, the watercourse has been historically modified and is of relatively low hydromorphological value only.



Image 9B3.1 South Killingholme Drain (TA 17128 17008) (January 27th 2023 around an hour after high tide)



Image 9B3.2 South Killingholme Drain (TA 16917 16953)



Image 9B3.3 South Killingholme Drain viewed looking east from the Town Street bridge (TA 15378 16229)



Image 9B3.3 South Killingholme Drain viewed looking east from the junction of Town Street and School Road (TA 15163 16192)



Image 9B3.5 South Killingholme Drain looking downstream towards the port (TA 17368 16747) (January 27th 2023 around an hour after high tide)

3.2 WFD Status

3.2.1 WFD Status – Surface Water Bodies

The study area has one WFD surface water body catchment: WFD principles and objectives do extend to cover the entire catchment of water bodies and thus tributaries that flow into a downstream WFD water body should also be considered. There are also several tributaries of this water body present within the study area; these are predominantly unnamed agricultural ditches, drains, and springs. According to the Environment Agency's Catchment Data Explorer the South Killingholme Drain is included within the WFD catchment of North Beck Drain⁵, but there is no hydrological connection between the two watercourses (although we note that the existing Environment Agency water quality monitoring station on South Killingholme Drain at Rosper Road has informed the WFD classification for this water body). Table 9B3.2 provides WFD classifications for this water body.

Table 9B3.2: Summary of the WFD status of the Proposed Developments underlying surface water body

| WFD Parameter | Status/Summary |
|-------------------------------------|-----------------------------|
| Water Body Name | North Beck Drain Water Body |
| Water Body ID | GB104029067575 |
| Water Body Type | River |
| Water Body Area (m ²) | 56.647 |
| Water Body Length (m) | 9033 |
| Hydromorphological Designation | Heavily modified |
| Overall Ecological Status | Moderate |
| Current Overall Status | Moderate |
| Overall Status Objective | Good by 2027 |
| Biological Quality Elements | Not assessed |
| Physico-chemical Quality Elements | Not assessed |
| Hydromorphological Quality Elements | Supports Good |
| Chemical | Fail |

3.2.2 WFD Status – Coastal and Transitional Water Bodies

South Killingholme Drain is believed to flow into the Humber Estuary within the confines of ABP Port of Immingham, approximately 2 km downstream of the Sites. The estuary here is designated under the WFD as the Humber Lower (GB530402609201) transitional water body. A summary of the WFD status of this water body is given in Table 9B3.3.

Table 9B3.3: Summary of the WFD status of the Humber Lower water body

| WFD Parameter | Status/Summary |
|-----------------------------------|--|
| Water Body Name | Humber Lower |
| Water Body ID | GB530402609201 |
| Water Body Type | Transitional Water Body |
| Water Body Area (m ²) | 246.45 |
| Hydromorphological Designation | Heavily modified |
| Overall Ecological Status | Moderate |
| Current Overall Status | Moderate |
| Overall Status Objective | Moderate by 2015 (some specific parameters have higher status targets at various dates including Good Chemical Status by 2063) |
| Biological Quality Elements | Moderate |
| Physico-chemical Quality Elements | Moderate |

| | |
|---------------------|------|
| Specific pollutants | High |
| Chemical | Fail |

3.2.3 WFD Status – Groundwater Bodies

The study area is underlain by one ground water bodies: North Lincolnshire Chalk Unit (GB40501G401500). A summary of the WFD status of both water bodies is given in Table 9B3.

Table 9B3.4: Summary of the WFD status of the Proposed Developments underlying groundwater body

| WFD Parameter | Status/Summary |
|--|-------------------------------|
| Water Body Name | North Lincolnshire Chalk Unit |
| Water Body ID | GB40401G401500 |
| Water Body Type | Ground Water Body |
| Overall Status | Poor |
| Quantitative | Poor |
| Quantitative Dependent Surface Water Body Status | Poor |
| Quantitative Status Elements | Poor |
| Quantitative Saline Intrusion | Good |
| Quantitative Water Balance | Good |
| Quantitative GWDTEs test | Good |
| Quantitative Dependent Surface Water Body Status | Poor |
| Chemical | Poor |
| Chemical Status Elements | Poor |
| Chemical Drinking Water Protected Area | Poor |
| General Chemical Test | Poor |
| Chemical GWDTEs test | Good |
| Chemical Dependent Surface Water Body Status | Good |
| Chemical Saline Intrusion | Good |
| Prevent and Limit Objective | Active |

4. Application of the WFD

The local land drains located directly adjacent to and in close proximity to the Sites, including the South Killingholme Drain, are not classified under the WFD as water bodies in their own right. Despite this, WFD principles and objectives do extend to cover the entire catchment of water bodies and thus tributaries that flow into a downstream WFD water body should also be considered. However, this is complicated by two factors, namely that there is no identified hydrological connection between South Killingholme Drain and North Beck Drain, and because the downstream water body is in fact the Humber Estuary, which is of different character.

North Beck Drain is approximately 4 km to the southeast and south of Immingham, with the Harbrough Drain in between it and South Killingholme Drain. There is no hydrological connection between South Killingholme Drain and North Beck Drain. Some water quality data from South Killingholme Drain has been used to determine the WFD status of this WFD water body, but the unique character of South Killingholme Drain and differing catchment land use may mean that there are differences between the two watercourses. Thus, the parameters monitored, or the status classes for North Beck Drain may not be a true reflection or appropriate for South Killingholme Drain. South Killingholme Drain is a relatively short Ordinary Watercourse maintained by the local IDB. It has been modified for a long time with a flow regime that is dominated by surface water runoff and treated process effluent from industrial sites, as well as a controlling influence by daily tide locking. It has limited geomorphic features, poor water quality and low habitat quality and biodiversity.

South Killingholme Drain is understood to flow into the Humber Estuary via an engineered outfall within the Port of Immingham. The Humber Estuary in this location is designated under the WFD as the Humber Lower Transitional water body. The scale and character of this transitional water body is significantly and materially different to the scale and character of the South Killingholme Drain, with different WFD parameters and criteria applying. Thus, it is considered that it would not be appropriate to determine WFD compliance of impacts on the South Killingholme Drain against the status and parameters monitored for the Humber Lower WFD water body.

One of the key proposed changes in water quality in the refinery's discharge will be an increase in sulphate levels. There are no WFD Environmental Quality Standards (EQS) for sulphate under the WFD (Classifications and Standards) Directions (England and Wales) 2015. The Environment Agency has a freshwater standard for sulphate of 400 mg/l that is available for use in permitting. However, the applicability of this standard to South Killingholme Drain is not clear. This is because there is the possibility that saline tidal waters from the Humber Estuary may propagate upstream. Marine water quality is likely to contain higher levels of sulphate than would typically be expected in a freshwater environment, thus the use of the freshwater standard used by the Environment Agency for permitting purposes may not apply. This is proposed to be investigated by a programme of water quality monitoring. If sulphate pollution risks were to be investigated and linked to WFD compliance this would need to be through indirect effects on other biological and physico-chemical parameters. The status classes for these would be those published for North Beck Drain or the Humber Lower. However, as discussed earlier, these may not be appropriate and introduces practical difficulties for how WFD compliance for this watercourse and this water quality impact is established.

Assessment will still be carried out and included in the Environmental Statement, a variation to the existing Environmental Permit is being applied for from the Environment Agency, and any water quality impact on the ecology of the Rosper Roads Pool Local Wildlife Site and birds associated with the SPA will still be required as part of the Environmental Statement and the Habitats Regulation Assessment. Through these assessments options for mitigation (and compensation) can be explored that could be implemented as far as the regulator agrees are technically feasible and cost proportionate.

5. WFD Screening

The purpose of the WFD screening stage as outlined in the Planning Inspectorate Advice Note 18 is to identify a zone of influence of the Proposed Developments and to determine whether that influence has the potential to adversely impact upon WFD water body receptors; this approach has been taken in this assessment and is outlined in this section. Please note that for transitional and coastal water bodies there is separate guidance.

A study area of generally 500 m from the pipeline has been considered in order to identify water bodies that are potentially hydrologically connected to the Proposed Developments, and potential works associated with the Proposed Developments that could cause direct impacts.

The screening stage has two parts. Firstly, at the highest level of assessment the screening process identifies WFD designated water bodies within the study area and indicates whether they may or may not be impacted by the Proposed Development. The second stage of the screening process is to consider specific activities of the Proposed Developments that could affect receptor water bodies' WFD status, and which should be carried forward to subsequent stages of the assessment. Justification is provided where water body receptors are screened out and are not carried forward through the assessment. Water bodies or activities screened 'out' of the assessment will therefore not be considered further at the impact assessment stage, subject to agreement being obtained from the Environment Agency.

5.1 Screening of WFD Water Bodies

There are three water bodies within the study area and that the Proposed Developments may interact with as listed in Table 9B5.1.

Table 9B5.1: Screening of WFD water bodies potentially impacted by the Proposed Developments

| Water Body ID | Screening Outcome | Justification |
|---|-------------------|---|
| North Beck Drain Water Body (GB104029067575) | In | The South Killingholme Drain is within this WFD water body catchment area, although there is no direct hydrological connectivity with the North Beck Drain itself and it is uncertain whether WFD principles apply to this watercourse. |
| Humber Lower (GB530402609201) | In | Water body may be indirectly impacted by the Humber Zero Project due to a range of activities that could affect the quality of water flowing in this watercourse and to the Humber Estuary during construction and operation. However, it is noted that the Humber Estuary is a tidal environment and that it would be expected that any discharge would be rapidly diluted and dispersed. |
| North Lincolnshire Chalk Unit Water Body (GB40401G401500) | In | Groundwater body may be directly impacted by the Humber Zero Project due to a range of activities that could result in water pollution during the construction and operation of the Proposed Development. However, the risk will depend on the depth of groundwater below ground levels, the characteristics of the superficial deposits, and the pollutant sources from the Proposed Developments (i.e. whether or not any discharges will be made to ground). |

5.2 Screening of Activities

The Proposed Developments comprise a number of activities, some of which present a potential risk to the WFD status of water bodies. These components and activities are listed in Table 9B5.2 together with a screening assessment.

At this point, it should be reiterated that detailed design for some key elements of the Proposed Developments are still to be confirmed, and assumptions may have been made. A re-evaluation of activities that remains uncertain may be required at a later date, as described in the Limitations and Assumptions sub-section of this report.

A review of the activities that are exempt from the requirement for Environmental Permits for Flood Risk Activities (and hence would also be considered low risk activities that would unlikely require a WFD assessments) and / or are considered low risk activities⁴ have been reviewed and none of the exemptions apply.

Table 9B5.2 Screening of the Proposed Developments' activities

| Activity | Description | Discussion | Screening Outcome | |
|--|---|---|--|---|
| Phillips 66 Flue Gas Pre-Treatment | <p>Sulphur oxides (SO_x), nitrogen oxides (NO_x) and particulates levels in the FCC flue gas are regulated by the existing Environmental Permit, but levels will need to be further reduced before the flue gas enters the absorber to improve the effectiveness of the PCC process as part of the Proposed Phillips 66 Development.</p> <p>This is not required for the Proposed VPI Development because levels of SO_x, NO_x and particulates are already lower in the CHP Plant flue gas.</p> <p>Ducting will be installed to divert the flue gas from the existing FCC stack to the flue gas pre-treatment facilities.</p> | <p>Wet scrubbing of the flue gases to remove sulphur oxides and subsequent oxidation will ultimately generate high sulphate levels in the effluent stream to the existing refinery ETP. The ETP is currently unable to treat sulphate and so without further, new treatment processes, the process discharge from the refinery may include a high level of sulphates. Options to remove some of the sulphate is being considered (potentially 50% may be viable).</p> <p>There is no WFD standard for sulphates, and as discussed in Section 4 the application of the WFD to South Killingholme Drain is not certain, and if it was to apply it is unclear how compliance would be robustly determined. A literature search has suggested that there could be some adverse impacts on aquatic fauna, although whether this is significant within South Killingholme Drain is less certain, especially given the habitat present is already degraded due to existing poor water, habitat structure and variability, and flow regime controlled by regular tide locking. The Environment Agency has a standard of 400 mg/l that is used for permitting, although this is for freshwater environments and may not be appropriate for the South Killingholme Drain, where it is suspected that some tidal ingress occurs.</p> | <p>Out – As there is no WFD status for sulphate, and since the South Killingholme Drain is not connected to North Beck Drain Water Body (GB104029067575) this has been screened out. However, this screening decision is provisional subject to agreement with the Environment Agency on whether WFD principles should apply to South Killingholme Drain.</p> | |
| | | <p>High levels of sulphate emitted in the new discharge will enter the Humber Estuary indirectly via the South Killingholme Drain, where initial dilution and dispersion will take place. Upon reaching the estuary, it is expected that the significant dilution and dispersion that would occur would quickly dissipate any flow of high sulphate levels. The outfall from South Killingholme Drain is into the Immingham Port area and not the main estuary, and so areas of more sensitive habitat are not directly exposed (the nearest higher sensitive habitat is a line of saltmarsh at the backshore approximately 1 km to the northwest). Concentrations of sulphate are also expected to be much higher in the estuarine environment.</p> | | <p>Out - Humber Lower (GB530402609201)</p> |
| | | <p>Process effluent from both the refinery and VPI Sites will be discharged to South Killingholme Drain, which is not thought to be in hydrological connectivity with ground water due to its relatively shallow depth and possible clay/concrete lining.</p> | | <p>Out - North Lincolnshire Chalk Unit Water Body (GB40401G401500)</p> |
| Phillips 66 and VPI Carbon Capture and Associated Stacks | <p>Both the Proposed Developments include the same processes for the removal of CO₂ from the existing flue gases.</p> <p>In the Proposed Phillips 66 Development the flue gas will enter the PCC process from the flue gas pre-treatment process (which will have already cooled the flue gas to a suitable temperature for the PCC process to work most effectively).</p> <p>In the Proposed VPI Development the flue gas will be diverted from the CHP Plant directly to the two PCC trains located to the south of the CHP Plant, where the flue gas will first be cooled using a direct contact cooler and air-cooled heat exchangers to enable the amine to more effectively absorb CO₂.</p> <p>The flue gas will enter the CO₂ absorber tower where it will come into contact with the amine. The CO₂ lean flue</p> | <p>The activity should not have any effect on the WFD status of the surrounding water body as the activity has no obvious interaction or impact pathway with the water environment. Any works during the construction phase that may generate runoff or spillages are anticipated to be adequately addressed through measures to be outlined in the CEMP and WMP to avoid adverse impacts on water quality to watercourses receiving drainage from the Sites. However, should there be significant changes to the design, then this activity may need to be re-assessed.</p> | <p>Out - North Beck Drain Water Body (GB104029067575), Humber Lower ((GB530402609201), and North Lincolnshire Chalk Unit Water Body (GB40401G401500)</p> | |

gas (flue gas with up to 95% CO₂ removed) will be released from the absorber tower, and the CO₂ rich amine will be heated to separate the CO₂ from the amine in the regenerator towers (also known as CO₂ stripper towers). The Proposed Phillips 66 Development will have one absorber tower and one regenerator tower, and the Proposed VPI Development will have two of each (one of each for each PCC train).

The majority of the amine will be cooled using air cooled heat exchangers and treated for re-use in the PCC plants. A very small quantity of amine will be 'lost' from the process (released with the CO₂ lean flue gas from the absorber towers) and the amine will also degrade over time so fresh amine will also be required.

| | | | |
|--|--|--|---|
| Phillips 66 and VPI CO ₂ Treatment and Compression | <p>The gaseous CO₂ will be saturated with water and will contain traces of oxygen which will need to be removed to achieve the specification required by the CO₂ gathering network operator.</p> <p>The captured CO₂ will also need to be compressed ready for injection into the CO₂ gathering network. Compression will be undertaken in two phases – first low pressure (LP) compression to approximately 30-40 barg, then high pressure (HP) compression to 135 barg (the pressure required for injection into the CO₂ gathering network).</p> | <p>The activity should not have any effect on the WFD status of the surrounding water body as the activity has no obvious interaction or impact pathway with the water environment. Any works during the construction phase that may generate runoff or spillages are anticipated to be adequately addressed through measures to be outlined in the CEMP and WMP to avoid adverse impacts on water quality to watercourses receiving drainage from the Sites. However, should there be significant changes to the design, then this activity may need to be re-assessed.</p> | <p>Out - North Beck Drain Water Body (GB104029067575), Humber Lower ((GB530402609201), and North Lincolnshire Chalk Unit Water Body (GB40401G401500)</p> |
| Phillips 66 and VPI CO ₂ Transport to CO ₂ Gathering Network | <p>The Proposed Developments will connect to V Net Zero and/ or Humber Low Carbon Pipelines to transport CO₂ to a storage site under the North Sea. As noted earlier, both of these CO₂ gathering networks are the subject of DCO applications due to be submitted in 2023 by Harbour Energy and National Grid Carbon respectively.</p> <p>At this stage it is important for the Proposed Developments to retain flexibility regarding the final CO₂ gathering network, so the Proposed Development layouts allow for connection at a CO₂ gathering network tie-in compound in the available land to the south of the VPI PCC plant.</p> <p>The Proposed Phillips 66 Development includes a CO₂ pipeline across the Network Rail railway line between the Humber Refinery and the VPI CHP Plant. The design of this crossing has been discussed with Network Rail and will use the existing pipe bridge.</p> <p>Metering will also be provided to measure the quantity of CO₂ leaving each of the Proposed Developments. CO₂ vents will be provided at each of the Proposed</p> | <p>The activity should not have any effect on the WFD status of the surrounding water body as the activity has no obvious interaction or impact pathway with the water environment. Any works during the construction phase that may generate runoff or spillages are anticipated to be adequately addressed through measures to be outlined in the CEMP and WMP to avoid adverse impacts on water quality to watercourses receiving drainage from the Sites. However, should there be significant changes to the design, then this activity may need to be re-assessed.</p> | <p>Out - North Beck Drain Water Body (GB104029067575), Humber Lower ((GB530402609201), and North Lincolnshire Chalk Unit Water Body (GB40401G401500)</p> |

Developments to allow for safe venting in the event that the CO₂ network is unavailable, or the CO₂ does not meet the required specification and cannot be injected into the CO₂ gathering network.

| | | | |
|--|--|---|---|
| Phillips 66 surface water drainage systems | A surface water drainage system, connecting to the existing surface water management system at the Humber Refinery for discharge to South Killingholme Drain via the Refinery's existing waste water treatment works. This discharges to South Killingholme Drain under an existing permit and it is not thought that any changes to the permit and its water quality limits will be necessary. | This activity has a clear interaction with the water environment but is in keeping with the current surface water arrangements from the refinery, which discharges via the sites treatment system and under a permit from the Environment Agency. As discussed earlier, the discharge is made into the South Killingholme Drain for which it is uncertain whether WFD principles apply. | Out – As there is no WFD status for sulphate, and since South Killingholme Drain is not connected to North Beck Drain Water Body (GB104029067575) this has been screened out. However, this screening decision is provisional subject to agreement with the Environment Agency on whether WFD principles should apply to South Killingholme Drain. |
| | | In addition to above, initial dilution and dispersion will take place within South Killingholme Drain. Upon reaching the estuary, it is expected that the significant dilution and dispersion that would occur would quickly dissipate any residual pollutants that may be present. | Out – Humber Lower (GB530402609201) |
| | | In addition to above, surface water drainage will be into shallow ditches that are unlikely to have any hydrological connectivity with groundwater. Sediment depth investigations reported in the FRA suggest that the bed may be clay lined or there may even be the presence of concrete. In addition, a review of local borehole records ⁷ suggests that the water of the chalk is c. 18 m bgl with relatively impermeable superficial deposits of tidal flats (clays and silt) and glacial till above. | Out - North Lincolnshire Chalk Unit Water Body (GB40401G401500) |
| Phillips 66 foul water drainage | Foul water generated from the Proposed Phillips 66 Development from occupied buildings (toilets, sinks, showers etc.) will be segregated from other drainage systems and routed via a dedicated foul water drainage network to a new septic tank/ cesspit, similar to existing. The design flow and discharge criteria for foul water will be confirmed based on anticipated occupancy levels, shift patterns and an estimated water usage per person. The final drainage commitments will be subject to permitting/and or permission from Anglian Water. For example, if a cess pit is used is assumed that it will be emptied by dedicated gupers operating on the refinery and discharge to the Anglian Water foul water sewer in the same way foul wastewater from the rest of the site is managed, or otherwise will be tankered and removed from site. There are no plans to discharge to South Killingholme Drain from the septic tanks (if it is proposed to discharge to a local watercourse, then this will need | At this stage it is not certain how new foul wastewater from the refinery will be managed. Water will be treated and temporarily stored in either a septic tank or a cesspit before being either pumped out and discharged into the nearest public sewer or if that is not possible, tankered and removed from site. It is proposed that this can be conditioned for determination at a later stage in the planning process. | Out - North Beck Drain Water Body (GB104029067575) and Humber Lower (GB530402609201) |

to be subject to a permit for the discharge and this screening updated).

| | | | |
|---|---|---|--|
| VPI surface water drainage systems | A surface water drainage system with an attenuation lagoon, discharging to South Killingholme Drain at the greenfield runoff rate. | This activity has a clear interaction with the water environment but is in keeping with the current surface water arrangements from the VPI Site. As discussed earlier, the discharge is made into the South Killingholme Drain for which it is uncertain whether WFD principles apply. | Out – As there is no WFD status for sulphate, and since South Killingholme Drain is not connected to North Beck Drain Water Body (GB104029067575) this has been screened out. However, this screening decision is provisional subject to agreement with the Environment Agency on whether WFD principles should apply to South Killingholme Drain. |
| | | In addition to above, initial dilution and dispersion will take place within South Killingholme Drain. Upon reaching the estuary, it is expected that the significant dilution and dispersion that would occur would quickly dissipate any residual pollutants that may be present. | Out – Humber Lower (GB530402609201) |
| VPI foul water drainage systems | The development makes no provision for new sanitary systems, additional staffing is expected to utilise the existing facilities with no new sanitary sewerage anticipated. Foul drainage from the existing facilities is collected and sent to the existing biological treatment plant. Any changes to the existing plant due to increased staffing levels is outside of the project scope. | No new sanitary sewerage is included within the project. | Out - North Beck Drain Water Body (GB104029067575) and Humber Lower (GB530402609201) |
| Phillips 66 and VPI internal access roads | Internal access roads providing access around the Proposed Phillips 66 Development and connecting the Proposed Phillips 66 Development to existing roads in and around the Refinery. Internal access roads providing access around the Proposed VPI Development and connecting the Proposed VPI Development to existing roads in and around the CHP Plant. | The activity should not have any effect on the WFD status of the surrounding water body as the activity has no obvious interaction or impact pathway with the water environment. Any works during the construction phase that may generate runoff or spillages are anticipated to be adequately addressed through measures to be outlined in the CEMP and WMP to avoid adverse impacts on water quality to watercourses receiving drainage from the Sites. However, should there be significant changes to the design, then this activity may need to be re-assessed. | Out - North Beck Drain Water Body (GB104029067575) and North Lincolnshire Chalk Unit Water Body (GB40401G401500) |
| Phillips 66 new site access from Eastfield Road | A new site access from Eastfield Road, which together with a recently constructed access road from Eastfield Road for a nitrogen storage facility in the north-west corner of the Refinery will allow one way entry and one way exit from the Phillips 66 Development. | The activity should not have any effect on the WFD status of the surrounding water body as the activity has no obvious interaction or impact pathway with the water environment. Any works during the construction phase that may generate runoff or spillages are anticipated to be adequately addressed through measures to be outlined in the CEMP and WMP to avoid adverse impacts on water quality to watercourses receiving drainage from the Sites. However, should there be significant changes to the design, then this activity may need to be re-assessed. | Out – North Beck Drain Water Body (GB104029067575) and North Lincolnshire Chalk Unit Water Body (GB40401G401500) |
| VPI new site access from Rosper Road | A new site access, for construction and maintenance and emergency use, located to the south of the existing CHP Plant. This will cross part of South Killingholme | Ppotential for some localised loss of channel and interruption to flow regime. However, the flow regime is already impacted by a high proportion of flow being derived from surface water runoff from local industrial sites (may be as much as 97%) and tide locking conditions. South | Out - North Beck Drain Water Body (GB104029067575) on the basis of future control of |

| | | | |
|--|--|---|---|
| | <p>Drain alongside Rosper Road with a new culvert to be installed.</p> | <p>Killingholme Drain has a cohesive fine sediment bed and there is no evidence of any coarse sediment transport. A planning condition may be appropriate to ensure detailed design is acceptable, although a land drainage consent application will be required to the IDB. Finally, any works during the construction phase that may generate runoff or spillages are anticipated to be adequately addressed through measures to be outlined in the CEMP and WMP to avoid adverse impacts on water quality to watercourses receiving drainage from the Sites.</p> | <p>designs through planning / land drainage consenting, the small scale and heavily modified character of the existing channel, and the localised nature of any impact.</p> |
| <p>Realignment of South Killingholme Drain through the VPI Development</p> | <p>South Killingholme Drain will be realigned through the VPI Site to facilitate the Proposed VPI Development. The existing open ditch is approximately 522 m long. The revised alignment will start and end in the same location but will be diverted to the south to facilitate the development platform. It will be 577.5 m long. The majority (approximately 441 m) of the realigned ditch will be open but the westernmost section (approximately 136 m) will need to be culverted to maintain an existing access route. The new ditch will be lined with clay where natural ground conditions are not themselves relatively impermeable.</p> | <p>Any works during the construction phase that may generate runoff or spillages are anticipated to be adequately addressed through measures to be outlined in the CEMP and WMP to avoid adverse impacts on water quality to watercourses receiving drainage from the Sites.</p> <p>Long term, permanent impacts will be avoided and minimised by:</p> <ul style="list-style-type: none"> ▪ Assumed that appropriate construction measures will be followed so as to minimise the level of impact during construction as will be described in a CEMP and a WMP. ▪ Given the low gradient, low energy environment controlled in part by tide locking conditions, and the use of cohesive puddle clay to line the new ditch, the risk of erosion and fine sediment mobilisation is low. ▪ It is believed that the existing drain is underlain by puddle clay or perhaps even concrete which will prevent any significant interaction with groundwater. The proposed new channel will be similarly lined with clay if ground conditions are not already sufficiently impermeable. ▪ It is assumed that the new channel will be excavated first so that flow can be transferred prior to infilling of the existing channel, thus always maintaining river continuity. Although there will be a slight increase in the existing culverted section under the refinery, from this point to the existing twin arch culverts under Rosper Road there will be no interruption of river continuity. ▪ The proposed design is to replace the existing channel on a 'like for like' basis and therefore the status quo will be largely maintained (e.g. channel structure, bed substrate, riparian habitat once established etc.), albeit approximately 80 m less open channel. However, South Killingholme Drain is highly modified and possesses very little variation in character and form. As such, the new channel should feasibly be able to replicate, or even improve, the status of this quality element. <p>A planning condition may be appropriate to ensure detailed design is acceptable, although a land drainage consent application will be required to the IDB.</p> | <p>Out - North Beck Drain Water Body (GB104029067575)</p> |
| | | <p>Any works during the construction phase that may generate a groundwater pollution risk are anticipated to be adequately addressed through measures to be outlined in the CEMP and WMP. In addition, a review of local borehole records⁷ suggests that the water of the chalk is c. 18 m bgl with relatively impermeable superficial deposits of tidal flats (clays and silt) and glacial till above.</p> | <p>Out - North Lincolnshire Chalk Unit Water Body (GB40401G401500)</p> |

6. Summary

For relevant WFD water bodies, the Proposed Developments will have to demonstrate that there is no deterioration in any of the identified baseline classifications, and no prevention of future improvement for these classifications, taking into account the objectives of any Protected Areas. If this cannot be achieved, an Article 4.7 derogation would be required. This report represents the first or 'screening' stage of WFD assessment. Activities associated with the Proposed Developments that could influence WFD water bodies have been described, and the WFD water bodies that could potentially be impacted have been identified and how.

South Killingholme Drain is not designated under the WFD in its own right but as part of North Beck Drain (GB104029067575). However, it has no known hydrological connection to this watercourse, and the influence of industrial drainage, management by the IDB, and tide locking conditions, mean that the WFD classification for North Beck Drain may not be a true reflection of the status of this watercourse.

Irrespective of the fact that South Killingholme Drain is included within the catchment of North Beck Drain WFD water body catchment, where a watercourse is not designated itself, the downstream WFD water body would usually be used as the proxy for WFD classification. However, this is the Humber Lower transitional water body, which has a significantly and materially different character to South Killingholme Drain, and thus the estuary's WFD classifications are not representative of the South Killingholme Drain.

If WFD principles did not apply to the South Killingholme Drain, other assessment processes including the impact assessment included in the ES and/ or future environmental permitting requirements would still be required. These will assess the risk to the South Killingholme Drain from short term (i.e. construction) or longer term water quality (i.e. future effluent discharges) and physical (e.g. from the proposed diversion) impacts. However, these assessments are not complicated by the lack of watercourse specific WFD classifications or suitable proxy water bodies where classifications for the determination of compliance could be adopted.

In terms of water quality impacts, this is mainly associated with potential impacts from high sulphate levels that are predicted to be contained within the future refinery effluent discharge. However, the potential for any impact remains uncertain and is subject to ongoing literature review. A programme of water quality, flow and level monitoring is being considered, although this data will not be available for some time.

There will also be some loss of habitat due to the realignment of a section of South Killingholme Drain between the existing refinery culvert and Rosper Road as part of the Proposed VPI Development. However, South Killingholme Drain is heavily modified with a poor flow regime and water quality, and therefore habitat diversity and low biodiversity. The new channel will be provided on a 'like for like' basis in terms of form but slightly shorter in length (a reduction of around 80 m). Any impact on riparian corridor will be short term while similar habitat to that lost re-establishes.

Based on the outcome of this assessment presented in Table 9B5.2 no further impact assessment is recommended for the **Humber Lower transitional water body (GB530402609201)**. There will be no direct impacts to the Humber Lower transitional water body. Impacts from changes in water quality or pollution risk (including during construction) via South Killingholme Drain are an indirect impact. Initial dilution and dispersion within the drain, following by further dilution and dispersion on entry into the estuary (which is within the Port of Immingham and likely deeper water), will reduce any pollution risk. High sulphate levels have been identified as the principal water quality impact, and sulphate levels are expected to be naturally higher in the estuarine environment (although existing Environment Agency monitoring does not have any data for sulphate). Therefore, it is proposed that no further consideration of the WFD transitional water body is required.

Regarding the **North Lincolnshire Chalk Unit Water Body (GB40401G401500)**, the depth to groundwater, presence of relatively impermeable superficial deposits, combined with standard best practice measures to prevent pollution of groundwater during construction works, are expected to be effective at managing any risks. Therefore, it is proposed that no further consideration of this WFD groundwater body is required.

It is recommended that the conclusions of this screening assessment are discussed with the Environment Agency.

