The London Resort Development Consent Order

BC080001

Environmental Statement
Volume 2: Appendices

Appendix 13.7 – Water Framework Directive Report

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Planning Act 2008
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009
Regulation 5(2)(a)
The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017
Regulation 12(1)

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Revisions

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The Environmental Dimension Partnership Ltd
Tithe Barn
Barnsley Park Estate
Barnsley
Cirencester
Gloucestershire
GL7 5EG

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Executive Summary

The London Resort Proposed Development is split across the north and south bank of the River Thames. For clarity, the section of the Project Site that is to the south of the Thames is referred to in this report as the 'Kent Project Site' and that to the north of the river is identified as the 'Essex Project Site' (see ES Figure 13.1: Order Limits; figure reference 6.3.13.1).

Works for the Proposed Development at the Kent Project Site include the construction of a new ferry terminal and ferry pontoon with linkspan and refurbishment of Bell's Warf. There are also options for construction of a new floating Roll-on / Roll-off (Ro-Ro) platform and linkspan, refurbishment/reinforcement of White's Jetty or dredging and deepening of Bell's Warf. At the Essex Project Site, a new ferry pontoon will be constructed with a linkspan (see Chapter 3: *Proposed Development* below).

During operation, the passenger terminal will be used by the London Resort ferry and Clipper ferry at both the Kent and Essex Project Sites.

The works are within the Thames Middle Water Framework Directive (WFD) transitional water body and this WFD Assessment report is required to determine if the Proposed Development could affect the current status/potential (or future objective status/potential) of relevant WFD supporting elements in the Thames Middle WFD water body. In addition, potential effects on groundwater bodies are considered.

For the Thames Middle water body the assessment considered the biological, hydromorphological and chemical quality elements potentially affected by all aspects of the Proposed Development and has been conducted following the Environment Agency's (EA) 'Clearing the Waters for All' guidance (EA 2016) which has been developed specifically to assess the effects of activities in transitional and coastal waters in relation to WFD objectives. For groundwater bodies the assessment was based on tests outlined in EA (2012), where appropriate.

The assessment approach was based on the following three stages: Screening, Scoping and Impact Assessment. Screening determined that the proposed activities were not classed as low risk activities and as such the assessment proceeded to the Scoping stage.

At the Scoping stage the WFD quality elements Biology – Habitats (Lower sensitivity habitats), Water Quality (in terms of phytoplankton and harmful algae) and Protected Areas were scoped out from further assessment following criteria in the 'Clearing the Waters for All' guidance.

The WFD quality elements taken forward to the Impact Assessment stage were:

- Hydromorphology;
- Biology - Habitats (higher sensitivity: Saltmarsh);

- Biology – Fish (only screened in for construction phase);
- Water quality;
    - potential effects on physicochemical parameters;
    - potential to release chemicals on Environmental Quality Standards Directive (EQSD) list;
    - potential to release Chemicals above Cefas Action Level 1; and
- Invasive non-native species (INNS).

Those not screened in to assessment were:

- Biology - Fish (only screened out for operation phase);
- Biology - Habitats (lower sensitivity habitats);
- Water quality – Phytoplankton status; Harmful algae
- Protected areas

For these WFD quality elements, available evidence was assessed to determine if there could be any effects of the works on status/potential of the Thames Middle WFD water body.

In addition, the groundwater bodies 'West Kent Darent and Cray Chalk water body', 'South Essex Thurrock Chalk water body' and 'North Kent Medway Chalk water body' were screened into assessment.

There are two embedded mitigation measures for the Proposed Development as indicated in ES Chapter 13: *Marine Ecology and Biodiversity* (document ref: 6.1.13). One is creation of approximately 3 ha of saltmarsh habitat by breaching the existing sea defences and via interventions at the shoreline; and the other is use of booms to minimise the potential effects of boat wash. A range of additional mitigation measures were proposed in ES Chapter 13: *Marine Ecology and Biodiversity* (document ref: 6.1.13) which will be secured as requirements of the DCO and these have also been considered during this assessment. These additional measures include but are not restricted to: provision of a Construction Environmental Management Plan (CEMP) with various measures that will be adhered to including measures to minimise the chances of accidental pollution and any subsequent effects; and provision of a Biosecurity Plan with a Biosecurity Risk Assessment to reduce the risk of the introduction and spread of invasive non-native species. In addition, a suite of mitigation measures of relevance to the groundwater bodies have been considered for this assessment which will be set out in a CEMP and Remediation Strategy. The Outline CEMP is provided in ES Appendix 3.2 (document ref: 6.2.3.2). All of these measures will be secured as a requirement of the DCO.

In addition, a range of additional mitigation measures were proposed to reduce the potential effect of underwater noise and vibration on fish in ES Chapter 13: *Marine Ecology and Biodiversity* (document ref: 6.1.13). These measures will be secured as a requirement of the DCO.

Overall, after the embedded and additional mitigation measures were considered the assessment concluded that the works for the Proposed Development (either alone or cumulatively) are not expected to have any non-temporary effects and would not prevent the Thames Middle water body from meeting WFD objectives set out for each WFD quality element.

In addition, no deterioration of the quantitative or qualitative elements of the groundwater bodies is anticipated due to the Proposed Development.

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Contents

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List of Tables

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List of Figures

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Glossary

AA	Annual Average
AOD	Above Ordnance Datum
BAP	Biodiversity Action Plan
BAT	Best Available Technology
BGS	British Geological Society
CEMP	Construction Environmental Management Plan
CITES	Convention on International Trade in Endangered Species
CKD	Cement Kiln Dust
CMAT	Construction Material and Aggregates Terminal
DCO	Development Consent Order
DIN	Dissolved Inorganic Nitrogen
DrWPAs	Drinking Water Protected Areas
EA	Environment Agency
EC	European Council
EQR	Ecological Quality Ratio
EQS	Environmental Quality Standards
EQSD	Environmental Quality Standards Directive
ES	Environmental Statement
EU	European Union
GEP	Good Ecological Potential
GES	Good Ecological Status
GWDTEs	Groundwater Dependent Terrestrial Ecosystems
HMWB	Heavily Modified Water Body
IMO	International Maritime Organisation
INNS	Invasive Non-Native Species
LRCH	London Resort Company Holdings Limited
MAC	Maximum Allowable Concentration
NERC	Natural Environment and Rural Communities
NGR	National Grid Reference
NNS	Non-Native Species
NSIP	Nationally Significant Infrastructure Project
NVC	National Vegetation Classification
PFOS	Perfluooctylsulphonate
PINS	Planning Inspectorate
PPG	Pollution Prevention Guideline
RBMP	River Basin Management Plan
Ro-Ro	Roll-on Roll-off
SAC	Special Areas of Conservation
SuDS	Sustainable Urban Drainage Systems
SPA	Special Protection Areas
SPZ	Source Protection Zone
SSC	Suspended Sediment Concentration

TBT	Tributyltin
TFCI	Transitional Fish Classification Index
WFD	Water Framework Directive

Chapter One ◆ Introduction

BACKGROUND

1.1. The Proposed Development is split across the north and south bank of the River Thames. For clarity, the section of the Project Site that is to the south of the Thames is referred to in this report as the 'Kent Project Site' and that to the north of the river is identified as the 'Essex Project Site' (see ES Figure 13.1: Order Limits; figure reference 6.3.13.1).

1.2. The Kent Project Site is bisected by the municipal boundary between the boroughs of Dartford Borough Council (to the west) and Gravesham Borough Council (to the east) and It lies mostly in the designated area of the Ebbsfleet Garden City, established in March 2015. The Kent Project Site covers an area of 387.53 ha. The development is primarily on the Swanscombe Peninsula, but also includes a corridor of land along to the south east past Ebbsfleet International train station toward Watling Street. The Order Limits also includes a stretch of Watling Street from the B255 junction to Pepper Hill. This will be where a new access road and upgrades to existing road junctions are likely to be made.

1.3. The Essex Project Site is within the administrative area of Thurrock Borough Council. The Essex Project Site covers an area of 25.54 ha. The majority of the Essex Project Site is on the River Thames between Tilbury Fort and Tilbury Docks. A much smaller part of the red line boundary encompasses a roundabout to the North West involving Dock Road and St Andrew's Road.

1.4. The works are located within the Thames Middle Water Framework Directive (WFD) transitional water body extending from Battersea Reach to East Tilbury [ID GB53060391140]. The area of the Thames Middle WFD water body potentially affected by the Proposed Development is indicated in Figure 13.7.2.

1.5. The downstream extent of the Thames Middle transitional water body is located approximately 12 km downstream of the Kent Project Site and 8 km downstream of the Essex Project Site near Lower Hope Point.

1.6. The Thames Middle Transitional water body is a Heavily Modified Water Body (HMWB) on account of the following designated uses (Cycle 2 2015-2021): Coastal protection; Flood protection; and Navigation

1.7. The Proposed Development is a Nationally Significant Infrastructure Project (NSIP), which will be authorised by a Development Consent Order (DCO) and this WFD Assessment report supports the Environmental Statement for the PINS application process for the Proposed Development.

PURPOSE OF REPORT

1.8. The objective of this assessment is to consider the available data for WFD supporting elements in the Thames Middle water body in accordance with the Environment Agency's (EA) 'Clearing the Waters for All' guidance (EA 2017) and to complete a WFD assessment for groundwater bodies.

1.9. The WFD assessment for the Thames Middle water body considered the potential effects of the proposed works on the status/potential of the following types of WFD parameter (see Table 5-1 for current status):

- Ecological potential:
  - Biological supporting elements;
  - Physicochemical supporting elements (and Specific Pollutants); and
  - Hydromorphological considerations.
- Chemical status:
  - 'Priority Substances'[1];
  - 'Other Pollutants'[1]; and
  - 'Priority hazardous substances'[1].

1.10. The WFD assessment for groundwater bodies covered the West Kent Darent and Cray Chalk Water Body, South Essex Thurrock Chalk Water Body and North Kent Medway Chalk Water Body. The assessment was based on consideration of the potential effects of the proposed works on Quantitative status and Chemical status of these groundwater bodies (EA 2012).

[1] Limited to chemicals on Environmental Quality Standards Directive (EQSD) list for WFD (as provided in EA 2017). Environmental thresholds are defined by Defra (2015).

Chapter Two ◆ Legislative Context

WATER FRAMEWORK DIRECTIVE OVERVIEW

2.1 The WFD establishes a framework for the management and protection of Europe's water resources. It is implemented in England and Wales through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (the Water Framework Regulations). Central to the WFD is the philosophy to make water bodies better through sustainable development for the joint benefits of aquatic habitats and the human environment.

2.2 For surface waters including transitional water bodies, ecological status is an expression of the quality of the structure and functioning of surface water ecosystems as indicated by the condition of a number of 'quality elements'. These include biological and chemical indicators. Where a water body is defined as a HMWB, which is the case for the Thames Middle water body, ecological status is replaced by ecological potential.

2.3 The development and implementation of strategic long-term River Basin Management Plans (RBMPs) is a key requirement of the WFD. They include a programme of measures outlining the on-going monitoring and management actions required for water bodies to achieve future objectives. The RBMPs are published by the EA every six years (UK Government 2019). The first RBMPs were published in 2009, and the current Cycle 2 RBMPs were published in December 2015.

2.4 Proposed developments or activities that have the potential to affect the water environment require a WFD Assessment. In this context, compliance with the WFD means prevention of deterioration (of ecological status, chemical status and supporting element status) and avoiding prevention of ability to achieve future targets. However, WFD Article 4.7 provides legislation for exemption conditions that could allow implementation of schemes that cause deterioration in ecological status, for example for reasons of overriding public interest.

2.5 A subsequent directive to the WFD sets out Environmental Quality Standards (EQSs; 2008/105/EC; Ref 12.2) for priority substances which is known as the EQS Directive and there have been subsequent amendments (2013/39/EU; Defra & EA 2015) as well as the Groundwater Directive (2006/118/EC). The environmental objectives of the WFD and its associated directives are to:

- prevent deterioration of aquatic ecosystems;

- protect, enhance and restore water bodies to Good status; based on ecology (with its supporting hydromorphological and physico-chemical factors) and chemical factors for surface water, and water quantity and chemical status for groundwater;

- comply with water related standards and objectives for environmentally protected areas established under other European Union (EU) legislation;

- progressively reduce pollution from priority substances and cease or phase out discharges of priority hazardous substances; and

- prevent or limit the input of pollutants into groundwater and reverse any significant or sustained upward trends in the concentration of any groundwater pollutant.

2.6 The default objective of the WFD is for all rivers, lakes, estuaries, groundwater and coastal water bodies to achieve Good status by 2027 at the latest. Where it is not possible to achieve this, alternative objectives can be set. The existing status, and measures required to achieve the 2027 status objective are set out for each water body in the relevant RBMPs. The plans set out the current baseline condition of the water environment at the time of publication and provide details on the measures needed and timescales required to attain their target status.

Transitional Water Bodies

2.7 For the following surface water bodies: rivers, lakes, estuaries and coastal waters, the overall water body status has both an ecological and a chemical component. Good ecological status (GES) is defined as a 'slight variation from undisturbed natural conditions, with minimal distortion arising from human activity'. The ecological status of water bodies is determined by examining biological elements (e.g. fish, invertebrates, plants) and a number of supporting elements and conditions, including physico-chemical (e.g. metals and organic compounds), and hydromorphological (e.g. depth, width, flow, and 'structure') factors. The WFD classification elements for transitional WFD water bodies such as the Thames Middle WDF water body are as follows:

- Hydromorphological:
  - tidal regime:
    - freshwater flow; and
    - wave exposure.
  - morphological conditions:
    - depth variation;
    - quantity, structure and substrate of the bed; and

  - structure of the intertidal zone.

- Biological:
  - phytoplankton;
  - other aquatic flora;
  - benthic invertebrates; and
  - fish.
- Physico-chemical and chemical:
  - transparency;
  - thermal conditions;
  - dissolved oxygen;
  - nutrients;
  - salinity; and
  - pollution by substances being discharged e.g. chemicals, metals, pesticides.

2.8 A flow chart illustrating how elements are combined to provide an overall water body status/potential is provided in Figure 13.7.2 (noting that this dates from Cycle 1). The classification hierarchy for surface waters (for Cycle 2) is illustrated in Figure 13.7.3.

2.9 The Thames Middle Water Body is a HMWB on account of physical modifications associated with coastal protection, flood protection and navigation (EA 2009). Where a water body is defined as a HMWB, the term water body 'status' is replaced by water body 'potential'. For HMWBs the term 'ecological status' (combination of multiple biological, physical and some chemical supporting elements) is replaced by 'ecological potential'. The term 'chemical status' (combination of other chemical supporting elements), however, remains unchanged when considering HMWBs. Only biological (and some physico-chemical) supporting elements have classification boundaries defined for High through to Bad (see Figure 13.7.2). Chemicals supporting Chemical Status that do not meet Environmental Quality Standards (EQS) are classified as 'Fail' (Figure 13.7.2). HMWBs have a target to achieve good ecological potential (GEP), which recognises their essential human use/s (e.g. flood protection, navigation), whilst making sure ecology is protected and enhanced as far as possible. Current classifications for the Thames Middle Water Body are provided in Table 5-1 and Table 6-5.

Groundwater Bodies

2.10 Under the WFD, groundwater body status is classified on the basis of quantitative and chemical status. The classification hierarchy for groundwater bodies is illustrated in Figure 13.7.4 (EA 2018). Further detail is provided in the 'Impact Assessment' section below.

Available Guidance and No Deterioration Assessment

2.11 The main source of guidance on WFD Compliance Assessment in England is from the EA. At present the only publicly available guidance is: Clearing the Waters for All (EA 2016), which relates to activities in water bodies up to one nautical mile out to sea. This guidance interprets the 'no deterioration criterion' as applying to each supporting WFD element as well as the overall status classification of the water body. An example of this would be a deterioration in the quality of one biological element in a transitional water body from good to moderate status would be classed as deterioration irrespective of whether this caused the overall water body status to be lowered. This approach was reinforced by a ruling from European Court of Justice and has been adopted as a general principal for the impact screening of Proposed Development presented in this report.

2.12 Further to this, Cycle 2 RBMPs indicate that within-class deterioration of any constituent element (e.g. a lowering of the quality of a biological element that does not result in a lowering of the status of that element (e.g. from good to moderate) is permissible, but should be limited as far as practicable. There are two exceptions to this: first, where the water body is at the lowest possible class (e.g. bad ecological status) where no within class deterioration is allowed and, second, elements that are at high status (with the exception of morphology), which may be allowed to deteriorate to good status provided a number of additional conditions are met.

Chapter Three ◆ Proposed Development

3.1 Full details of the proposed design are provided in Environmental Statement (ES) Chapter 3: *Project Description* (document ref: 6.1.3).

3.2 For the purpose of this WFD assessment the proposed works refer to the refurbishment of existing marine infrastructure and the construction of new marine infrastructure as well as existing ground conditions and the possible disturbance of ground conditions.

KENT PROJECT SITE

3.3 There are three main options at the Kent Project Site as follows: Option A (Figure 13.7.5); Option B (Figure 13.7.6); and Option C (Figure 13.7.7), (see ES Chapter 3: *Project Description*, document ref: 6.1.3). Due to similarities in potential effects across different options, they are not assessed separately but it is indicated when a particular consideration or aspects of assessment only applies to a specific option. It should be noted that due to potential ecological effects being greater for Option C than for Options A and B (especially in relation to effect on the MCZ feature tentacled lagoon worm), Option C and dredging would only be conducted if Option A and B prove to be unfeasible.

Option A

1. New ferry terminal and ferry pontoon with linkspan
2. Refurbishment of Bell Wharf – an open-piled quay deck
3. Construction of a new floating Roll-on / Roll-off (Ro-Ro) platform and linkspan (Option A only)

Option B

1. New ferry terminal and ferry pontoon with linkspan
2. Refurbishment of Bell Wharf – an open-piled quay deck
3. Refurbishment/reinforcement of White Jetty – an open-piled deck structure in an uncertain state of repair (Option B only)

Option C

1. New ferry terminal and ferry pontoon with linkspan
2. Refurbishment of Bell Wharf – an open-piled quay deck

3. Dredging to deepen access to Bell Wharf (Option C only)

3.4 The ferry terminal is proposed to be on piles. As the number of piles has not yet been finalised and due to considerations of shading, the area of habitat under the terminal has been considered to be equivalent to a loss of habitat for the purposes of this assessment (i.e. the full footprint has been estimated) although actual loss of habitat (i.e. within the footprint of individual piles) would be a lot less. This is considered to be a precautionary worst-case scenario approach.

3.5 As part of the Proposed Development, new saltmarsh will be created within the Kent Project Site (this is embedded mitigation). This will be achieved via managed retreat of the flood defences in the area south of Bell Wharf and interventions at the shoreline to create an enhanced intertidal zone and encourage saltmarsh habitat to form along the north and northwest coast of the Peninsula. This will increase areas of mud flat, salt marsh, small pools, rocks and shingle areas, with reeds, sedges and grasses transitioning into scrub vegetation. It is estimated that creation of c.3 ha of saltmarsh habitat will be achievable. Further details are provided in ES Appendix 12.3: *Ecological Mitigation and Management Framework* (document ref: 6.2.12.3).

3.6 This habitat creation will be secured in a requirement in the DCO.

TILBURY PROJECT SITE

3.7 The proposed works at the Essex Project Site will involve construction of a new ferry pontoon with linkspan (Figure 13.7.8).

THAMES MIDDLE WATER BODY

3.8 For the Thames middle WFD water body the key considerations in terms of potential effects on Thames transitional waters are the following activities.

Construction Activities

- Construction of ferry pontoon with linkspan at Kent Project Site.
- Refurbishment of Bell Wharf (open-piled quay deck) at Kent Project Site.
- Construction of new floating Ro-Ro slipway and linkspan at the Kent Project Site (only relevant to Option A).
- Refurbishment/reinforcement of White Jetty (open-piled quay deck; only relevant to Option B).
- Dredging at the Kent Project Site (only relevant to Option C).

- Wastewater treatment plant outfall at Kent Project Site. Water released from this facility will be treated prior to discharge to ensure it complies with the relevant legislation (this will be secured as a requirement in the DCO). The location of this outfall will be on the north east coast of the Peninsula. The construction of the outfalls could require the construction of a temporary cofferdam within the subtidal zone.

- Surface water outfalls. Surface water runoff outfalls will be installed at up to five locations along the Kent Project Site coastline, four of which are within the Swanscombe MCZ area. The construction of the outfalls will likely require the construction of temporary cofferdams within the intertidal zone in the MCZ. A single outfall is anticipated to be installed at the Essex Project Site and will be sited to pass between existing infrastructure. As set out in ES Chapter 17: *Water Resources and Flood* Risk (document ref: 6.1.17), there is potential for on-site activities to influence the water quality of the tidal River Thames. However, pollutant interceptors and siltation controls will be employed and the water will be treated prior to discharge. For full details of proposed mitigation to prevent pollution from surface water runoff entering the tidal River Thames see ES Chapter 17: *Water Resources and Flood Risk* (document ref: 6.1.17). The residual environmental effects following implementation of these mitigation measures has been assessed to be not significant in ES Chapter 17: *Water Resources and Flood* Risk (document ref: 6.1.17).

- Extension of jetty at Essex Project Site.

Operational Activities

- Deliveries to the Ro-Ro facility or White's Jetty at Kent Project Site.

- Use of passenger terminal by London Resort ferry and Clipper ferry at both the Kent and Essex Project Sites.

- Discharge of water from wastewater treatment plant outfall to the estuary at Kent Project Site. The discharge will comply with regulatory requirements from the EA in terms of water quality and any other requirements (this will be secured as a requirement in the DCO);

- Discharge of water from surface water outfalls. Details of discharge volumes are not currently available but the discharge will comply with regulatory requirements from the EA in terms of water quality and any other requirements;

- Maintenance dredging (only relevant to Option C). Note that if Option C is chosen, it is the intention that Bell Wharf will only be used during the construction phase and therefore maintenance dredging will not be conducted. If it was decided that Bell Wharf is to be used during operation of the Proposed Development, however, maintenance dredging may be required periodically which would cause disturbance and re-suspension of sediments. Consequently, consideration of maintenance dredging has been included in the assessment.

- Maintenance of structures.

GROUNDWATER BODIES

3.9 The groundwater bodies considered were 'West Kent Darent and Cray Chalk water body', 'South Essex Thurrock Chalk water body' and 'North Kent Medway Chalk water body' (see Chapter 5: *Groundwater Bodies*). For the groundwater bodies key considerations in terms of potential effects are associated with the following activities.

Construction Activities

- Construction of the new access road (which includes construction across / through landfilled wastes) has the potential to impact on the groundwater body. Specifically, promotion of infiltration in areas of earthworks may encourage leaching of contamination and migration into the aquifer, deep foundations protruding into the aquifer may create or modify flow paths, and runoff from potentially contaminated surfaces could be discharged into the aquifer.

- Construction of the various buildings and structures of the Proposed Development, which includes construction over landfilled wastes (mainly cement kiln dust), has the potential to impact on the groundwater body. Specifically, promotion of infiltration in areas of earthworks may encourage leaching of contamination and migration into the aquifer, deep foundations protruding into the aquifer may create or modify flow paths, and runoff from potentially contaminated surfaces could be discharged into the aquifer.

- Construction of the marine infrastructure has the potential to impact on the groundwater body from deep foundations protruding into the aquifer.

Operational Activities

- Increased surface runoff from scheme could cause deterioration to water quality of groundwater body if runoff is contaminated.

    - Deep foundations may create rapid vertical flow pathways into the groundwater body for potentially contaminated runoff.

- Deep foundations (piling) may form a barrier to groundwater flow, potentially reducing groundwater contributions to adjacent water courses and any groundwater abstractions in the water body

Mitigation measures

3.10 The following measures will limit potential effects on groundwater bodies and will be implemented through the outline Construction Environmental Management Plan (CEMP) (ES Appendix 3.2: *Outline Construction and Environmental Management Plan*, document ref: 6.2.3.2) which will be secured by a requirement in the DCO:

- A piling risk assessment in accordance with EA guidance will be undertaken as the design progresses;

- Piling techniques deemed appropriate to identify and manage potential risks as a result of creating pathways to groundwater will be used;

- Working methods during earthworks and ground stabilisation works to appropriately manage groundwater and surface water, ensuring that there is no uncontrolled runoff from the works, material / waste stockpiles, and storage containers into the aquifer, in accordance with Pollution Prevention Guideline (PPG) 6: Working at Construction and Demolition Sites;

- Working methods during earthworks and ground stabilisation works to appropriately manage exposed areas, to minimise infiltration and to ensure that there is no uncontrolled runoff from the works, in accordance with Pollution Prevention Guideline (PPG) 6: Working at Construction and Demolition Sites;

- The Kent and Essex Project Sites will be operated in accordance with the relevant regulations and best practice guidance in applying Best Available Techniques and pollution prevention;

- An appropriate pollution incident control will be implemented on the Kent and Essex Project Sites and any leaks / spills will be identified as soon as possible and dealt with appropriately to prevent aquifer contamination; and

- The drainage system will be designed so that any unplanned spillages can be contained and will not enter the aquifer underlying the Kent and Essex Project Sites.

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Chapter Four ◆ Methods

STRUCTURE OF ASSESSMENT

4.1 The assessment for has followed the structure of the EA's 'Clearing the Waters for All' guidance that was developed specifically to assess the effects of activities in transitional and coastal waters in relation to WFD targets. The assessment approach is based on the following three stages (EA 2017):

- Screening
- Scoping
- Assessment

Stage 1: Screening

4.2 This screening stage is used to determine if the proposed works are classed as a low risk activity. Low risk activities are identified as:

- a fast-track or accelerated marine licence activity that meets specific conditions;
- maintaining pumps at pumping stations;
- removing blockages or obstacles like litter or debris within 10 m of an existing structure to maintain flow;
- replacing or removing existing pipes, cables or services crossing over a water body – but not including any new structures or supports, or new bed or bank reinforcement;
- 'over water' replacement or repairs to, for example, bridge, pier and jetty surfaces, if bank or bed disturbance is minimised.

4.3 As the proposed works do not fulfil criteria for a low risk activity, the assessment presented in this document commences at the Scoping stage.

Stage 2: Scoping

4.4 For surface waters (i.e. the Thames Middle Transitional water body), biological, hydromorphological and chemical quality elements potentially affected by the Proposed Development were first considered using the Scoping Template provided in the EA guidance (EA 2017). The Scoping Template indicates criteria to consider for a range of

parameters to determine the potential for adverse effects on WFD targets for surface water bodies. Completion of the template helps identify whether there is a requirement to take these receptors to the impact assessment stage.

4.5 For groundwater bodies the main consideration was whether they have either direct or indirect connectivity to the proposed works. If it was considered that they could have connectivity with the works, they were scoped into the assessment.

Stage 3: Impact Assessment

Surface water bodies

4.6 The impact assessment stage involved determination of the potential effects for the work activities on the specific parameters that were taken forward from the Scoping stage (EA 2017).

4.7 For the Thames Middle water body the assessment involved consideration of whether the activities will have a non-temporary effect on status/potential of WFD quality elements at the Thames Middle water body level (i.e. cause deterioration or compromise the achievement of measures set out in the Thames River Basin District RBMP programme of measures and therefore future objective status/potential) (Defra & EA 2015). The scope of the assessment was determined following the steps in the 'Impact Assessment' section of EA (2017).

4.8 Where no specific guidance for assessment is provided in the EA guidelines (EA 2017), the WFD assessment has followed principles of EIA guidance where applicable in that the following aspects have been considered when assessing the potential for a change in WFD status/potential due to effects on WFD quality elements (CIEEM 2018), (further detail and definitions are provided in ES Chapter 13: *Marine Ecology and Biodiversity*, document ref: 6.1.13):

- Nature of effect i.e. beneficial / adverse; direct / indirect;
- Extent of the effect (geographical area e.g. site-wide, local, district, regional, and the size of the population affected);
- Likelihood of effect occurring;
- Value and sensitivity of receptor;
- Magnitude of effect;
- Duration
  - Temporary or permanent effect. If the effect occurs on all of, or a proportion of, a community/population on a continual basis it can be considered to be permanent (e.g. a continual cooling water discharge). If it is not on a continual basis when

considering the community/assemblage/population or habitat level it can be described as temporary (e.g. intermittent piling);

- Persistence of the effect. This can vary regardless of whether an effect is temporary or permanent e.g. the effect of an impact can be short term (1 to 2 years/generations), medium term (2-10 years/generations), or long term (>10 years/generations);

- Reversibility
  - An irreversible effect is one from which recovery is not possible within a reasonable timescale or there is no reasonable chance of action being taken to reverse it. A reversible effect is one from which spontaneous recovery is possible or which may be counteracted by mitigation (CIEEM 2018).

- Timing and frequency of impacts in relation to key potential periods of increased sensitivity e.g. migration periods for diadromous fish species.

4.9 The assessment was also based on consideration of specific WFD typology standards and thresholds where available (e.g. for specific chemicals), however, in instances where there were no specific standards, professional judgement was applied.

4.10 The assessment was undertaken taking into account embedded mitigation which already forms part of the design/approach for the Proposed Development. It has also considered additional mitigation measures proposed in ES Chapter 13: *Marine Ecology and Biodiversity* (document ref: 6.1.13).

4.11 If it was considered that the activity would not affect the potential/status of a given WFD receptor then no further evaluation or mitigation was required for the WFD assessment for that receptor (i.e. WFD supporting element). If possible adverse effects were identified then the next step was to identify suitable mitigation measures (beyond embedded mitigation measures and those already identified as being required in ES Chapter 13: *Marine Ecology and Biodiversity* (document ref: 6.1.13) to address the potential effect (EA 2017).

Groundwater bodies

4.12 For the groundwater bodies the assessment was based on consideration of the outcome of the tests outlined in EA (2012), (Figure 13.7.10).

4.13 Both quantitative and chemical status were determined based on the tests indicated and the worst case classification was assigned as the overall groundwater body status in a 'one-out all-out' system (Figure 13.7.10).

4.14 If it was considered that the activity would not affect the status of a given groundwater body then no further evaluation or mitigation was required for the WFD assessment for that groundwater body (see Chapter 6: *WFD Assessment*). If possible adverse effects were

identified, then the next step was to identify suitable mitigation measures to address the potential effect.

Quantitative Status

4.15 Quantitative status is defined by the quantity of groundwater available as baseflow to watercourses and water-dependent ecosystems, and as a 'resource' available for use as drinking water and other consumptive purposes. This is assigned on a scale of Good or Poor, and on the basis of four classification elements or 'tests' as follows (EA 2012, EA 2018):

- Saline or other intrusions: This test is designed to identify groundwater bodies where the intrusion of poor quality water, such as saline water or water of different chemical composition as a result of groundwater abstraction, is leading to sustained upward trends in pollutant concentrations or significant impact on one or more groundwater abstractions.

- Surface Water: This test is designed to identify groundwater bodies where groundwater abstraction is leading to a significant diminution of the ecological status of associated surface water bodies.

- Groundwater Dependent Terrestrial Ecosystems (GWDTEs): This test is designed to identify groundwater bodies where groundwater abstraction is leading to 'significant damage' to associated GWDTEs (with respect to water quantity).

- Water Balance: This test is designed to identify groundwater bodies where groundwater abstraction exceeds the 'available groundwater resource', defined as the rate of overall recharge to the groundwater body itself, as well as the rate of flow required to meet the ecological needs of associated surface water bodies and GWDTEs.

Chemical Status

4.16 Chemical status is defined by the concentrations of a range of key pollutants; the quality of groundwater feeding into watercourses and water-dependent ecosystems; and by the quality of groundwater available for drinking water purposes. This is assigned on a scale of Good or Poor, and on the basis of five classification elements or 'tests' as follows:

- Saline or other intrusions: This test is designed to identify groundwater bodies where the intrusion of poor quality water, such as saline water or water of different chemical composition, as a result of groundwater abstraction is leading to sustained upward trends in pollutant concentrations or significant impact on one or more groundwater abstractions.

- Surface Water: This test is designed to identify groundwater bodies where groundwater abstraction is leading to a significant diminution of the chemical status of associated surface water bodies.

- Groundwater Dependent Terrestrial Ecosystems (GWDTEs): This test is designed to identify groundwater bodies where groundwater abstraction is leading to 'significant damage' to associated GWDTEs (with respect to water quality).

- Drinking Water Protected Areas (DrWPAs): This test is designed to identify groundwater bodies failing to meet the DrWPA objectives defined in Article 7 of the WFD or at risk of failing in the future.

- General Quality Assessment: This test is designed to identify groundwater bodies where widespread deterioration in quality has or will compromise the strategic use of groundwater.

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Chapter Five ◆ WFD Baseline Environment

TRANSITIONAL WATER BODIES

Thames Middle Water Body

5.1 The only transitional WFD water body that could be affected by the Proposed Development is the Thames Middle Water Body.

5.2 The Thames Middle transitional water body is designated as a HMWB on account of physical modifications associated with coastal protection, flood protection and navigation (EA 2009).

5.3 A summary of the 2016 and 2019 Cycle 2 assessment is provided in Table 5-1.

Table 5-1: Cycle 2 classifications for the Thame Middle Water Body.

Parameter		Year	
		2016	2019
Water Body ID		GB530603911402	
Water Body Area		4391.26 ha	
Water Body Type		Estuarine	
Hydromorphological designation		Heavily Modified	
Overall Potential		Moderate	Moderate
Ecological Potential		Moderate	Moderate
Chemical Potential		Fail	Fail
Ecological			
Biological Quality Elements	Angiosperms	Moderate	Moderate
	Fish	Good	Good
	Invertebrates	Good	Good
	Macroalgae	Good	Good
	Phytoplankton	Good	Good
Physico-chemical Quality Elements	Dissolved Inorganic Nitrogen	Moderate	Moderate
	Dissolved Oxygen	Moderate	Good
Supporting Elements (Surface Water)		Moderate	Moderate
Specific Pollutants		Moderate	Moderate
Chemical			
Priority substances		Good	Good
Other pollutants		Good	Good
Priority hazardous substances		Fail	Fail

GROUNDWATER BODIES

Kent Project Site: Swanscombe Peninsula

5.4 The Swanscombe Peninsula is an approximately triangular area of land in a meander of the River Thames, comprising predominantly low lying marshland, landfills, business parks and commercial land, amongst other less dominant land uses.

5.5 Made Ground varies across the Swanscombe Peninsula. Towards the north it is predominantly comprised of cement kiln dust, a waste product from the previous, local cement industry; whilst towards the south it is comprised of chalk, clay, sand and gravels which have been used to backfill pits and quarries, together with a mixture of domestic and commercial wastes within landfilled areas. The general topography is variable across the Kent Project Site, with low-lying, undulating land towards the north due to natural marshland and historical landfilling. Substantial chalk spines are present in the centre of the Kent Project Site, upon which roads and railway lines run, approximately 16-20 m above the surrounding ground.

5.6 Alluvium covers a large portion of the Swanscombe Peninsula north of Manor Way, and these deposits are predominantly silty clay and clayey silt, with some coarser grained units. Historical borehole records indicate two prominent layers of peat across the peninsula, at approximately -4 m and -8 m above Ordnance Datum (AOD). Head deposits are anticipated across small pockets of the Peninsula, formed from the chalk bedrock comprising sandy, silty and angular to sub-angular flints. Both the alluvium and the head deposits beneath the Peninsula are classified as Secondary 'A' aquifers by the EA, defined as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

5.7 Both the Taplow Gravel Member and Boyne Hill Gravel Member are present across the Peninsula to the north of Manor Way, and both comprise of sand and gravel, with possible lenses of silt, clay or peat, with the Boyn Hill Gravel Member being more poorly sorted. Both are considered to be Secondary (undifferentiated) aquifers, designated to strata for which it is not possible to assign an 'A' or 'B' classification, likely as the aquifer type has previously been classified as either a minor or non-aquifer in different places due to varying characteristics of the rock type.

5.8 The Swanscombe Peninsula is located on the southern boundary of the Transitional Province, with the local chalk forming part of the White Chalk Subgroup, in particular the Seaford and Lewes formations. Available borehole records do not indicate which formation and no detailed face logging has been undertaken to confirm the stratigraphy of the chalk exposures. The chalk bedrock beneath the Peninsula is classified as a Principal aquifer, defined as layers of rock or drift deposits that usually provide a high level of water storage and may support water supply and/or river base flow on a strategic scale.

5.9 The British Geological Society (BGS) Hydrogeological Maps indicate that the regional groundwater flow in the area is north, towards the River Thames, although abstractions

associated with the number of quarries in the vicinity of the development will have an impact on flow direction locally.

Kent Project Site: A2(T) Highway Works

5.10 The A2(T) Highway Works area is located to the south-west of Ebbsfleet International Station including the A2(T) corridor and land to the south and will be less than 200 ha in size when complete. It comprises an irregularly shaped parcel of land including part of the A2(T) Watling Street, B259 Southfield Road and A2260 Hall Road (see ES Figure 13.1: Order Limits; figure reference 6.3.13.1). It is roughly 3 km east to west and 2 km north to south and is currently used as parking lots for Ebbsfleet International Station, agricultural land, roads and road infrastructure, commercial properties, a water works and a small number of residential properties.

5.11 The majority of the A2(T) Highway Works area is not underlain by superficial deposits. The eastern is partly underlain by head and alluvium (Secondary (undifferentiated) aquifers). Head deposits also underlay parts of the central and western part of the area, and the western part A2(T) Highway Works area is also part-underlain by undifferentiated River Terrace Deposits (a Secondary 'A' aquifer).

5.12 Most of the A2(T) Highway Works area is underlain by chalk and Thanet Formation bedrock, although the central portion of the corridor is underlain by the Lambeth Group and the London Clay Formation. The chalk is a Principal Aquifer, whilst the Thanet Formation and Lambeth Group are classified as Secondary 'A' aquifers. The London Clay Formation is an unproductive stratum, defined as layers of rock or drift deposits with low permeability, that have negligible significance for water supply or river base flow.

5.13 The entirety of the A2(T) Highway Works area is within a Source Protection Zone (SPZ), ranging from Zone 1 (inner zone) to Zone 3 (total catchment), due to multiple groundwater abstraction points on and in proximity to the Kent Project Site. Regional groundwater flow is thought to be towards the River Thames to the north.

Essex Project Site

5.14 The anticipated geology is a heterogeneous composition of Made Ground (including ash, concrete, brick, timber, flint), typically between about 1 and 3 m, underlain by a natural geological sequence comprising about 15 m of alluvium (very soft to firm clays, peats and sands) over a relatively limited thickness (approximately 2 to 5 m) of River Terrace Gravels. Beneath these is the Upper Chalk at about 18 to 24 m bgl (below ground level).

5.15 Part of the Essex Project Site extends onto the shore of the River Thames. This area is underlain by tidal deposits. BGS borehole records indicate this to include about 12 to 20 m of alluvial clays and peats, over River Terrace Gravels, with chalk present at about 22 to 23 m bgl.

5.16 Perched groundwater is likely to be present above low permeability bands in both the made ground and the alluvium. EA Aquifer maps show the Essex Project Site to be underlain by a Secondary (Undifferentiated) Aquifer in superficial alluvium and River

Terrace Gravel deposits. The Upper Chalk bedrock is classified as a Principal Aquifer (defined as rock with high intergranular and / or fracture permeability). This stratum may support water supply and / or river base flow – although it is unlikely to be utilised for potable water supply in the vicinity due to its proximity to the River Thames. Groundwater levels across the Essex Project Site will be influenced by its proximity to the River Thames and associated tidal flows.

5.17 There are limited records of groundwater strikes on BGS borehole records. However, where recorded/encountered shallow groundwater ingress was generally at approximately 1 to 2 m bgl in made ground or alluvium. A deeper groundwater body was recorded at the top of River Terrace Deposits at approximately 16 to 17 m bgl, rising to between 8 and 9 m bgl, indicating sub-artesian pressures due to confinement by the overlying alluvium. This deeper body is likely to be in continuity with the chalk.

5.18 The Essex Project Site is located on the north bank of the River Thames, with the southern part extending onto the river foreshore. The River Thames is tidal in this location. A number of other surface water features are shown within the Essex Project Site or adjacent to the boundary. Some of these are orientated approximately north-south and are likely to be draining to the River Thames. Groundsure data indicates these surface water features to contain water year-round and to not be influenced by normal tidal action. Wet docks (part of Port of Tilbury) are present from about 150 m west and moats associated with Tilbury Fort are present about 150 m east. Both of these water bodies are supplied by water from the River Thames.

WFD Groundwater Body Status

5.19 The Proposed Development encompasses three WFD groundwater bodies:

- West Kent Darent and Cray Chalk water body
- South Essex Thurrock Chalk water body
- North Kent Medway Chalk water body

The West Kent Darent and Cray Chalk Water Body

5.20 The West Kent Darent and Cray Chalk water body (ID: GB40601G501800) is a groundwater water body, located under the Swanscombe Peninsula (NGR TQ5218768736; Figure 13.7.10) and is a Drinking Water Protected Area. The West Kent Darent & Cray Chalk is an outcrop of chalk Principal Aquifer situated along the North Downs. The water body currently has an overall poor status (2019 classification) based on poor quantitative status and poor chemical (groundwater) status (Table 5-2). The issues preventing the groundwater body achieving a good status include:

- changes to the natural flow and levels of water, due to:
  - agriculture and rural land management; and
  - water industry.

- pollution from rural areas, due to:
    - agriculture and rural land management.

Table 5-2: Overview of the West Kent Darent and Cray Chalk Groundwater Body.

Water body	Description, notes or more information
WFD water body name	West Kent Darent and Cray Chalk
Water body ID	GB40601G501800
Water body type	Groundwater Body
Groundwater total area	29328.796ha
Surface area	292.288 km2
Overall Water Body Status (2019)	Poor
Quantitative	Poor
Chemical status	Poor
Target water body status and deadline	Poor by 2015
Protected Areas (Directive)	Drinking Water Protected Area Nitrates Directive

The South Essex Thurrock Chalk Water Body

5.21 The South Essex Thurrock Chalk water body (ID: GB40601G401100) is a groundwater body, located on the Essex Project Site (NGR TQ5803377518; Figure 13.7.11).

5.22 It is a Drinking Water Protected Area. The water body currently has an overall poor status (2019 classification) based on poor quantitative status and poor chemical (groundwater) status (Table 5-3).

Table 5-3: Overview of the South Essex Thurrock Chalk Groundwater Body.

Water body	Description, notes or more information
WFD water body name	South Essex Thurrock Chalk
Water body ID	GB40601G401100
Water body type	Groundwater Body
Groundwater total area	3357.339ha
Surface area	33.57km2
Overall Water Body Status (2019)	Poor
Quantitative	Poor
Chemical status	Poor

Water body	Description, notes or more information
Target water body status and deadline	Good by 2015
Protected Areas (Directive)	Drinking Water Protected Area Nitrates Directive

The North Kent Medway Chalk Water Body

5.23 The North Kent Medway Chalk water body (ID: GB40601G500300) is a groundwater water body, located under the Swanscombe Peninsula (NGR TQ6187174992; Figure 13.7.12) and is a Drinking Water Protected Area.

5.24 The North Kent Swale Chalk is an outcrop of chalk (Principal Aquifer) situated along the North Downs. Flow through the aquifer is predominantly via fractures in the rock. To the north it dips under the North Kent Tertiaries groundwater body. The western boundary is with the North Kent Medway Chalk groundwater body, whilst to the east and south it meets impermeable clay rocks. The groundwater is naturally of good quality, supplying large public, industrial, agricultural, and private water supplies. Springs feed into the North Kent marshes and their associated surface water bodies.

5.25 The water body currently has an overall poor status (2019 classification) based on poor quantitative status and poor chemical (groundwater) status (Table 5-4).

Table 5-4: Overview of the North Kent Medway Chalk Groundwater Body.

Water body	Description, notes or more information
WFD water body name	*North Kent Medway Chalk*
Water body ID	*GB40601G500300*
Water body type	*Groundwater Body*
Groundwater total area	*2336.581ha*
Surface area	*233.666 km2*
Overall Water Body Status (2019)	*Poor*
Quantitative	*Poor*
Chemical status	*Poor*
Target water body status and deadline	*Good by 2027*
Protected Areas (Directive)	*Drinking Water Protected Area* *Nitrates Directive*

Chapter Six ◆ WFD Assessment

STAGE 1: SCREENING

6.1 The proposed activities are not classed as low risk and as such the assessment proceeded to the Scoping stage.

STAGE 2: SCOPING

6.2 The completed Scoping Templates for Transitional Water Assessment are provided in Appendix 2 for both Construction and Operation for the Thames Middle transitional water body. These templates are not applicable to the Groundwater Assessment.

Thames Middle Transitional Water Body

Construction

6.3 As indicated in the Scoping Templates the following WFD quality elements were taken forward to assessment for Construction phase activities for the Thames Middle water body (see Appendix 2).

- Hydromorphology;
- Biology - Habitats (higher sensitivity: Saltmarsh);
- Biology – Fish;
- Water quality;
    - Potential effects on physicochemical parameters;
    - potential to release chemicals on Environmental Quality Standards Directive (EQSD) list;
    - potential to release Chemicals above Cefas Action Level 1; and
- Invasive non-native species (INNS).

6.4 At the Scoping stage the WFD quality elements Biology – Habitats (Lower sensitivity habitats) and Water Quality (in terms of phytoplankton and harmful algae) were scoped out of assessment (see Appendix 2). In addition, the WFD quality element 'Protected Areas' was scoped out of the assessment (see Appendix 2). This is due to the location of the Kent and Essex Project sites which are not located within 2 km of any WFD Protected Areas. It is within a Marine Conservation Zone, Swanscombe MCZ, which is not classified

as a WFD Protected Area but potential effects of the Proposed Development on the MCZ have been assessed under a site-specific MCZ Assessment (see ES Appendix 13.8: *Marine Conservation Zone Assessment*, document ref: 6.2.13.8).

Operation

6.5 The same WFD quality elements were scoped in for the Operational Phase as were scoped in for the Construction Phase apart from 'Biology – Fish' which was scoped out for operational effects (see Appendix 2).

6.6 'Biology – Fish' was scoped out as the main effect during operation is considered to be increased vessel activity in the Estuary due to operation of the London Resort ferry and Clipper ferry and fish in the estuary are well acclimatised to the presence of vessels and the noise and vibration effects associated with vessels movements. As indicated in ES Chapter 17: *Water Resources and Flood Risk* (document reference 6.1.17), the wastewater treatment plant discharge will meet all consenting requirements and will be designed and constructed in accordance with any design parameters and discharge limits to be advised by the EA and other relevant stakeholders. These requirements will be secured in the DCO. Consequently, it is considered that fish will not be affected. The frequency of maintenance dredging (Option C only) is yet to be finalised (if it was required) but fish are highly mobile and would generally be able to move away from areas subjected to dredging if required and such effects would be short term. It should be noted that Option C and dredging would only be conducted if Option A and B proved to be unfeasible.

Groundwater Bodies

6.7 All three groundwater bodies indicated in the 'WFD Baseline Environment' section were scoped in for detailed assessment.

Quantitative Status

6.8 Surface Water, GWDTEs and Water Balance were not assessed as the project will not directly abstract from any of the assessed groundwater bodies.

6.9 An assessment of effects on groundwater bodies associated with supplying potable water to the development was not undertaken as potable water supply will be provided via an enhanced Thames Water network and the water sources have not been confirmed. Refer to London Resort Utilities Statement 7.6.

Chemical Status

6.10 Surface Water and GWDTEs were not assessed as the project will not directly abstract from any of the assessed groundwater bodies.

6.11 DrWPAs and the General Quality Assessment were not assessed as it is not considered that the project will impact the ability of any of the assessed groundwater bodies to achieve these aims.

6.12 Consequently, only the 'Saline or other intrusions' test was scoped in for assessment for each of the three groundwater bodies:

Construction

6.13 For Option A, B and C 'Saline or other intrusions' were considered due to the potential following construction impacts from the Proposed Development.

- Qualitative impact - Potential for increased infiltration and / or surface runoff from the scheme to cause deterioration to water quality of groundwater body if runoff is contaminated; and

- Qualitative impact - Deep foundations may create rapid vertical flow pathways into the groundwater body for potentially contaminated runoff.

Operation

6.14 For Option A, B and C 'Saline or other intrusions' were considered due to the potential following operational impacts from the Proposed Development. This was considered for potential impacts on quantity and chemical quality.

- Quantitative impacts - Deep foundations (piling) may form a barrier to groundwater flow, potentially reducing groundwater contributions to adjacent water courses and any groundwater abstractions in the water body;

- Qualitative impact - Potential for increased infiltration and / or surface runoff from the scheme to cause deterioration to water quality of groundwater body if runoff is contaminated; and

- Qualitative impact - Deep foundations may create rapid vertical flow pathways into the groundwater body for potentially contaminated runoff.

STAGE 3: IMPACT ASSESSMENT

Thames Middle Water Body

Hydromorphology

Construction

6.15 The potential effects of the works on hydromorphology are primarily associated with piling, backhoe dredging (with dredging being associated with Option C only), vessel movements and cofferdam construction for the wastewater treatment outfall and surface water outfalls, as follows:

- variation in sediment depth;

- change in quantity, structure and substrate type on the estuary bed; and
- change in water flow, sediment transport regime and structure of the intertidal zone (sediment erosion and accretion).

6.16 At the Kent Project Site, construction works for the new jetties, Ro-Ro facility and refurbishment of Bell Wharf may disturb the riverbed and create the potential for silt mobilisation from existing contaminated ground. This is also the case for the proposed extension of the jetty at the Essex Project Site. The extent of disturbance will be greater for Option C due to the use of dredging.

6.17 Vessel movements and propeller wash can cause localised scour of the seabed. For the purposes of assessment, the upper limit for daily barge movements during construction is likely to be the capacity of the berths at the Kent and Essex Project Sites and it is estimated that there would be 10 barge movements per day during the construction phase (ES Appendix 10.1: *Preliminary Navigation Risk Assessment,* document ref: 6.2.10.1). It is likely that piles may be installed by a vessel such as a jack up barge, there may be floating cranes, safety boats or supply vessels.

6.18 The construction of cofferdams in the intertidal zone for outfall construction could also affect water flow, sediment transport and could results in localised sediment accretion or erosion.

6.19 Hydrodynamic modelling has been conducted to determine the extent of changes in flow rate and areas of erosion and deposition due to the installation of structures (for Option A, B and C) and during the dredging required for Option C (ES Appendix 17.4: *Hydrodynamic and sedimentation assessment*, document ref: 6.2.17.4). The changes in flow rate indicated below for operation due to the presence of structures are applicable for the construction phase but will be smaller during the construction phase as structures are put in place.

6.20 The main change to emergence regime will be that some of the small area of intertidal habitat in the dredge pocket (628 m^2) would become subtidal.

Operation

6.21 It is anticipated that during operation the following could be affected for all options:

- variation in sediment depth;
- change in quantity, structure and substrate type on the estuary bed; and
- change in water flow, sediment transport regime and structure of the intertidal zone (sediment erosion and accretion).
- change in wave exposure (due primarily to increased boat wash); and

6.22 Increases in vessel traffic could result in increased localised scour of the seabed due to propeller wash and boat wash of the foreshore. During operation it is anticipated that there would be 27 passenger vessel movements per day between upstream locations and London Resort (extension of existing route) and 42 passenger vessel movements per day

between London Resort and Tilbury (new passenger ferry services), (ES Appendix 10.1: *Preliminary Navigation Risk Assessment,* document ref: 6.2.10.1). Most of these vessel movements will be restricted to the subtidal zone as opposed to intertidal areas at high water.

Kent Project Site

6.23 Modelling results indicate that due to the presence of structures installed for the Proposed Development for Option A, there could be a localised reduction in current speed of 0.05 to 0.1 m/s over a distance of 800 m on a peak ebb tide reducing to 600 m on a peak flood tide. Speed reductions of 0.1 to 0.2 m/s are evident over a distance of 300 m (peak flood tide) to 400 m (peak ebb tide), (ES Appendix 17.4: *Hydrodynamic and sedimentation assessment*, document ref: 6.2.17.4). These effects are due to the introduction of blockage to the passing flow by the two pontoons (Ro-Ro and passenger pontoon) and drag effect of the piles (ES Appendix 17.4: *Hydrodynamic and sedimentation assessment*, document ref: 6.2.17.4).

6.24 For Option B (without the Ro-Ro pontoon) reductions in current speed were modelled to have a smaller footprint over a distance of 400 m on the peak ebb and flood tides and remained within the range 0.05 to 0.1 m/s with only small spots of speed reduction greater than 0.1 m/s seen close to White's Jetty (ES Appendix 17.4: *Hydrodynamic and sedimentation assessment*, document ref: 6.2.17.4).

6.25 Under Option C (with dredging) the hydrodynamic assessment has indicated potential reductions in current speed of 0.05 to 0.2 m/s over a distance of 700 m on a peak ebb tide and 600 m on a peak flood tide. At the time of peak ebb tide the area of larger changes in currents which might have an effect on other estuary processes is restricted to the immediate area of the dredging, extending from the new passenger pontoon to White's Jetty. Within this area the modelling indicates some areas of speed reduction 0.2 m/s to 0.3 m /s. On a peak flood tide, speed reductions of 0.05 to 0.2 m/s are modelled over a distance of 500 m, extending from the dredged area towards the north west of White's Jetty (ES Appendix 17.4: *Hydrodynamic and sedimentation assessment*, document ref: 6.2.17.4).

6.26 These changes in current speed are extremely small in relation to natural variation in current speed within the estuary across the tidal cycle.

6.27 For all options, on the ebb tide, small spots of speed increase (0.05 to 0.2 m/s) are shown by the new breaches out of the habitat creation areas (see Proposed Development Design section above). This is likely due to the water flowing out of the habitat creation areas as they dry out (ES Appendix 17.4: *Hydrodynamic and sedimentation assessment*, document ref: 6.2.17.4). Small spots of speed increase are also evident at the time of peak flood. However, as the time of peak flood is closer to high water, when the habitat areas are flooded these small areas of increase are surrounded by areas of speed decrease (mainly 0.05 to 0.2 m/s). This is due to the interaction of the passing flow with that entering the habitat areas and the increased flow cross section area present when the habitat areas are inundated (ES Appendix 17.4: *Hydrodynamic and sedimentation assessment*,

document ref: 6.2.17.4) and these effects are limited to the immediate area of the habitat areas.

6.28 The very limited impacts predicted for hydrodynamics (see below) are reflected by the prediction of effects on sediment transport and erosion/deposition. No discernible effect is seen on suspended sediment concentration for all the options studied in relation to background sediment concentrations in the estuary. At Swanscombe the various structures result in a potential change to the distribution of sediments increasing the proportion of 5 mm gravel in the area north east of White's Jetty (ES Appendix 17.4: *Hydrodynamic and sedimentation assessment*, document ref: 6.2.17.4).

6.29 In addition, a coarsening of the bed sediment under the passenger pontoon may occur depending on the nature of the existing bed in this area.

6.30 No effects on the erosion or deposition patterns are seen on the intertidal areas near the Kent Project Site due to the works and presence of structures in the water column. Based on modelling outputs, however, habitat creation areas on the east of the peninsula are anticipated to receive more fine sediment than those on the west (ES Appendix 17.4: *Hydrodynamic and sedimentation assessment*, document ref: 6.2.17.4).

6.31 If Option C is chosen, it is the intention that Bell Wharf will only be used during high tide during the operational phase and therefore maintenance dredging will not be conducted. If it was decided that Bell Wharf is to be used at all tides during operation of the Proposed Development, however, maintenance dredging may be required periodically which would cause disturbance and re-suspension of sediments. If the dredging associated with Option C is taken forward an annual infill rate of up to 29,700 m^3 per year is predicted but the sediment infilling the dredge areas is likely to be similar to the substate removed. This is a precautionary total as the rate will reduce as the dredged area fills and vessel effects will also resuspend fine sediment (ES Appendix 17.4: *Hydrodynamic and sedimentation assessment*, document ref: 6.2.17.4).

6.32 The main objective of the maintenance dredge would be to remove any recently deposited sediment. Consequently, the sediment type would likely be similar to that currently present, and the chemical concentrations may be lower than those potentially reached by the deeper dredging during construction. In addition, the area and volume of sediment that could potentially require maintenance dredging is anticipated to be a lot smaller than for the capital dredge. For these reasons any effects of maintenance dredging are anticipated to be no greater than the effects assessed for the construction phase capital dredge.

6.33 In addition, there will be surface water runoff (from hard surfaces adjacent to the river, and through the proposed surface water drainage outfalls for the wider development) at the Kent Project Site (up to five outfalls) and Essex Project Site (one outfall). There will also be discharge from the wastewater treatment outfall (one location with two location options being considered at the Kent Project Site).

Essex Project Site

6.34 At the Essex Project Site the effect on the currents of the blockage of the new pontoons is small as the pontoons have a small draft and are in line with the existing landing stage structure. At the time of peak ebb modelling outputs indicate an area of speed reduction of 0.05 to 0.1 m/s east of the new pontoons extending less than 200 m. A patch of speed increases (0.05 to 0.1 m/s) is anticipated to the north of the new pontoon.

6.35 At the time of peak flood tide only speed reductions are predicted (mainly 0.05 to 0.1 m/s with a small area of 0.1 to 0.2 m/s), and these are mostly confined to the area under the existing landing stage structure within 600 m of the proposed pontoons (ES Appendix 17.4: *Hydrodynamic and sedimentation assessment*, document ref: 6.2.17.4).

6.36 At the Essex Project Site only limited effects on erosion and deposition and bed substrate are predicted and these are in the immediate area of the proposed pontoon and the exiting landing stage. No changes to the pattern of erosion and deposition are predicted on the intertidal area to the north of the pontoon location (ES Appendix 17.4: *Hydrodynamic and sedimentation assessment*, document ref: 6.2.17.4).

Assessment of Effects

Construction

6.37 Additional mitigation has been proposed in ES Chapter 13: *Marine Ecology and Biodiversity* (document ref: 6.1.13) to reduce the potential effects of underwater noise and vibration by using for pilling methodology which will reduce the vibration and noise impacts, where possible dependant on ground investigations (this will be secured by a requirement in the DCO).

6.38 Installation of the new structures will cause temporary effects from vessel usage with very localised displacement of sediments via prop wash.

6.39 As indicated above, it is estimated that there would be 10 barge movements per day during the construction phase across the Kent and Essex Project Sites (ES Appendix 10.1: *Preliminary Navigation Risk Assessment*, document ref: 6.2.10.1). Such vessel movements could cause scour of subtidal sediments and result in boat wash which can erode the foreshore. Vessel activity is high in the Thames, however, any such effects during construction are considered to be small scale and commonplace throughout the tidal River Thames.

6.40 As indicated above, changes to water flow and associated effects on sediment transport are indicated to be highly localised based on the results of the hydrodynamic modelling (ES Appendix 17.4: *Hydrodynamic and sedimentation assessment*, document ref: 6.2.17.4). Considering the considerable variation in current speed in the tidal Thames during the tidal cycle the changes indicated by the hydrodynamic modelling are extremely small. Any effects on sediment deposition and erosion are negligible.

6.41 Consequently, at the Essex and Kent Project Sites it is concluded that during construction there are not expected to be any non-temporary effects on hydromorphology for the Thames Middle water body.

Operation

6.42 The following measure is embedded mitigation to reduce the potential effects of boat wash on intertidal habitats/species as outlined in ES Chapter 13: *Marine Ecology and Biodiversity* (document ref: 6.1.13). This mitigation will be secured under requirements in the DCO:

- Booms or other equivalent infrastructure will be included within the designs for the ferry terminal and jetties to reduce the potential for erosion caused by boat wash.

6.43 Mitigation measures will also be in place to reduce potential effects during operation as follows. This mitigation will be secured under requirements in the DCO:

- Sustainable Urban Drainage Systems (SuDS) will be implemented where possible to enable water quality control of the surface water runoff.

- There will be commitments made in the drainage strategy to ensure suitable water quality treatment is undertaken prior to discharge.

6.44 As indicated in paragraph 6.22, during operation it is anticipated that there would be 27 passenger vessel movements per day between upstream locations and London Resort (extension of existing route) and 42 passenger vessel movements per day between London Resort and Tilbury (new passenger ferry services), (ES Appendix 10.1: *Preliminary Navigation Risk Assessment,* document ref: 6.2.10.1). The Thames Estuary is a very active waterway with extensive vessel use across the year. The Proposed Development will result in further vessel activity in the tidal Thames but with the mitigation of booms in place, effects are anticipated to be negligible in relation to the high level of vessel activity within the Thames Middle Water Body.

6.45 Considering the considerable variation in current speed in the tidal Thames during the tidal cycle, the changes indicated by the hydrodynamic modelling during the operational phase are extremely small for all options (ES Appendix 17.4: *Hydrodynamic and sedimentation assessment*, document ref: 6.2.17.4).

6.46 Consequently, it is concluded that during operation there are not expected to be any non-temporary effects on hydromorphology for the Thames Middle water body and it is considered that the operational phase of the Proposed Development would not prevent the water body from meeting the WFD objectives for hydromorphology.

Biology (Habitats – Saltmarsh)

6.47 Saltmarsh is considered as part of the Angiosperm WFD biological quality element. Within the Thames Middle waterbody this is classified as Moderate (based on the 2019 assessment, Table 5-1).

6.48 Extensive saltmarsh is present at the Kent Project Site and a project-specific survey was conducted in August 2020 to map National Vegetation Classification (NVC) saltmarsh communities at this location (see ES Appendix 13.3: *Saltmarsh Survey Report*, document ref: 6.2.13.3). A small area of saltmarsh is also present in the vicinity of the Essex Project Site.

6.49 Results from the 2020 survey found that saltmarsh vegetation was present along the majority of the shore within the Kent Project Site. The only exception to this was towards the western end of the Peninsula due to the presence of a piled deck and deeper water. Saltmarsh varied from approximately 7 to 70 m in width. Wider areas of saltmarsh were present on the western side of the Peninsula whilst narrower sections were present on the eastern side of the Peninsula.

6.50 The lower saltmarsh was generally limited in its width and zonation was restricted to narrow bands due to the presence of a coastal defence embankment which ran the entire length of the area surveyed. S21 *Scripus maritima* swamp dominated the lower saltmarsh in a west facing creek towards the centre of the survey area and SM6 *Spartina anglica* saltmarsh was also supported.

6.51 The mid-level saltmarsh was heavily dominated by SM13 *Puccinellia maritima* saltmarsh community. In some areas, the seaward edge of the community formed a sheer face of clay with little to no vegetation below apart from the occasional patch of SM6 saltmarsh.

6.52 The upper salt marsh was heavily dominated by S24 *Elymus pycnathus* community with the dominant species, sea couch *Elytrigia atherica* extending out to the sea embankment and inland towards the grassland habitats. Lower areas of the upper saltmarsh supported the SM23 *Spergularia maritima-Puccinella distans* saltmarsh community.

6.53 Results from the condition assessment found that the majority of saltmarsh within the survey area was considered to be in 'Fairly Good' condition based on Natural England Criteria (Natural England 2020) as 'zonation of vegetation is present but may have gaps or be incomplete' and 'processes appear to be functioning and not compromised by artificial structures' (Natural England 2020). This is despite the significant presence of the embankment and that fact that abundant wood and plastic rubbish was observed in the shallow bay near the western limit of the survey area (see ES Appendix 13.3: *Saltmarsh Survey Report,* document ref: 6.2.13.3).

6.54 In the vicinity of the Essex Project Site an intertidal habitat survey was conducted for the Tilbury2 Project in 2017. This identified saltmarsh within the Tilbury2 area further upstream and downstream of the Essex Project Site (PoTLL 2017) with a small (187 m^2)

patch of dense saltmarsh 180 m east of the Essex Project Site. At this location English scurvy grass *Cochlearia anglica* and sea plantain *Plantago maritima*. *A. tripolium* and *Spartina* sp. were recorded as abundant, *A. portulacoides* was occasional, and *C. anglica* and *P. maritima* was recorded as frequent. There are patches of saltmarsh on the higher shore at the Essex Project Site.

Construction

6.55 The main aspect of the construction works that could affect saltmarsh is construction of the ferry terminal at the Kent Project Site with the footprint of this structure covering 5,812 m^2 of saltmarsh. This is the case for Option A, B and C.

6.56 The ferry terminal is proposed to be on piles, however, the number of piles has not yet been finalised and due to considerations of shading, the area of habitat under the terminal has been considered to be equivalent to a loss of habitat for the purposes of this assessment (i.e. the full footprint has been estimated). This has been assumed as a precautionary worst-case approach.

6.57 The August 2020 survey indicated that the saltmarsh in this area was predominantly *Elymus pycnanthus* saltmarsh (SM24) with very small areas *of Pucinellia maritima* saltmarsh (SM13) and *Spartina anglica* saltmarsh (SM6). This area is currently covered by a lot of wood and plastic refuse (ES Appendix 13.3: *Saltmarsh Survey Report,* document ref: 6.2.13.3).

6.58 There is also the potential for installation of surface water outfalls at up to five locations which could involve disturbance and removal of saltmarsh. As a worst-case scenario, cofferdams may need to be constructed to install the outfalls. For the purposes of assessment it is currently assumed that cofferdam construction/saltmarsh removal could occur along approximately 30 to 50 m of saltmarsh depending on location, with a width of 7 m. Overall, it is anticipated that across the five locations there could be removal of approximately 1,190 m^2 of saltmarsh during installation of the outfalls/cofferdams. This is considered to be a worst-case scenario. There could also be further disturbance of saltmarsh during construction due to presence of personnel and plant. Any area of saltmarsh potentially disturbed, however, will be minimised by having clearly delineated restricted access routes where required.

6.59 As a worst-case scenario the cofferdam is anticipated to be in place for a number of months so there may be opportunity for saltmarsh to become re-established once the cofferdam is removed.

6.60 There is the potential for accidental pollution events (e.g. oil spill) from plant and machinery required for construction activities which could potentially affect the saltmarsh.

Operation

6.61 During operation the main potential effect at the Kent and Essex Project Sites is erosion of saltmarsh due to boat wash caused by the increased vessel activity due to the operation of the London Resort ferry and Clipper ferry. As set out in ES Appendix 10.1: *Preliminary Navigation Risk Assessment* (document ref: 6.2.10.1) during operation it is anticipated that there would be 27 passenger vessel movements per day between upstream locations and London Resort (extension of existing route) and 42 passenger vessel movements per day between London Resort and Tilbury (new passenger ferry services). This is the case for Option A, B and C.

Assessment of Effects

6.62 The following embedded mitigation will be in place:

- Habitat creation plans to create 3 ha of saltmarsh habitat by breaching the existing sea defences and via interventions at the shoreline.

6.63 In addition, a CEMP (ES Appendix 3.2, document reference 6.2.3.2) will be produced as an additional mitigation measure as outlined in ES Chapter 13: *Marine Ecology and Biodiversity* (document ref: 6.1.13). The CEMP will include a range of measures to minimise the chances of accidental pollution and any subsequent effects.

6.64 The saltmarsh WFD tool enables an assessment of the ecological health of the biological quality element 'Angiosperms'. The WFD monitoring metrics for saltmarsh considers species composition, abundance and presence of disturbance sensitive taxa. The metrics are outlined in WFD-UKTAG (2014a) and are as follows:

- saltmarsh extent as proportion of 'historic saltmarsh';
- saltmarsh extent as proportion of the intertidal;
- change in saltmarsh extent over two or more time periods;
- proportion of saltmarsh zones present (out of five zones for England and Wales);
- proportion of saltmarsh area covered by the dominant saltmarsh zone; and
- proportion of observed taxa to historical reference value or proportion of observed taxa to 15 selected taxa.

6.65 Ecological Quality Ratio (EQR) classification boundaries for the saltmarsh quality element in transitional water bodies as set out in WFD-UKTAG (2014a) are presented in Table 6-1.

Table 6-1: Classification boundaries for the angiosperm quality element in WFD transitional water bodies.

Lower classification boundaries for angiosperm quality element in WFD transitional water bodies				
High	*Good*	*Moderate*	*Poor*	*Bad*
0.80	0.60	0.40	0.20	-

6.66 Normative definitions set out in Annex V of the WFD describe the aspects of the angiosperm biological quality element in transitional waters that must be included in the ecological status assessment of transitional waters, namely:

- taxon composition; and
- abundance.

6.67 The WFD normative definitions of 'High', 'Good', and 'Moderate' status for transitional water body angiosperms as described in Annex V of the WFD are set out in Table 6-2.

Table 6-2: Normative definitions of 'High', 'Good' and 'Moderate' status/potential for transitional angiosperms.

High Status/Potential	**Good Status/Potential**	**Moderate Status/Potential**
Species composition and abundance is consistent with undisturbed conditions.	There are slight changes in the composition of angiosperm taxa compared to the type-specific communities. Angiosperm abundance shows slight signs of disturbance.	The composition of the angiosperm taxa differs moderately from the type-specific communities and is significantly more distorted than at good quality. There are moderate distortions in the abundance of angiosperm taxa.

Construction

6.68 In terms of loss of habitat, the 7,002 m^2 (0.7 ha) of saltmarsh potentially lost due to the construction of the ferry terminal and the surface water outfalls represents 0.54% of the area of saltmarsh within the Thames Middle water body (based on an area of 130.06 ha (1,300,600 m^2) of saltmarsh in this water body). Within the proposed ferry terminal footprint *Elymus pycnanthus* saltmarsh (SM24) is the main NVC community present but this area represents a small proportion of the extent of the *Elymus pycnanthus* saltmarsh (SM24) on the Swanscombe Peninsula itself, as the majority of this habitat type is present on the eastern side of the peninsula.

6.69 Due to the potential reduction in saltmarsh extent the Proposed Development has an embedded mitigation proposal to create a new area of saltmarsh using two different methods:

- managed retreat of the flood defences in the area south of Bell Wharf; and
- interventions at the shoreline to create an enhanced intertidal zone and encourage saltmarsh habitat to form along the north and northwest coast of the Peninsula.

6.70 The proposed plans will increase areas of mud flat, salt marsh, small pools, rocks and shingle areas, with reeds, sedges and grasses transitioning into scrub vegetation.

6.71 It is anticipated that approximately 3 ha of saltmarsh habitat would be created (4.3 times the extent lost) with the view to that offsetting any loss of saltmarsh in the project footprint (see ES Appendix 12.3: *Ecological Mitigation and Management Framework*, document ref: 6.2.12.3).

6.72 There could be potential for accidental spillage of chemicals such as oil onto saltmarsh during construction. To reduce the risk, mitigation measures will be applied as part of the CEMP for the works (ES Appendix 3.2, document reference 6.2.3.2), as outlined below.

6.73 The CEMP will include a range of measures to minimise the chances of accidental pollution and any subsequent effects which will be secured as requirements of the DCO. These measures are:

- Stockpiling of contaminated materials will be avoided, wherever possible. Stockpiles will be located on areas of hard standing or on plastic sheeting to prevent mobile contaminants infiltrating into the underlying ground.
- Potentially hazardous liquids on the Kent and Essex Project Sites such as fuels and chemicals will be managed and stored in accordance with best practice guidance. Storage tank and container facilities will be appropriately bunded within designated areas and located away from surface water drains and the Thames Estuary.
- The CEMP will include measures to deal with any spillages and/or pollution incidents. This will include the provision of on-site equipment for containing spillages, such as emergency booms and chemicals to soak up spillages and training and competency to use the equipment. Any pollution incidents will be reported immediately to the Applicant and regulatory bodies such as the EA.

6.74 With these various mitigation measures for potential saltmarsh disturbance and pollution in place it is considered that any changes to the relative abundances of different taxa or the relative coverage of different saltmarsh zones during construction would not be significant and there is not expected to be any noticeable effect on any the saltmarsh metrics.

6.75 The habitat creation strategy will take time to generate a new area of saltmarsh on the Swanscombe Peninsula. Given time, however, as indicated above it is anticipated that the area of new saltmarsh habitat created with be considerably greater than the area lost (~3 ha anticipated to be created) and is expected to support a range of saltmarsh communities (see ES Appendix 12.3: *Ecological Mitigation and Management Framework,* document ref: 6.2.12.3). The habitat creation will be secured as a requirement of the DCO.

6.76 Overall, with the habitat creation measures that will be implemented there are not expected to be adverse effects on saltmarsh extent, community composition or abundance at the scale that could affect calculation of metrics and influence angiosperm potential for the Thames Middle WFD water body.

6.77 Consequently, it is concluded that there are not expected to be any non-temporary effects on the saltmarsh metrics for the Thames Middle water body and it is considered that the construction phases of the London Resort would not prevent the water body from meeting the WFD objective of Moderate potential for this element.

Operation

6.78 Boat wash has the potential to lead to erosion of saltmarsh at the Kent and Essex Project Sites. Any erosion as a result of hydrodynamic changes from boat wash from ferries and other vessels using the jetties is expected to small scale in terms of potential effects on saltmarsh and would be very localised.

6.79 As best practice and embedded mitigation, booms or other equivalent infrastructure will be included within the designs for the ferry terminal and jetty to minimise potential for erosion caused by boat wash. This mitigation will be secured as a requirement of the DCO.

6.80 Overall, with this mitigation in place, in relation to the effects of boat wash there are not expected to be any non-temporary effects on the saltmarsh metrics for the Thames Middle water body and it is considered that the construction phases of the London Resort would not prevent the water body from meeting the WFD objective of Moderate potential for this element.

Biology – Fish

6.81 The Thames Middle transitional waterbody is classified as being at Good potential for Fish (based on 2019 assessment), with a target of Good potential for 2021 and 2027.

6.82 Approximately 125 fish species have been recorded within the Thames Estuary including species of commercial and conservation interest. The species identified range from freshwater species with no estuarine requirement, to marine species with an estuarine requirement. Euryhaline species (those that can live in both fresh water and salt water) migrate through the estuary to spend different parts of their life-cycle in fresh or salt water. These species include seabass *Dicentrarchus labrax*, European eel *Anguilla anguilla*,

and European flounder *Platichthys flesus*. A primary source of information is EA survey data (available in the National Fish Population Database) including approximately 9,900 records of species counts obtained from >1,000 monitoring surveys undertaken between 1989 and 2019 throughout the estuary. Four of the EA sample stations are located within 10 km of the Kent and Essex Project Sites.

6.83 Numerous species of conservation and commercial importance protected by a range of legislation utilise the River Thames/Thames Estuary (see Table 7-3 in ES Appendix 13.2: *Marine Ecology and Biodiversity Baseline Conditions*, document ref: 6.2.13.2). Of particular note is an important population of European smelt *Osmerus eperlanus* which is a priority species on the Section 41 list of the NERC Act.

6.84 In addition, the diadromous species European eel *A. anguilla* is known to migrate through the Thames Estuary and utilise the estuary whilst maturing (Naismith & Knights 1988). The European eel is protected under European Council (EC) Regulation No 1100/2007, which establishes measures for the recovery of the stock of European eel. This is implemented in UK legislation by the Eels (England and Wales) Regulations 2009. European eel is also a priority species on the Section 41 list of the NERC Act.

6.85 European smelt and European eel are frequently recorded diadromous species in the Thames Estuary. Other diadromous migrants also present which are Annex II species under the EC Habitats Directive are Atlantic salmon *Salmo salar*, sea trout *Salmo trutta*, river lamprey *Lampetra fluviatilis*, sea lamprey *Petromyzon marinus,* twaite shad *Alosa fallax* and allis shad *Alosa alosa* (ZSL 2016). A number of other species present within the Thames Estuary are on the Section 41 List under the NERC Act (previously UK BAP species) and/or covered by protective international legislation, including the Bern Convention and CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). A number of species are also on the OSPAR list of threatened species and/or the IUCN Red List.

6.86 Many fish species demonstrate seasonal patterns of use of the Thames Estuary and a detailed overview of the fish assemblage within the Thames Estuary including an indication of the sensitive periods for different species is provided within Table 7-1 in ES Appendix 13.2: *Marine Ecology and Biodiversity Baseline Conditions* (document ref: 6.2.13.2).

6.87 To complement the data available from previous fish surveys within the wider Thames Estuary and the site-specific data obtained from previous surveys, APEM undertook an intertidal fish survey in the area surrounding White's Jetty within the Kent Project Site. The purpose of this survey was to provide a finer resolution and up-to date understanding of the local fish populations in the area. Surveys were conducted in June and September 2020 using fyke and seine netting (see ES Appendix 13.6: *Intertidal Fish Survey Report*, document ref: 6.2.13.6).

6.88 A total of four fyke net stations (F01 to F04) and four to five seine net stations (S01 to S05) were deployed in the intertidal area around White's Jetty.

6.89 A total of 14 taxa were identified across both fyke and seine netting surveys. In the June survey a total of four taxa were recorded in fyke net samples (57 individuals) and eight taxa in seine net samples (102 individuals) while the September survey four taxa were recorded in fyke nets (47 individuals) and six were in the seine net samples (41 individuals). The most abundant and frequently observed taxon across the June survey was Atlantic herring and the most abundant and frequently observed taxon across the September survey was European seabass.

6.90 A number of species of conservation interest were recorded. European eel, European smelt, Atlantic herring and European plaice are Species of Principal Importance on the Section 41 list under the Natural Environment and Rural Communities (NERC) Act (NERC Act, 2006). In addition as indicated above, European eel is considered globally critically endangered by the IUCN Red List of Threatened Species and is also protected under the Eels (England and Wales) Regulations 2009. Common and sand goby are on Appendix III of the Bern Convention.

Construction

6.91 The potential effects of the Construction Phase on fish within the Thames Estuary (as indicated in Table 13-13 within ES Chapter 13: *Marine Ecology and Biodiversity,* document ref: 6.1.13) are as follows for Option A, B and C.

- changes in water quality;
- loss of habitat;
- physical disturbance and displacement;
- increase in underwater noise and vibration;
- Use of artificial lighting
- Collision risk with vessels
- Presence of structures in estuary margins
- Introduction and/or spread of invasive non-native species
- Physical disturbance and displacement (indirect via food chain)
- Accidental pollution events (e.g. oil spill)

Operation

6.92 The potential effects of the Operation Phase on fish within the Thames Estuary (as indicated in Table 13-13 within ES Chapter 13: *Marine Ecology and Biodiversity,* document ref: 6.1.13) are as follows for Option A, B and C.

- Change in hydrodynamics and sediment accretion/erosion
- Changes in water quality
- Increase in underwater noise and vibration
- Introduction of new artificial habitat
- Shading
- Use of artificial lighting
- Collision risk with vessels
- Presence of structures in estuary margins
- Introduction and/or spread of invasive non-native species
- Physical disturbance and displacement (indirect via food chain)
- Accidental pollution events (e.g. oil spill)

Assessment of Effects

6.93 Fish fauna are assessed as a quality element in WFD transitional water bodies, and each water body is classified using the Transitional Fish Classification Index (TFCI), (WFD-UKTAG 2014b). The TFCI is a multimetric index composed of ten individual components, known as metrics, and each metric is assessed by comparing the observed metric values with those expected metric values under reference conditions. The ten metrics are:

- species composition;
- presence of indicator species;
- species relative abundance;
- number of taxa that make up 90% of the abundance;
- number of estuarine resident taxa;
- number of estuarine-dependent marine taxa;
- functional guild composition;
- number of benthic invertebrate feeding taxa;
- number of piscivorous taxa; and

- feeding guild composition.

6.94 Reference conditions for each metric in transitional waters within England and Wales are provided on a method-specific basis (seine netting, beam trawling, fyke netting and otter trawling). Ecological Quality Ratio (EQR) classification boundaries for the fish quality element in transitional water bodies as set out in the TFCI are presented in Table 6-3.

Table 6-3: Classification boundaries for the fish quality element in WFD transitional water bodies.

Lower classification boundaries for Fish quality element in WFD transitional water bodies				
High	**Good**	**Moderate**	**Poor**	**Bad**
0.81	0.58	0.4	0.2	-

6.95 The species relevant to the calculation of the TFCI are predominantly marine/estuarine residents. Consideration is given to diadromous species within one metric of the TFCI, but only as an indicative presence/absence measure.

6.96 Normative definitions set out in Annex V of the WFD describe the aspects of the fish fauna biological quality element in transitional waters that must be included in the ecological status assessment of transitional waters, namely:

- species composition;
- abundance; and
- disturbance-sensitive species.

6.97 The WFD normative definitions of 'High', 'Good', and 'Moderate' status for transitional water body fish as described in Annex V of the Directive are set out in Table 6-4.

Table 6-4: Normative definitions of 'High', 'Good' and 'Moderate' status/potential for transitional fish.

High Status/Potential	Good Status/Potential	Moderate Status/Potential
Species composition and abundance is consistent with undisturbed conditions.	The abundance of the disturbance-sensitive species shows slight signs of distortion from type-specific conditions attributable to anthropogenic impacts on physico-chemical or hydromorphological quality elements.	A moderate proportion of the type-specific disturbance-sensitive species are absent as a result of anthropogenic impacts on physicochemical or hydromorphological quality elements.

Construction

6.98 A full assessment of the potential effects of the Proposed Development on fish is provided in ES Chapter 13: *Marine Ecology and Biodiversity* (document ref: 6.1.13) and the effects during construction are considered to cause only short-term and temporary disturbance to individuals of resident and migrating fish species populations within the Thames Estuary. These effects will generally only be over a small spatial area of the Thames Estuary and may affect movement or migrations of individuals but risk of mortality/injury is very low.

6.99 A primary consideration is the potential effects of underwater noise and vibration from the piling for the new passenger pier at the Kent Project Site, extension of the jetty at the Essex Project Site and mooring area at the Essex Project Site. In addition, for any cofferdams required for the installation of outfalls for the wastewater treatment facility and surface water runoff, piling will be required. In the absence of confirmed methods, taking a precautionary approach it has been assumed that percussive piling would be used as a worst-case scenario.

6.100 Piling activities will be restricted to standard working hours and therefore there would be extensive windows of no piling activity when fish could move past the area and fish could swim away from the area if required. However, for fish species in the hearing groups 'Swim bladder is involved in hearing (primarily pressure detection)' and 'Swim bladder is involved in hearing (primarily pressure detection)' it was assessed in ES Chapter 13: *Marine Ecology and Biodiversity* (document ref: 6.1.13) that without mitigation effects could be of moderate adverse significance.

6.101 To mitigate these potential effects the following potential measures will be undertaken and will be secured as a requirement of the DCO:

- planning pile driving works so they are not conducted at the same time at the Kent and Essex Project Sites;
- using a quieter installation method e.g. vibropiling or rotary auger drilling;
- using smaller piles which will require less force to install and reducing noise and vibration levels generated;
- piling at low tide within intertidal areas when intertidal sediments are exposed to the air will reduce potential for noise and vibration propagation through the water column;
- employing 'soft start' procedures to piling to provide mobile receptors an opportunity to move away from the sound source.

6.102 In addition, the following measure will be applied, where possible, if it is required with the above measures in place.

- developing a construction programme that avoids piling at sensitive times of the year where possible including fish migration and spawning periods in the tidal River Thames.

6.103 With these mitigation measures, potential effects would be greatly reduced.

6.104 With this mitigation in place, and accounting for mitigation to reduce the risk of pollution events (via the CEMP; ES Chapter 13: *Marine Ecology and Biodiversity,* document ref: 6.1.13), the Proposed Development is not predicted to result in any fish species ceasing to be present in the Thames Middle waterbody as a result of the construction of the Proposed Development. Consequently, there is not anticipated to be any noticeable effect on the WFD metrics species composition, presence of indicator species, number of estuarine resident taxa, number of estuarine-dependent marine taxa, functional guild composition, number of benthic invertebrate feeding taxa, number of piscivorous taxa and feeding guild composition, during the construction phase.

6.105 There is not predicted to be an adverse change to the species composition or abundance within the Thames Middle waterbody as a result of the construction of the Proposed Development and it not expected to have an effect on the presence or absence of species, including disturbance-sensitive species. Therefore, the presence of disturbance-sensitive species will be unchanged and there would be no notable change in relation to Normative definitions.

6.106 As indicated above the current potential for Fish in the Thames Middle waterbody is Good (2019), with a target of Good potential for 2021 and 2027. Overall, it is concluded that there are not expected to be any non-temporary effects on the fish quality element at water body level and that the Construction Phase of the Proposed Development would not prevent the Thames Middle waterbody from meeting its WFD objective of Good potential for this element.

Operation

6.107 For the operational phase, all effects for fish were assessed to be of minor significance or negligible (accounting for mitigation to reduce the risk of pollution events via a handover Environmental Management Plan (EMP)) in ES Chapter 13: *Marine Ecology and Biodiversity* (document ref: 6.1.13). Potential impacts would generally only occur over a small spatial area of the Thames Estuary and fish are highly mobile and would be able to avoid potential areas of disturbance if required.

6.108 Overall, it is concluded that there are not expected to be any non-temporary effects on the fish quality element at water body level and that the operational phase of the Proposed Development would not prevent the Thames Middle waterbody from meeting its WFD objective of Good potential for this element.

Water Quality

6.109 Mitigation measures will be in place in terms of the following measures, which will be secured as requirements of a DCO:

- Provision of storage facilities and tanks and conducting refuelling of machinery within bunded areas, which will not be located within 10 m of water bodies or drainage lines.

- Storage and bunded areas will be constructed of impervious floors and walls with the capacity for the contents of the storage tank and an additional ten per cent safety margin.

- As a remedial measure, spill containment equipment such as absorbent materials will be stored on site.

- Sustainable Urban Drainage Systems (SuDS) will be implemented where possible to enable water quality control of the surface water runoff.

- There will be commitments made in the drainage strategy to ensure suitable water quality treatment is undertaken prior to discharge.

6.110 Water quality parameters contribute to the classification of WFD Ecological Potential and to WFD Chemical Status.

6.111 The EA undertakes an annual classification of water quality supporting elements as part of water body monitoring and reporting. In recent years (the most recently published data are from 2019) the majority of water quality parameters have been consistent with Good conditions or greater. However, there remain a limited number of water quality parameters at less than Good and these are contributory limiting factors in the overall Moderate potential classification of the Thames Middle water body (Table 6-5).

6.112 Extensive EA water quality data are collected in the Thames Estuary, primarily to support WFD classification purposes. Long term monitoring of WFD water quality suites is undertaken on a monthly basis at fixed locations throughout the estuary, including Gravesend near the Essex Project site and Greenhithe near the Kent Project site.

Table 6-5: Summary of recent Thames Middle (Transitional) WFD classification status for physico-chemical quality elements, specific pollutants and priority hazardous substances.

Classification (Cycle 2)	Overall Potential	Ecological	Chemical	Supporting elements at <Good								
				Ecological			Chemical					
				Physico-chemical quality elements		Specific pollutants	Priority hazardous substances					
				DIN	Dissolved oxygen	Zinc	TBT	PBDE	PFOS	Benzo(b)fluoranthene	Benzo(g-h-i)perylene	Mercury and its compounds
2019	MP	M	F	M	G	M	F	F	F	F	F	F
2016	MP	M	F	M	M	M	F	/	/	/	/	G
2015	MP	M	G	M	M	M	/	/	/	/	/	G
Objective (objective date)	MP (2015)	M (2015)	G (2015)	M (2015)	G (2027)	H (2027)	G (2015)	G (2015)	G (2015)	G (2015)	G (2015)	G (2015)

N.B. G=Good, M=Moderate, F=Fail, MP=Moderate Potential, /=not assessed, SP= Specific Pollutant (noting that individual SP classification is either High or Moderate depending on EQS pass/fail), PHS=Priority Hazardous Substance, ^2014 assessment was Fail. Source: http://environment.data.gov.uk/catchment-planning/

6.113 A summary of the current Thames Middle water body WFD status is presented in Table 6-5, together with those supporting elements that do not currently meet at least Good status and their associated objectives. This table indicates that the Thames Middle HMWB has Moderate ecological potential and is failing for chemical status with an overall water body potential of Moderate. Some of the supporting ecological elements currently at less than Good have water body objectives to improve by 2027 (Table 6-5). Zinc has been included in the table as the objective is to improve status to High and there is the potential for background condition for zinc to improve to High over the lifetime of the Proposed Development.

6.114 There is no future improvement planned for Dissolved Inorganic Nitrogen (DIN). The EA's catchment planning data portal states that actions to achieve Good DIN status would involve an 'unfavourable' balance of costs and benefits. The EA objective with respect to TBT is Good (although there are no direct RBMP improvement schemes planned - corresponding objective date of 2015), (EA 2018). The EA have identified several catchment activities contributing to the current TBT classification, i.e. sewage discharges (probable), contaminated sediments (probable), other urban and transport sources

(probable), landfill leaching (suspected), contaminated land (suspected) and navigation (suspected). Environmental improvements to these business sectors over time will facilitate indirect improvements to background TBT conditions. A range of other chemicals currently failing had a target of Good by 2015 (Table 6-5).

6.115 Given the limitations on future potential for some elements, however, there is no objective to achieve overall Good WFD Potential for the Thames Middle water body as a whole.

Dissolved Oxygen

6.116 Based on values recorded across the last eight years of (monthly) data, Dissolved Oxygen (DO) at EA Greenhithe and EA Gravesend has exhibited concentrations on the boundary of Moderate and Good status. Recognising that improvements have been realised over recent years, consideration of 2016 to 2020 data in isolation indicates that at Greenhithe the DO conditions have been consistent with High-Good status.

Zinc

6.117 Data for zinc and TBT for Greenhithe are only available from pre-2010 to June 2012 and mean dissolved zinc concentration was 14.25 µg/l (with all of the 32 results in excess of the long-term mean standard (Annual Average (AA)-EQS as set out in The Water Framework Directive i.e. 6.8 µg/l dissolved plus Ambient Background Concentration; Defra 2015)).

6.118 Mean dissolved zinc concentration recorded at the EA's Gravesend monitoring location (data from Jan 2012 to March 2019) was 9.81 µg/l (with two of the 21 results in excess of the AA-EQS value).

TBT

6.119 At Greenhithe, TBT concentrations averaged 0.00065 µg/l (sampling since 2010) and a review of EA data for Gravesend indicated TBT concentrations averaged 0.00075 µg/l (sampling since 2012). The AA-EQS (priority substance) value for TBT is 0.0002 µg/l. These results reflect the current (2019) WFD status for TBT (Fail) in the Thames Middle water body (Table 6-5).

PBDEs

6.120 At Greenhithe no data have been recorded for Polybrominated diphenyl ethers (PBDEs) which are brominated flame retardants. At Gravesend they were recorded between February 2015 and September 2017. In all instances PBDE concentrations recorded were <0.00006 µg/l which is considerably less than the Maximum Allowable Concentration (MAC)-EQS of 0.014 µg/l although for the Thames Middle water body these chemicals are indicated to be failing (Table 6-5).

PFOS

6.121 Mean concentration of perfluorooctylsulphonate anion (i.e. perfluorooctane sulfonate (PFOS)) at Gravesend across seven sample occasions between March 2016 and September 2017 was 0.0059 µg/l. Concentration of perfluorooctylsulphonate anion has not been recorded at Greenhithe since November 2006 when it was recorded as <0.1 µg/l. These background concentrations exceed the AA-EQS for PFOS in transitional waters which is 0.00013 µg/l.

Benzo(b)fluoranthene

6.122 At Gravesend, between October 2017 and April 2019 mean concentration of benzo(b)fluoranthene was 0.026 µg/l which is greater than the MAC EQS of 0.017 µg/l. No data are available for Greenhithe.

Benzo(g-h-i)perylene

6.123 At Gravesend, between October 2017 and April 2019 mean concentration of benzo(g-h-i)perylene was 0.027 µg/l which is greater than the MAC-EQS of 0.00082 µg/l. No data are available for Greenhithe.

Mercury and its compounds

13.1 At Gravesend, between October 2017 and April 2019, concentration has been repeatedly recorded as <0.01 µg/l with one record above this in November 2018 (0.018 µg/l). This is in relation to a MAC-EQS of 0.07 µg/l. At Greenhithe concentrations are also <0.01 µg/l.

Construction

6.124 The main potential effects of the Proposed Development on water quality (as assessed within ES Chapter 13: *Marine Ecology and Biodiversity,* document ref: 6.1.13) are as follows:

- Dredging (for Option C only) and piling activity (Option A, B and C) resulting in an indirect increase in chemical concentrations within the water column via disturbance and mobilisation of chemicals associated with contaminated sediments;

- Option A, B and C: Increase in suspended sediment concentration via direct disturbance of estuary bed sediment due to other construction-related activities such as cofferdam dewatering. Suspended sediment is not a WFD parameter itself but changes in suspended sediment concentrations can have chemical and ecological effects;

- Option A, B and C: Emission of chemicals associated with construction phase activities;

- Option A, B and C: Runoff to aquatic environments from terrestrial construction site activities (following management and treatment) via surface water outfalls;

- Option A, B and C: Discharge from waste water treatments works outfall.

Operation

6.125 The potential effects of the operational phase on water quality within the Thames Estuary (as assessed within the ES Chapter 13: *Marine Ecology and Biodiversity,* document ref: 6.1.13) are as follows.

- Option A, B and C: Runoff to aquatic environments from terrestrial construction site activities (following management and treatment) via surface water outfalls;

- All options: Discharge from waste water treatment works outfall

Assessment of effects

Construction

6.126 Dredging is the primary activity that could result in the greatest suspended sediment concentration increases during construction (this is associated with Option C only). Other activities with potential to release small amounts of sediment include piling and installation of structures on the estuary bed. Any dredging would be undertaken by a backhoe dredger.

6.127 The disturbance and re-suspension of sediments could lead to the release of chemicals within the sediments into solution, which may in turn affect compliance with WFD water quality standards.

6.128 An assessment of the potential increases in chemical concentrations above background levels was conducted utilising the SeDiChem WFD assessment tool (EA 2019). This tool is designed to test exceedances for chemicals on the Marine Management Organisation Cefas Action Level chemical analysis list2. Hydrodynamic modelling outputs provided a net flow of 18,118,920 m3 / day at Gravesend for input into the analysis tool (ES Appendix 17.4: *Hydrodynamic and sedimentation assessment*, document ref: 6.2.17.4) and background chemical levels were determined based on data from the EA Gravesend monitoring station from October 2017 to April 2019 (a period over which each of the chemicals considered for assessment were recorded consistently), (EA 2020).

6.129 Suspended sediment concentration (SSC) increase for piling works associated with Options A and B was modelled as 3 mg/l at 100 m from the source (ES Appendix 17.4: *Hydrodynamic and sedimentation assessment*, document ref: 6.2.17.4). For a backhoe dredge operation SSC increase at 100 m from the dredging activity was calculated to be approximately 18 mg/l (ES Appendix 17.4: *Hydrodynamic and sedimentation assessment*,

[2] https://www.gov.uk/guidance/marine-licensing-sediment-analysis-and-sample-plans

document ref: 6.2.17.4). These SSC values were inputted to SeDiChem as part of the analysis. It was considered appropriate to estimate concentrations at 100 m from source due to the extensive tidal movements in the Thames Estuary.

6.130 Maximum and mean concentrations of chemicals across sample stations were inputted into SeDiChem (chemistry data are provided in ES Appendix 13.5: *Subtidal Benthic Ecology Survey Report*, document ref: 6.2.13.5).

6.131 When indicating potential concentrations reached in the water column, taking a precautionary approach, maximum concentration outputs provided by SeDiChem have been indicated as opposed to mean concentrations.

6.132 For Options A and B, with just pile driving involved, the SeDiChem tool predicted that there would be no exceedances of EQS for any of the trace metals. Copper would be at its EQS of 3.76 µg/l but its baseline concentration is already at this level. There would also be no exceedances for TBT.

6.133 The only chemicals predicted to exceed EQS values 100 m from source were benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene and benzo(g,h,i)perylene as indicated below.

6.134 In terms of the PAHs, for benzo(a)pyrene, baseline concentrations are already at the EQS level of 0.027 µg/l and 100 m from the works the concentration could be up to twice as high (0.060 µg/l). For benzo(b)fluoranthene baseline concentrations are already above the EQS of 0.017 µg/l (indicated as Failing in Table 6-5), and during the works the concentration 100 m from the works could be more than double the EQS value (0.049 µg/l). The situation is similar for benzo(k)fluoranthene with a baseline of 0.0157 µg/l which is just below the EQS of 0.017 µg g/l, and when the works are conducted this could increase up to 0.032 µg/l.

6.135 The greatest exceedance is evident for benzo(g,h,i)perylene which is largely due to its very low EQS concentration. Baseline concentrations of benzo(g,h,i)perylene (0.0267 µg g/l) are two orders of magnitude greater than the EQS of 0.00082 µg/l (indicated as Failing in Table 6-5) and due to sediment disturbance caused by the works for Options A and B concentrations could increase up to 0.046 µg/l which is almost double the baseline concentrations.

6.136 It should be noted, however, that these exceedances at a distance of 100 m of the works would be short-term in duration. Sediment fluxes in the tidal Thames are in the region of tens of millions of kg per tidal phase and with tidal movements any chemicals in the water column would be very rapidly diluted with increased distance from the source of disturbance.

6.137 Overall, for Options A and B the short-term increases in chemical concentrations across small spatial scales are considered to be negligible in relation to the tidally influenced changes in the chemical concentrations in the tidal Thames each day and it is not predicted

to impact upon the current status of the Thames Middle waterbody or its ability to achieve future status objectives.

6.138 For Option C, the potential effects of dredging were considered and based on deployment of a backhoe dredger, the results for trace metals and TBT were the same as that indicated above in that concentrations were not predicted to exceed EQS concentrations 100 m from the source of the dredging. Concentrations relative to baseline levels, however, would be higher than for Options A and B. The only chemicals predicted to exceed EQS values 100 m from source are benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene and benzo(g,h,i)perylene as indicated below. PFOS is not currently covered by the SeDiChem tool and based on the fact that current background concentrations exceed PFOS AA-EQS by two orders of magnitude as indicated above, any effects of the Proposed Development on PFOS concentrations are considered to be negligible.

6.139 SediChem outputs indicate concentration of benzo(a)pyrene 100 m from the dredge area could reach 0.22 µg/l which is an order of magnitude above the EQS and baseline concentrations. This is also the case for benzo(k)fluoranthene which could reach concentrations of 0.12 µg/l in relation to an EQS of 0.017 µg/l and a baseline concentration of 0.016 µg/l.

6.140 As indicated above, baseline levels of benzo(b)fluoranthene and benzo(g,h,i)perylene are already above EQS concentrations and these chemicals are currently classed as failing WFD requirements (Table 6-5). Concentrations of benzo(b)fluoranthene could reach 0.165 µg/l in the water column 100 m from source, which is an order of magnitude above the EQS (0.017 µg/l) and the baseline concentration of 0.0257 µg/l. For benzo(g,h,i)perylene the predicted concentration 100 m from the dredge area is 0.14 µg/l which is many orders of magnitude above the EQS of 0.00082 µg/l and an order of magnitude above the baseline concentration of 0.0267 µg/l.

6.141 The same logic indicated above applies, however, in that the values indicated above do not account for tidal dilution of chemicals in terms of spatial and temporal effects. Although the exceedances indicated for benzo(b)fluoranthene and benzo(g,h,i)perylene are considerable they will be relatively short term and the values indicated are in proximity to the dredge area (within 100 m). With increased distance from the dredge area and with the influence of tidal movements, concentrations will rapidly decrease. Consequently, overall it is considered that effects on water quality due to dredging at the scale of the Thames Middle water body would be minimal.

6.142 Discharge of surface runoff via outfalls to the aquatic environment and discharges from the wastewater treatment plant have been considered within ES Chapter 13: *Marine Ecology and Biodiversity* (document ref: 6.1.13) and it is noted that any such discharges will be made under an Environmental Permit and will comply with relevant legislation. Any temporary adverse change to water quality parameters (e.g. pH) associated with construction phase emissions are considered to be negligible in the context of the Thames Middle water body (given consideration of extremely small volumes relative to the large

tidal flux of the receiving water). Consequently, it is considered that they do not constitute a risk of current status/potential deterioration, or reduction in the potential for the water body to achieve future status objectives.

6.143 Overall, it is concluded that there are not expected to be any non-temporary effects on chemical status/potential at water body level and that the construction phase of the Proposed Development would not prevent the Thames Middle waterbody from meeting its WFD objective of Good/High potential for water chemistry.

Operation

6.144 The main potential effects during operation are due to discharges from outfalls as indicated above. As indicated these discharges will be made under an Environmental Permit and will comply with relevant legislation and pollutant interceptors and siltation controls will be employed to treat the water prior to discharge.

6.145 If Option C is selected, maintenance dredging will have a potential effect if required. As indicated above in the hydromorpology section, however, maintenance dredging is not anticipated to be required and if it is, any effects would be less than those described for capital dredging for the construction phase stated above.

6.146 With these measures in place any adverse change to water quality parameters are considered to be negligible in the context of the Thames Middle water body (given consideration of extremely small volumes relative to the large tidal flux of the receiving water) and do not constitute a risk of current status/potential deterioration.

6.147 Overall, it is concluded that there are not expected to be any non-temporary effects on chemical status/potential at water body level and that the operational phase of the Proposed Development would not prevent the Thames Middle waterbody from meeting its WFD objective of Good/High potential for water chemistry.

Invasive Non-Native Species

6.148 Non-native species (NNS) are defined as species that have been introduced to non-native environments either accidentally or deliberately. Introduction and transfer of these species primarily occur by the transport and discharge of ballast water, and to a lesser extent transport of fouling organisms on hulls or through aquaculture. The establishment of NNS into marine habitats may cause effects ranging from those which are almost undetectable to the displacement of native communities (where invasive NNS (INNS) are involved). The introduction of INNS can also cause diseases and may adversely affect a range of interests from commercial use of the marine environment to wildlife conservation (Eno et al. 1997).

6.149 Once non-native species become established and disperse within a new habitat they can out-compete local species for space and resources, prey directly on local species, or introduce pathogens (Roy et al. 2012). Consequently, the introduction of non-native species could potentially affect the ecological functioning of estuarine communities,

however, it is important to understand that the majority of non-native species are not 'invasive' non-native species (INNS) (i.e. a non-native species that has the ability to spread causing damage to the environment, the economy and our health (GBNNSS 2018)).

6.150 A number of non-native species are known to be present at the Kent and Essex Project Sites. Those identified via desk-based study of previous surveys in the area and recorded during surveys conducted in 2020 for the Proposed Development are indicated in Appendix 13.2: *Marine Ecology and Biodiversity Baseline Conditions* (document ref: 6.2.13.2).

6.151 As specified in the Clearing the Water for All guidance (EA 2017) INNS are required to be included in the WFD assessment if an activity could introduce or spread INNS to a water body.

Construction

6.152 The main risks of introducing or spreading INNS during construction include:

- Introduction of materials or equipment that have come from, had use in or travelled through other water bodies.

- Increased vessel activity during construction. Within the UK, pathways of introduction involving vessel movements (fouling of hulls and ballast water) have been identified as the highest potential risk routes for the introduction of non-native species. This could either be from the discharge of ballast water at site or via transportation on vessel hulls. It is estimated that there would be 10 barge movements per day during the construction phase across the Kent and Essex Project Sites (ES Appendix 10.1: *Preliminary Navigation Risk Assessment,* document ref: 6.2.10.1) and a dredger would be in operation for Option C at the Kent site.

Operation

6.153 The main risks of introducing or spreading INNS during operation will be that the new passenger ferry between the Essex Project Site and the Kent Project Site. During operation it is anticipated that there would be 27 passenger vessel movements per day between upstream locations and London Resort (extension of existing route) and 42 passenger vessel movements per day between London Resort and Tilbury (new passenger ferry services), (ES Appendix 10.1: *Preliminary Navigation Risk Assessment*, document ref: 6.2.10.1). These vessels, however, are generally expected to remain within the tidal Thames waterbody.

Assessment of Effects

Construction

6.154 The potential effects associated with estuarine/marine INNS for the Proposed Development have been assessed in ES Chapter 13: *Marine Ecology and Biodiversity* (document ref: 6.1.13).

6.155 It was considered that risks of introduction via ballast water would be minimal due to the position that the Ballast Water Management Convention has been ratified and all vessels will be fully compliant with International Maritime Organisation (IMO) guidelines. As identified in ES Chapter 13: *Marine Ecology and Biodiversity* (document ref: 6.1.13), however, it was considered that mitigation measures would be undertaken in line with best practice to reduce the risks of introduction/spread of INNS from a range of potential pathways (such as on vessel hulls) as well as in ballast water.

6.156 A project-specific Biosecurity Plan with a Biosecurity Risk Assessment has been produced which outlines numerous measures which will be incorporated into construction methods to limit the risk of introduction of non-native species (see Biosecurity Plan: ES Appendix 13.9, document ref: 6.2.13.9). In addition, measures taken will include consideration of the following. Adherence to measures in a Biosecurity Plan and these measures below will be secured as a requirement of the DCO:

- Conforming to guidelines on marine biosecurity planning as advised by NE, including production of a Biosecurity Plan following best practice guidance as set out in the Natural England and Natural Resources Wales Biosecurity Planning guidance (Payne *et al*. 2015).
- Management of vehicles and vessels during construction including:
    - Biofouling
    - Ballast water
    - Movement of slow or stationary vehicles
    - Use of small vessels where possible
- Ports and Harbour protocol:
    - Adherence to legislative guidance for specific port and harbour authorities
- Conforming to industry guidelines:
    - Follow best practice guidance, apply Best Available Technology (BAT)

6.157 With appropriate mitigation measures in place as indicated above, it is considered that the risk of potential spread/introduction of INNS during construction would not be expected to have any non-temporary effects on the WFD potential of the Thames Middle water body and would not prevent the attainment of WFD objectives.

Operation

6.158 The project-specific Biosecurity Plan indicated above will encompass the operational phase and will outline numerous measures which will be incorporated into operation methods to limit the risk of introduction of non-native species. Potential measures will be consistent with those indicated above for the construction phase.

6.159 Overall, with appropriate mitigation measures in place as indicated above, it is considered that the risk of potential spread/introduction of INNS during operation would not be expected to have any non-temporary effects on the WFD potential of the Thames Middle water body and would not prevent the attainment of WFD objectives.

Groundwater bodies

Impact Assessment

West Kent Darent and Cray Chalk water body

Construction

6.160 Construction of the various buildings and structures of the Proposed Development (which includes construction over landfilled wastes (mainly Cement Kiln Dust (CKD)) has the potential to impact on the groundwater body. Specifically, promotion of infiltration in areas of earthworks may encourage leaching of contamination and migration into the aquifer, deep foundations protruding into the aquifer may create or modify flow paths, and runoff from potentially contaminated surfaces could be discharged into the aquifer.

Operation

6.161 Operation of the Proposed Development (which includes areas of landfilled wastes (mainly CKD)) has the potential to impact on the groundwater body. Specifically, the surface water drainage strategy could encourage leaching of contamination and migration into the aquifer, deep foundations protruding into the aquifer may create or modify flow paths, and runoff from potentially contaminated surfaces could be discharged into the aquifer.

South Essex Thurrock Chalk water body

Construction

6.162 Construction of the multi-storey car park has potential to impact on the groundwater body. Specifically, promotion of infiltration in areas of earthworks may encourage leaching of contamination and migration into the aquifer, deep foundations protruding into the aquifer may create or modify flow paths, and runoff from potentially contaminated surfaces could be discharged into the aquifer.

Operation

6.163 Operation of the multi-storey car park has limited potential to impact on the groundwater body. Deep foundations protruding into the aquifer may create or modify flow paths.

North Kent Medway Chalk water body

Construction

6.164 Construction of the new access road (which includes construction across / through landfilled wastes) has the potential to impact on the groundwater body. Specifically, promotion of infiltration in areas of earthworks may encourage leaching of contamination and migration into the aquifer, deep foundations protruding into the aquifer may create or modify flow paths, and runoff from potentially contaminated surfaces could be discharged into the aquifer.

Operation

6.165 Operation of the new access road has the potential to impact on the groundwater body. Specifically, promotion of infiltration in areas of earthworks may encourage leaching of contamination and migration into the aquifer, deep foundations protruding into the aquifer may create or modify flow paths, and runoff from potentially contaminated surfaces could be discharged into the aquifer.

6.166 Mitigation measures for potential effects on groundwater is as follows for all three groundwater bodies, which will be secured as requirements of a DCO:

- Detailed site investigations, sampling, monitoring and risk assessments will inform both the remedial strategy and the geotechnical designs.
- A CEMP will set out the procedures for the protection of controlled waters.
- Adoption of good construction techniques, implemented through a CEMP which will include prevention of the migration of contamination via surface water run off or via permeable strata.
- Undertaking a Foundation Works Risk Assessment to inform foundation solutions and ensure mitigation of risk to groundwater quality. Piling techniques deemed appropriate

to identify and manage potential risks as a result of creating pathways to groundwater will be used.

- Long term maintenance of existing leachate management system (Kent Project Site) or installation of a new system, with appropriate controlled access.
- Remediation Strategy (to be prepared in general accordance with ES Appendix 18.9: *Contaminated Land Management Strategy* (document ref: 6.2.18.9) to include particular remedial action (treatment, isolation or removal) of any areas of gross contamination.
- Provision of appropriate thicknesses of suitable sub soil and topsoil in areas of soft landscaping and public open space to minimise infiltration.

6.167 Control of groundwater during excavation:

- CEMP will include measures to limit un-sealed surfaces and contain / manage infiltration and surface water runoff.

- Preparation of Verification Report(s) to demonstrate that the remedial actions have been carried out in accordance with the Strategy and accordingly that construction activities have not given rise to unacceptable risks to controlled waters in both short and long term.

Assessment of Effects

The potential impacts of the scheme on the three groundwater bodies were assessed. With the mitigation measures outlined above, no deterioration of the quantitative or qualitative elements of these groundwater bodies are anticipated. Additionally, the potential effects associated with groundwater have been assessed in ES Chapter 18: *Soils, hydrogeology and ground conditions* (document ref: 6.1.18), which concludes that the residual effects on the Principal Aquifers are negligible.

Chapter Seven ◆ Cumulative Effects

PROJECTS ASSESSED

7.1 This cumulative effects section assesses effects of the Proposed Development on Thames Middle Water Body supporting elements when combined with the effects of other plans and projects in the area. Those which are outlined in the ES Chapter 13: *Marine Ecology and Biodiversity* (document ref: 6.1.13) and are also considered relevant to assess potentially significant effects at the scale of the Thames Middle Waterbody are:

- Tilbury2 port development (NSIP ref: TR030003)
- Thurrock Flexible Generation Plant (NSIP ref: EN010092)
- Purfleet Centre Regeneration (Thurrock Council, 17/01668/OUT)

Tilbury2 port development (NSIP ref: TR030003)

7.2 Tilbury2 is a proposed new port terminal to be located on land that formed the western part of the previous Tilbury Power Station site. It will be 820 m east of the Essex Project Site, and will have associated facilities for importing, exporting and processing a variety of goods. The main components of Tilbury2 will be:

- A Roll-On / Roll-Off (Ro-Ro) terminal for importing and exporting containers and trailers which has now been constructed.

- A 'Construction Materials and Aggregates Terminal' (CMAT) for handling and processing bulk construction materials. This will be located at the northern part of the site.

7.3 Other parts of the site will be used for storage of bulk goods or vehicles (onshore).

7.4 A DCO application for Tilbury2 has been submitted to the Planning Inspectorate (PINS) (on behalf of the Secretary of State for Communities and Local Government) and all associated supporting environmental reports have been published on the PINS website.

7.5 The Tilbury2 scheme is now operational. It has been included within the Cumulative Assessment as the Ro-Ro facility only became operational in July 2020 and so the effects of this development are not considered to be included within the baseline.

Cumulative effects between construction of the Proposed Development and Tilbury2 operation

7.6 The Tilbury2 project will require regular maintenance dredging to allow access to the Ro-Ro facility. Given normal licensing practice that staggers dredging operations within the same portion of the river (as controlled by the PLA and MMO) it is expected that the construction phase dredge (Option C) for the Proposed Development will not be

undertaken at the same time as any Tilbury2 maintenance dredging although this has not been assumed. Should these activities occur at the same time, this is not anticipated to result in an increased likelihood of potential water quality change at the scale of the Thames Middle water body, compared to either in isolation. Consequently, any cumulative effects associated with the capital dredging for Option C for the Proposed Development and Tilbury2 maintenance dredging are assessed to be negligible.

7.7 Other potential interactions between the construction phase of the Proposed Development and operational impacts of Tilbury2 could include disturbance to fish from artificial lighting of the Tilbury2 jetty and the construction works of the Proposed Development and underwater noise due to increased vessel traffic from Tilbury2 operations and construction activities for the Proposed Development. However, with the implementation of measures to reduce the effects of artificial lighting such as the Tilbury2 Lighting Strategy, the cumulative effects of artificial lighting will be negligible. During operation of Tilbury2, vessel traffic on the Thames will increase by approximately 10.5% (PoTLL 2017). The Tilbury2 ES states vessels transiting to and from Tilbury2 will be relatively slow moving as they would be operating within a busy waterway and manoeuvring to enter or exit the port and so the risk of collision at these speeds would be low. Approximately 10 vessel movement may occur each day at the Kent and Essex Project Sites and it is anticipated that cumulative effects with Tilbury2 would be negligible in terms of increased levels of underwater noise for fish or increased risk of introduction or spread of INNS.

7.8 Overall, it is concluded that the cumulative effects of construction phase of the Proposed Development and operation of Tilbury2 would not have any non-temporary effects on the WFD potential and would not prevent the Thames Middle water body from meeting WFD objectives.

Thurrock Flexible Generation Plant (NSIP ref: EN010092)

7.9 Thurrock Flexible Generation Plant is a flexible electricity generation plant on land next to Tilbury Substation in Thurrock. It will be 400 m east of the Essex Project Site. The main marine components of Thurrock Flexible Generation Plant will be the construction of a Ro-Ro causeway and capital dredging.

7.10 Construction is expected to start in 2021 for the majority of the development including the marine components. Construction is expected to take either 1-2 years or 3-6 years depending on the options chosen for the construction programme. It is then expected to operate for up to 35 years.

Cumulative effects between construction of the Proposed Development and Thurrock Flexible Generation Plant construction

7.11 Construction of the Ro-Ro causeway for the Thurrock Flexible Generation Plant has the potential to overlap with construction of the marine aspects of the Proposed Development. Both projects will require piling and so there is a potential for cumulative noise and vibration effects to occur on fish. These effects are not expected to be additive

but may increase the duration of effects if piling activities take place consecutively between the two projects. If piling works are not mitigated effectively and are undertaken along this stretch of the tidal River Thames for a sustained period during sensitive ecological periods (such as fish migration) the cumulative effect has the potential to cause temporary effect to migrating fish species.

7.12 Mitigation to reduce this cumulative effect should include careful timing of piling works to avoid piling at ecologically sensitive times of year and to avoid a sustained period of piling works between the two projects. It is anticipated that the Thurrock Flexible Generation Plant Project and the Proposed Development will have appropriate mitigation in place to limit the potential effects of underwater noise and vibration.

7.13 The dredging required for the Proposed Development (Option C only) is at the Kent Project Site which is 4 km west of the Thurrock Flexible Generation Plant. Given normal licensing practice that staggers dredging operations within the same portion of the river (as controlled by the PLA and MMO) it is expected that the construction phase dredge (Option C) for the Proposed Development will not be undertaken at the same time as any Thurrock Flexible Generation Plant capital dredging although this has not been assumed. Should these activities occur at the same time, this is not anticipated to result in an increased likelihood of potential water quality change at the scale of the Thames Middle water body, compared to either in isolation.

7.14 Overall, it is concluded that the cumulative effects of the construction phase of the Proposed Development combined together with the construction of the Thurrock Flexible Generation Plant would not have any non-temporary effects on the WFD potential and would not prevent the Thames Middle water body water body from meeting WFD objectives.

Cumulative effects between construction of the Proposed Development and Thurrock Flexible Generation Plant operation

7.15 During operation, the main effect of the Thurrock Flexible Generation Plant will occur from maintenance dredging. If Option C is chosen, it is possible that capital dredging for the Proposed Development may take place at the same time as maintenance dredging for the Thurrock Flexible Generation Plant. However, this is not anticipated to result in an increased likelihood of potential water quality change at the scale of the Thames Middle water body, compared to either in isolation.

7.16 Overall, it is concluded that the cumulative effects of the construction phase of the Proposed Development and operation of the Thurrock Flexible Generation Plant would not have any non-temporary effects on the WFD potential and would not prevent the Thames Middle water body water body from meeting WFD objectives.

Cumulative effects between operation of the Proposed Development and Thurrock Flexible Generation Plant operation

7.17 During operation, the main effect of the Thurrock Flexible Generation Plant will occur from maintenance dredging. If Option C is chosen, it is possible that maintenance dredging for the Proposed Development may take place at the same time as maintenance dredging for Thurrock Flexible Generation Plant.

7.18 However, this is not anticipated to result in an increased likelihood of potential water quality change at the scale of the Thames Middle water body, compared to either in isolation.

7.19 Overall, it is concluded that the cumulative effects of the construction phase of the Proposed Development and operation of the Thurrock Flexible Generation Plant would not have any non-temporary effects on the WFD potential and would not prevent the Thames Middle water body water body from meeting WFD objectives.

Purfleet Centre Regeneration (Thurrock Council, 17/01668/OUT)

7.20 Purfleet Centre Regeneration will redevelop land on the north bank of the tidal River Thames in Purfleet city centre. The marine elements of this project are limited to replacement of parts of the river wall and flood defences (including piling) and the provision of surface water runoff outfalls. It is not clear when the piling for the river wall will be conducted for the Purfleet Centre Regeneration. The overall construction programme is from 2019 until 2034.

Cumulative effects between construction of the Proposed Development and Purfleet Centre Regeneration construction

7.21 Both projects will require piling and so there is a potential for cumulative noise and vibration effects to occur on fish. These effects are not expected to be additive but may increase the duration of effects if piling activities take place consecutively between the two projects. If piling works are undertaken along this stretch of the tidal River Thames for a sustained period during sensitive ecological periods such as fish migration the cumulative effect has the potential to cause temporary effects to migrating fish species.

7.22 Mitigation to reduce this cumulative effect should include careful timing of piling works to avoid a sustained period of piling works between the two projects. It is anticipated that the Purfleet Centre Regeneration Project and the Proposed Development will have appropriate mitigation in place to limit the potential effects of underwater noise and vibration.

7.23 Overall, it is concluded that the cumulative effects of construction phase of the Proposed Development and construction for the Purfleet Centre Regeneration project would not have any non-temporary effects on the WFD potential and would not prevent the Thames Middle water body water body from meeting WFD objectives.

Chapter Eight ◆ Conclusions

SUMMARY

8.1 This assessment has considered the potential effects of the Proposed Development on WFD receptors in the Thames Middle water body and on groundwater bodies.

Thames Middle Water Body

8.2 For the Thames Middle water body the assessment considered the biological, hydromorphological and chemical quality elements potentially affected by all aspects of the proposed works.

8.3 The Scoping stage identified that the following receptors would not be affected by the proposed works and could be scoped out with no need for further assessment:

- Biology - Fish (only screened out for operation phase)
- Biology - Habitats (lower sensitivity habitats);
- Water quality – Phytoplankton status; Harmful algae
- Protected areas

8.4 The receptors that could not be scoped out and were taken forward to the Impact Assessment stage were:

- Biology - Habitats (higher sensitivity: Saltmarsh)
- Biology - Fish (only screened in for construction phase)
- Water quality – Physicochemical parameters; Chemicals on the EQSD; Chemicals above Cefas Action Level 1
- INNS

8.5 The Assessment took into account the following two embedded mitigation measures (which will be secured as a requirement in the DCO):

- Habitat creation plans to create saltmarsh habitat by breaching the existing sea defences and via interventions at the shoreline.

- Booms or other equivalent infrastructure will be included within the designs for the ferry terminal and jetties to reduce the potential for erosion caused by boat wash.

8.6 In addition, a range of additional mitigation measures were determined to be required in ES Chapter 13: *Marine Ecology and Biodiversity* (document ref: 6.1.13) (which will be secured as a requirement in the DCO), and these have been considered in this assessment. These measures include but not restricted to:

- Implementation of a CEMP to include a range of measures to minimise the chances of accidental pollution from spillage of chemicals and any subsequent effects.

- Conforming to guidelines on marine biosecurity planning including production of a Biosecurity Plan (see Biosecurity Plan: ES Appendix 13.9, document ref: 6.2.13.9) following best practice guidance (Payne *et al*. 2015).

- A range of mitigation measures to reduce the potential effect of underwater noise and vibration on fish.

8.7 For all receptors taken forward to the Impact Assessment stage it was concluded, with these identified mitigation measures in place, that the Proposed Development is not expected to produce non-temporary effects on the biological, hydromorphological and chemical quality elements of Thames Middle water body, and are not expected to prevent the water body from meeting WFD objectives.

Groundwater Bodies

8.8 The groundwater assessment screened in the West Kent Darent and Cray Chalk water body, South Essex Thurrock Chalk water body and North Kent Medway Chalk water body.

8.9 For the quantitative status assessment, Surface Water and GWDTEs and Water Balance were not assessed as the project would not directly abstract from any of the assessed groundwater bodies. In addition, an assessment of effects on groundwater bodies associated with supplying potable water to the development was not undertaken as potable water supply will be provided via an enhanced Thames Water network and the water sources have not been confirmed.

8.10 For the chemical status assessment Surface Water and GWDTEs were not assessed. In addition, DrWPAs and the General Quality Assessment was not conducted assessed as it was not considered that the project would impact the ability of any of the assessed groundwater bodies to achieve these aims.

8.11 Saline or other intrusions were considered due to the potential construction impacts from the Proposed Development.

8.12 A suite of mitigation measures of relevance to the groundwater bodies was considered which will be set out in a CEMP as secured as a requirement of the DCO.

8.13 With these mitigation measures in place no deterioration of the quantitative or qualitative elements of these groundwater bodies was anticipated.

Future Good Status

8.14 The status objective for the Thames Middle waterbody as reported within the 2015 RBMP is Moderate by 2015, therefore the objective is currently met. The focus of the WFD and RBMP is to prevent deterioration of status in all water bodies, including Thames Middle, which is assessed above.

8.15 At present there are no local targeted measures within the catchments to maintain or achieve improvements to the status of the water body. National Measures set by EA in the 2015 RBMP to achieve the objectives of the plan relate to:

- Water (including habitat enhancement, water quality, and flood risk)
    - Liaising with the Thames Estuary 2100 project to achieve greater public access and habitat restoration, particularly inter-tidal habitat in the estuary, from any capital works on flood defence.
    - EU Horizon 2020 bid, worth £0.5 million to the catchment. Focusing on ecosystem services and suitable mitigation measures for estuaries. It will include intertidal habitat creation, opportunities for vertical or artificial foreshore, and retrofitting of existing structures.
- Human element (education, access, and public awareness)
- Planning and economic development (including river traffic, commerce, fishing, and riverside redevelopment)

Statement of Compliance

8.16 The assessment provided in this document demonstrates that the Proposed Development is compliant with the objectives of the WFD. Therefore, there is no requirement for an Article 4.7 assessment.

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Appendix

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Appendix 1.0 Figures

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Figure 13.7.1: Thames Middle Water Body from Fulham to East Tilbury

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Figure 13.7.2: Flow chart indicating elements contributing to ecological status/potential, chemical status and the approach applied to calculate overall status/potential for surface waters. Image reproduced from EA 2013. H=High; G = Good; M = Moderate; P=Poor; B=Bad; F=Fail

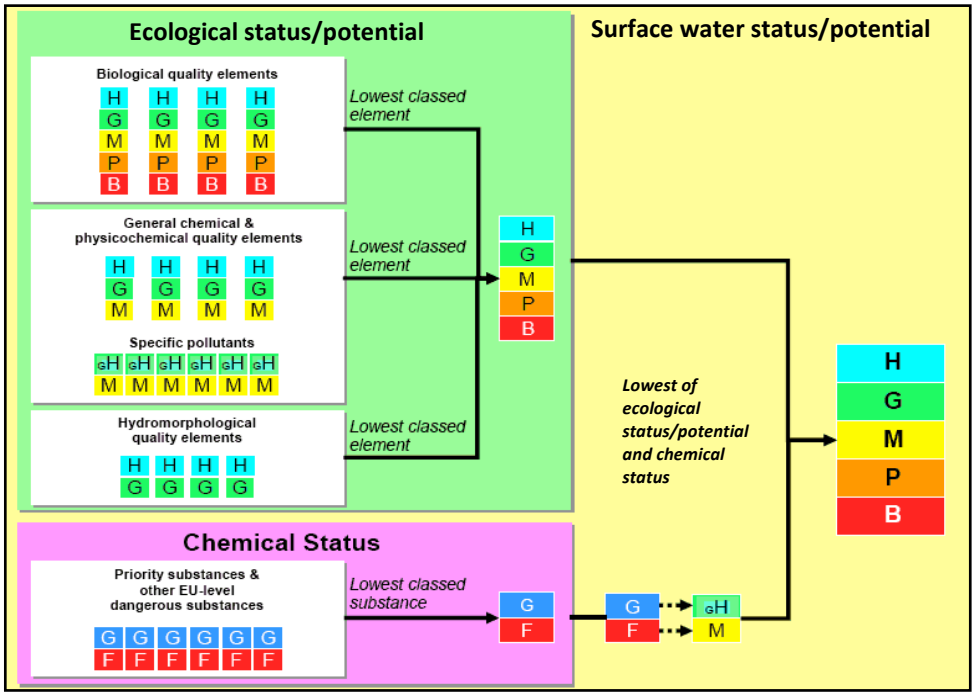


Figure 13.7.3: Classification hierarchy for surface waters (extracted from EA 2018).

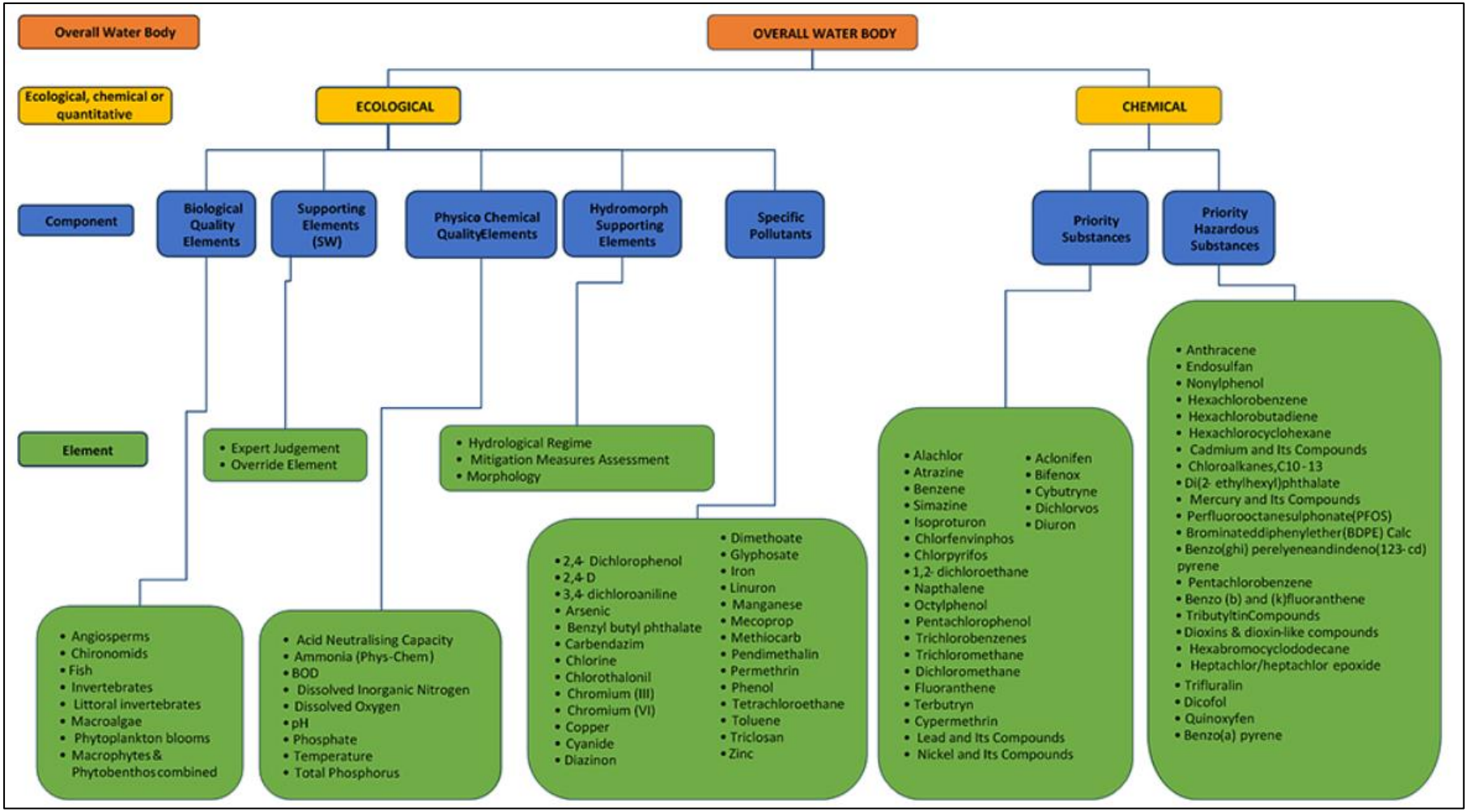


Figure 13.7.4: Classification hierarchy for groundwaters (extracted from EA 2018).

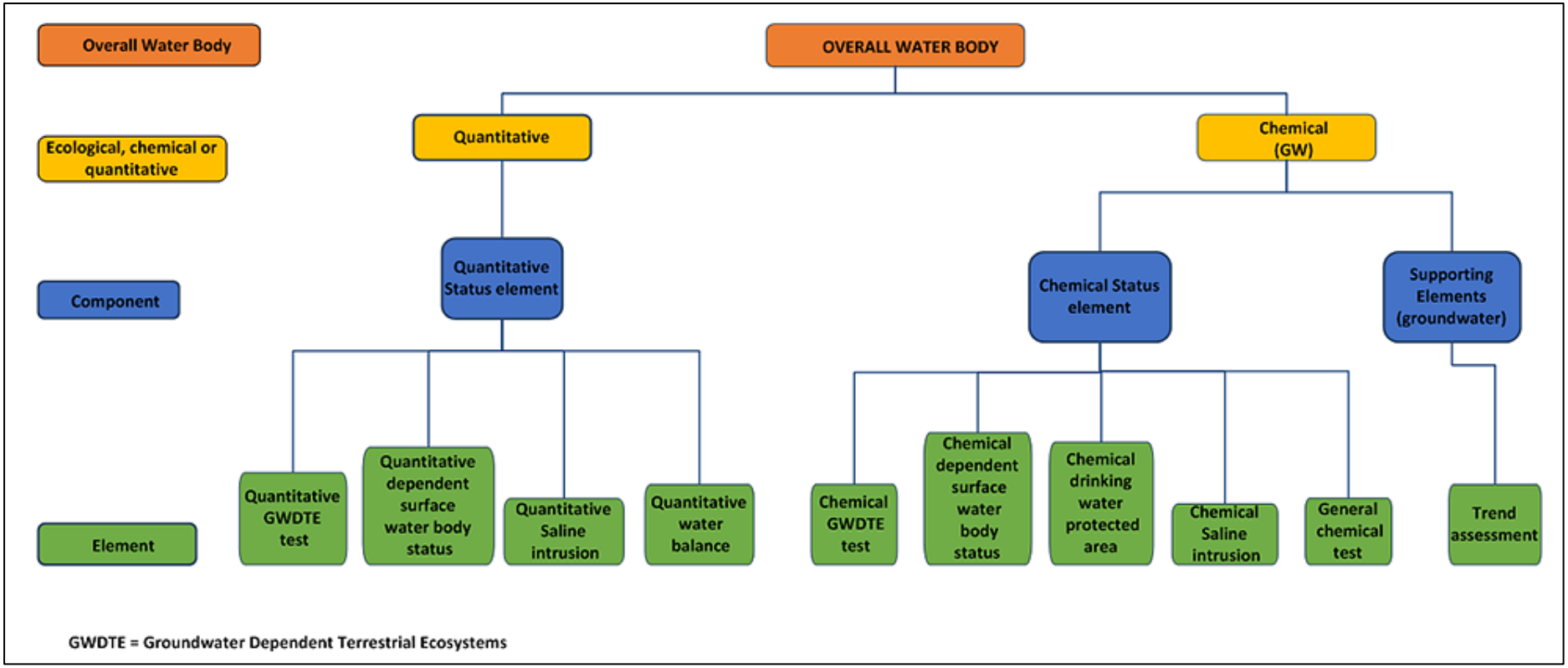


Figure 13.7.5: Option A design at the Kent Project Site.

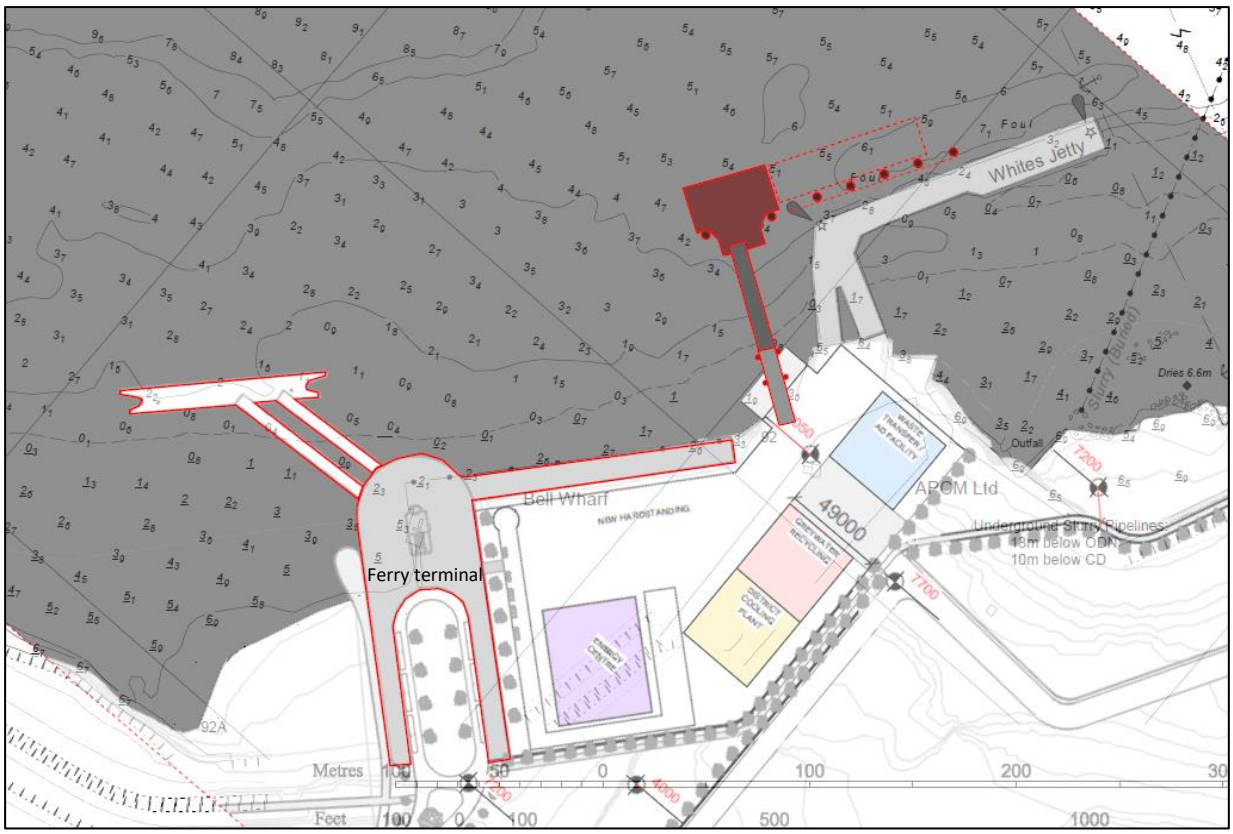


Figure 13.7.6: Option B design at the Kent Project Site.

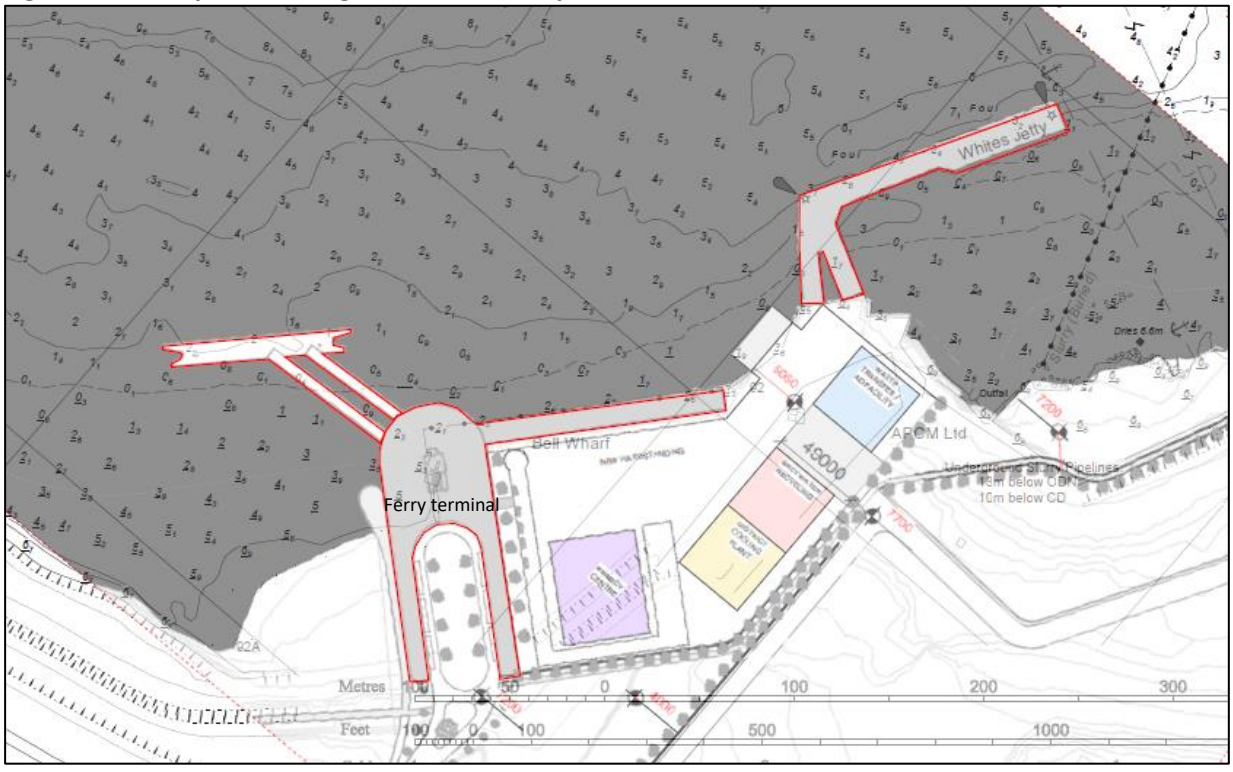


Figure 13.7.7: Option C design at the Kent Project Site.

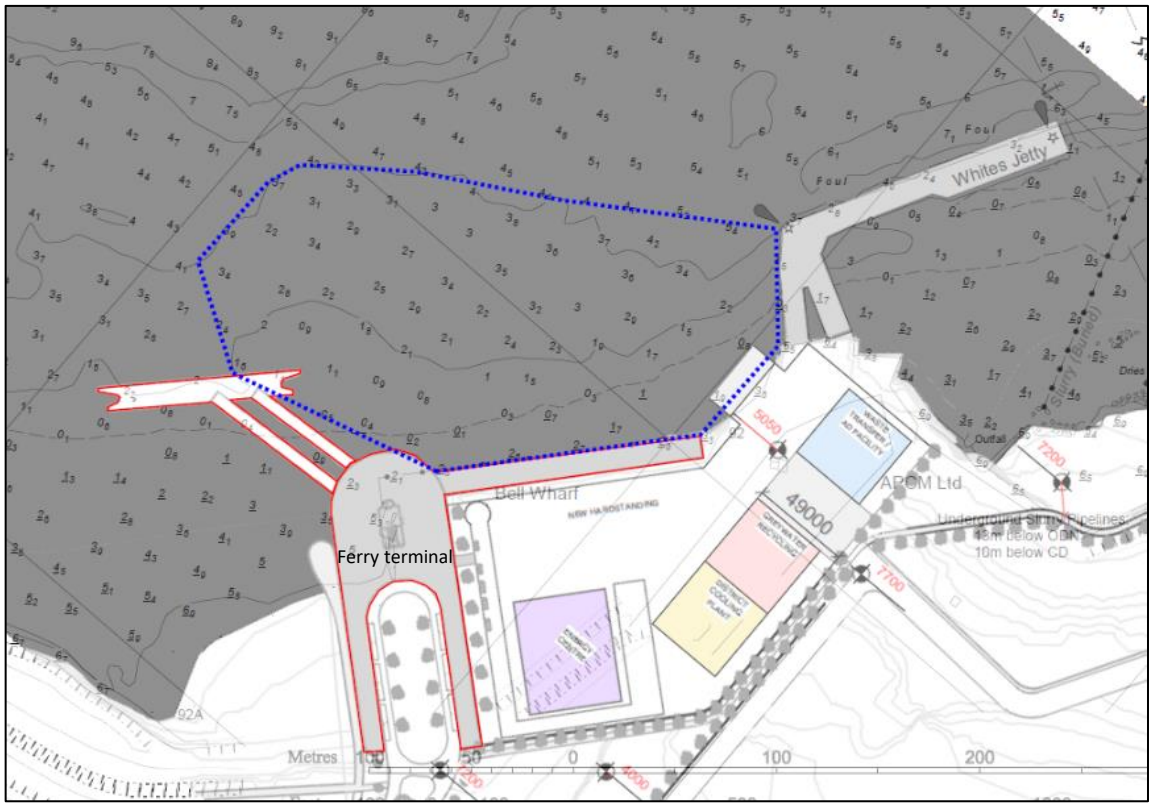


Figure 13.7.8: Design of proposed ferry pontoon at the Essex Project Site.

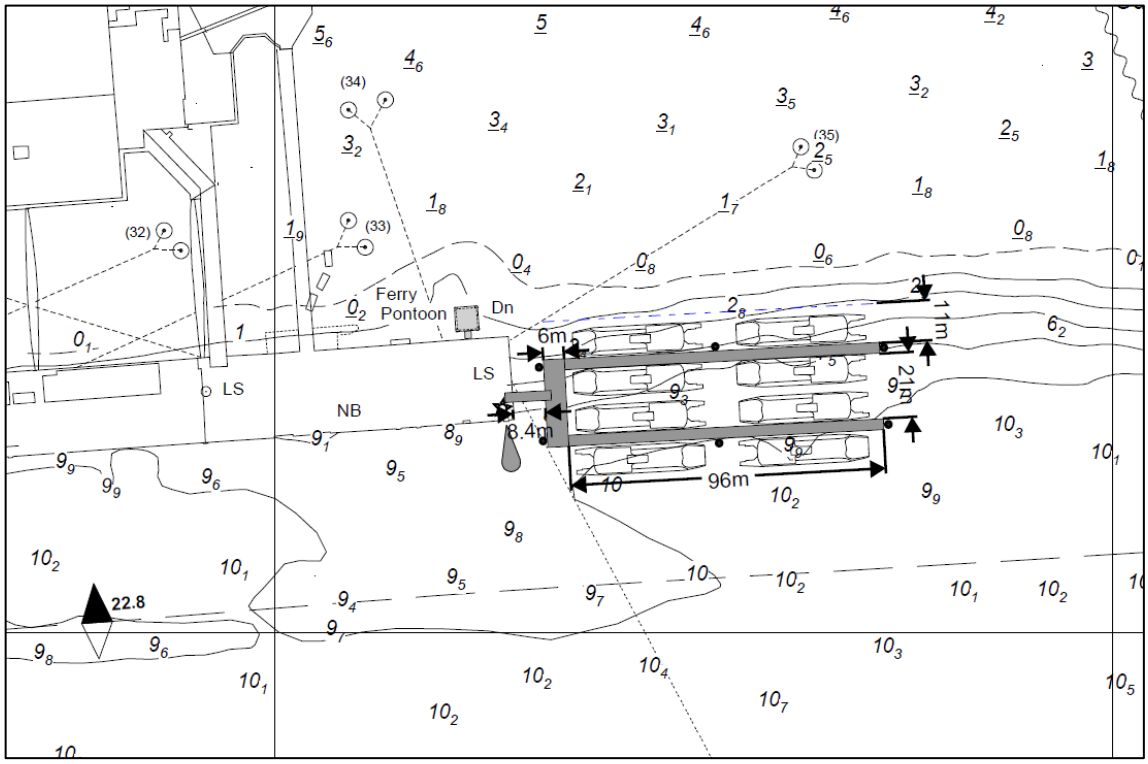


Figure 13.7.9 Overview of the groundwater classification elements (from EA 2012).

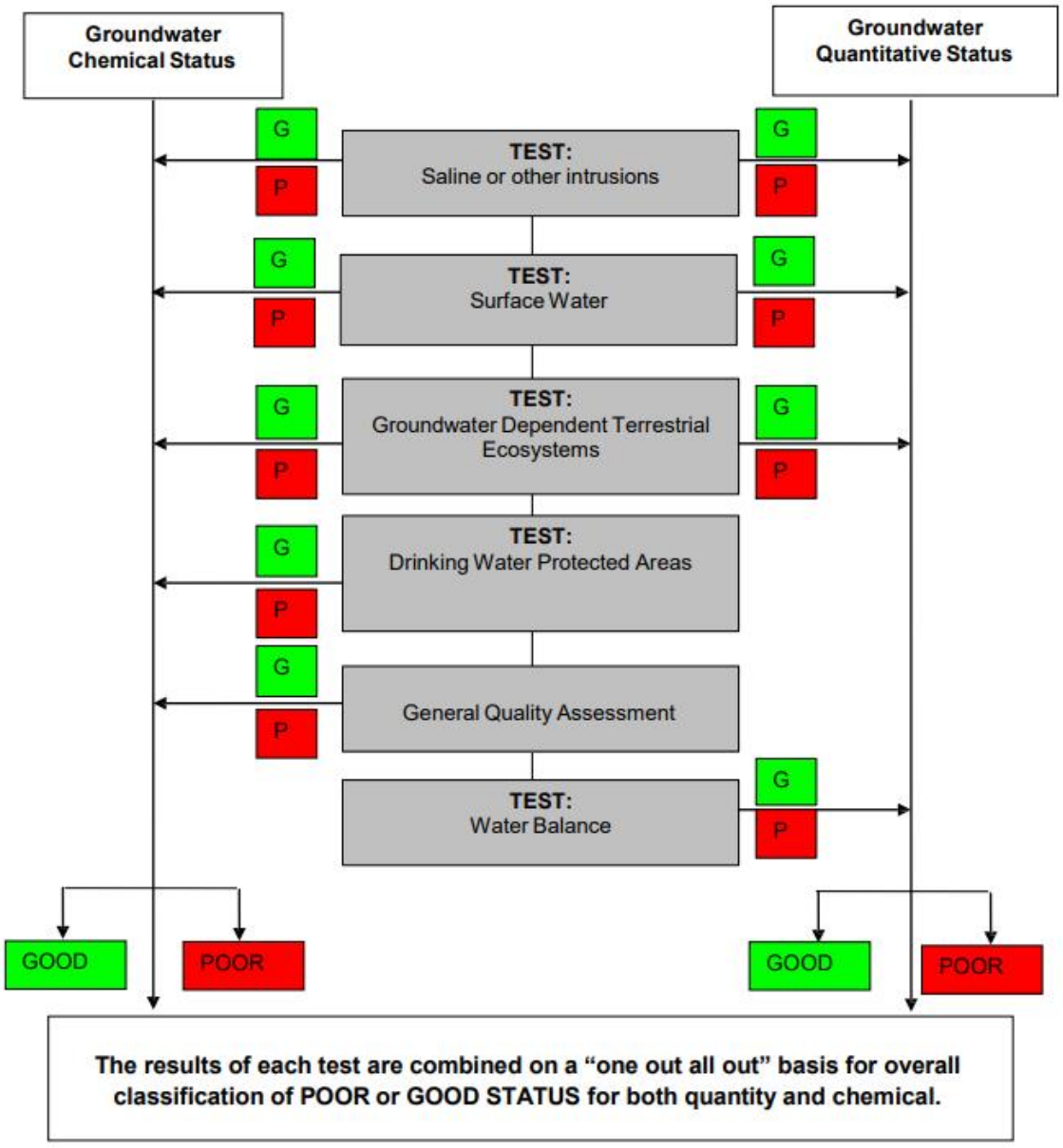


Figure 13.7.10: The West Kent Darent and Cray Chalk WFD Groundwater Water Body (Source: https://environment.data.gov.uk/catchment-planning/).

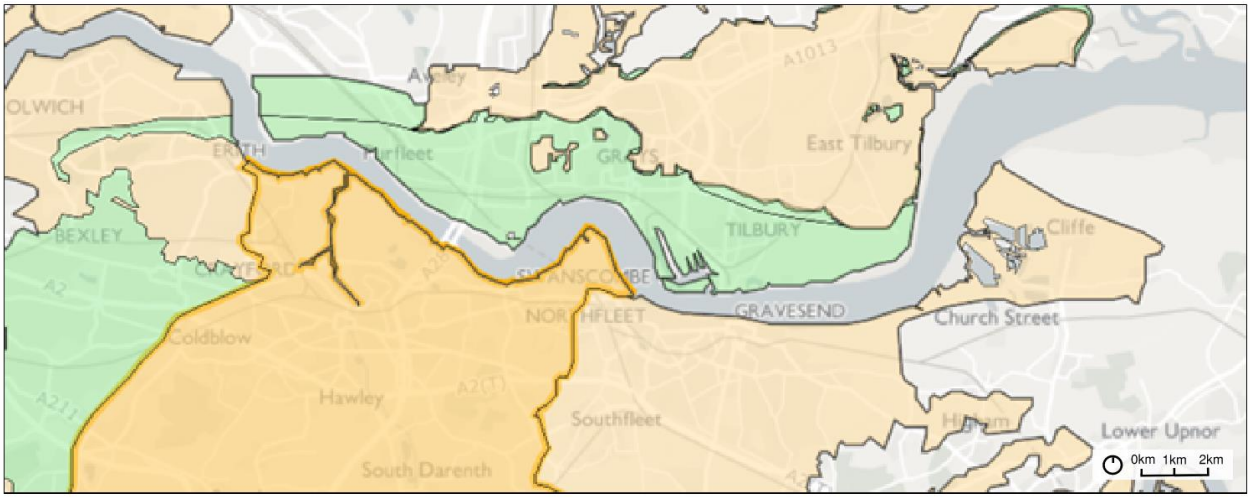


Figure 13.7.11: The South Essex Thurrock Chalk WFD Groundwater Water Body (Source: https://environment.data.gov.uk/catchment-planning/).

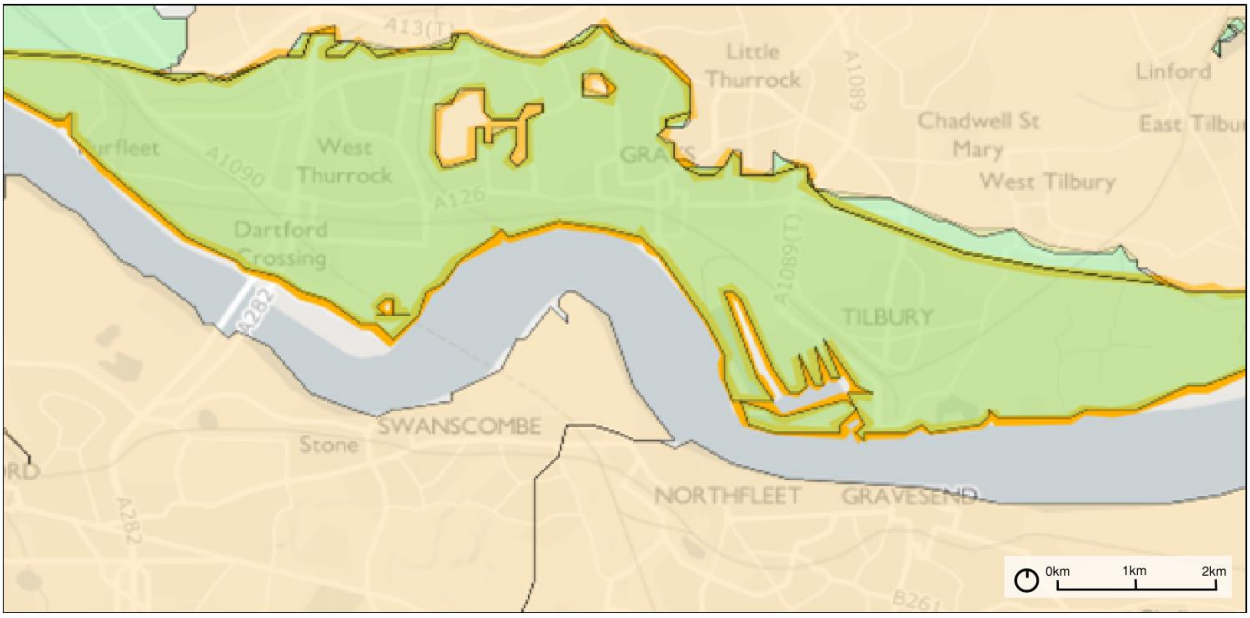
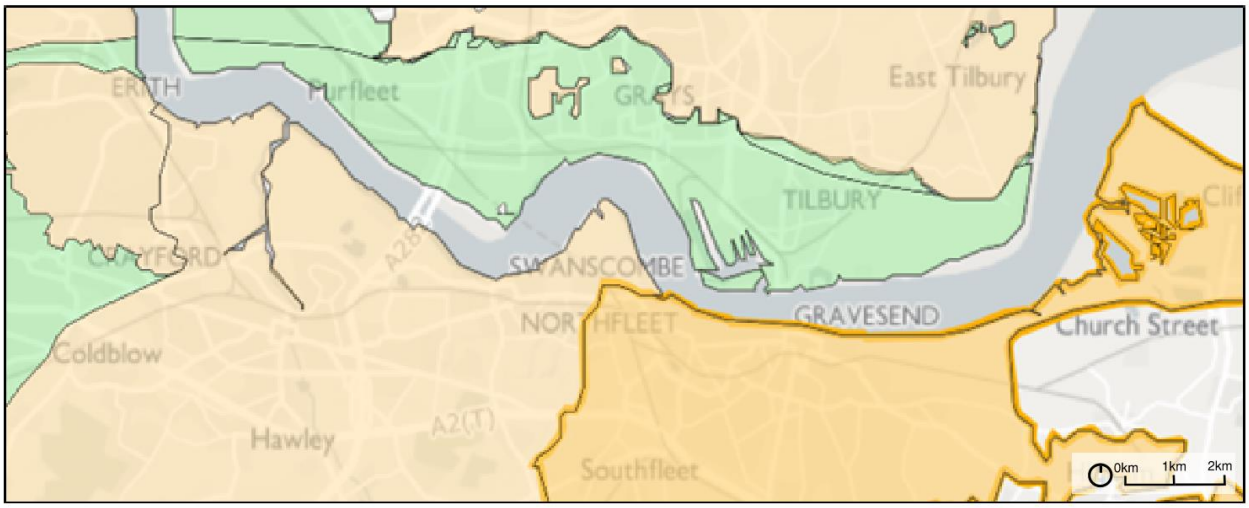


Figure 13.7.12: The North Kent Medway Chalk WFD Groundwater Water Body (Source: https://environment.data.gov.uk/catchment-planning/).



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Appendix 2.0 Scoping Template

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Scoping Template for CONSTRUCTION PHASE

Your activity	Description, notes or more information
Applicant name	London Resort Company Holdings Limited (LRCH)
Application reference number (where applicable)	To be confirmed
Name of activity	Kent Project Site: activities include the construction of two new jetties, renovation of Bell's Wharf, new wastewater treatment outfall (1 location) and surface water outfalls (5 locations) (likely requiring cofferdam construction) which will discharge into the river. Essex Project Site: activities include the extension of the jetty at Port of Tilbury and a mooring area for vessels in the immediate vicinity of the jetty extensions. Potential new surface water outfall into the river (1 location).
Brief description of activity	At the Kent Project Site Bell's Wharf and the quay side will potentially be developed to include a new Thames Clipper terminal, a Ro-Ro facility and an RNLI slipway. This could involve: • Extending the Ferry pontoon into a minimum of -2mCD water depth with a preference of 2.5m o allow for any future increases to the size of vessels using the jetty. • The ferry jetty for the Thames Clipper should be at least 80m in length. • Refurbishment of the existing Wharf, including extension to accommodate RoRo. • Additional Ferry pontoon. • RoRo facility sloping from the dock wall to water depths of -4mCD. • The construction of stormwater outfalls (5 at the Kent Project Site), wastewater treatment outfall (1 at the Kent Project Site) – with associated cofferdams. The works at Tilbury Docs are proposed to include: 1. A ferry terminal link to the Resort ferry terminal, utilising Tilbury Docks. 2. Maintenance area for the Thames Clipper vessels. 3. The construction of one stormwater outfall (potentially with a cofferdam). The size and shape of the jetty at the Essex Project Site is to be defined based on accommodating 8no. Thames Clipper vessels (LOA 40m, draft 1.5m, beam 9m). The minimum water depth at chart datum will be 2.0m with a preference of 2.5m to allow for any future increases to the size of vessels using the jetty.

	Jetties and works to the wharf will be undertaken from the river. Salt marsh is to be created via managed realignment of the flood defence wall and areas along the shoreline are intended to be enhanced through minor interventions to improve existing salt marsh habitats. Detail for the habitat creation aspects is provided in ES Appendix 12.3: *Ecological Mitigation and Management Framework* (document ref: 6.2.12.3).
Location of activity (central point XY coordinates or national grid reference)	Kent Site: TQ599758 (559902, 175893) Essex Site: TQ643751 (564384, 175108)
Footprint of activity (ha)	Kent Site: 70 ha Essex Site: 12 ha
Timings of activity (including start and finish dates)	Jan 2022 – December 2024
Extent of activity (for example size, scale frequency, expected volumes of output or discharge)	Footprint of structures in the intertidal mud is approximately 5,000 sq m. Footprint of cofferdams approximately 4,186 sq m in intertidal mud (temporary presence). Footprint of ferry terminal in saltmarsh approximately 5,812 sq m. Installing cofferdams for the outfalls is estimated to potentially result in a further temporary loss of approximately 1,190 sq m of saltmarsh. Dredge pocket (for Option C only) is 77,430 sq m (with 628 sq m in the intertidal and 76,802 sq m in the subtidal). up to 10 construction barges may travel to the Kent and Essex Project Sites a day during the construction period.
Use or release of chemicals (state which ones)	Release of chemicals that are on the Environmental Quality Standards Directive (EQSD) list and contaminants above CEFAS Action Level 1 are expected, however levels are very low. Sampling has been conducted to determine the presence of any such chemicals in the sediments. The main potential source for release of chemicals during construction from benthic sediment is via dredging (which is only associated with Option C). Piling and other activities may release small amounts of sediment (and potentially associated chemicals) to the marine environment. The Kent Project Site has former cement kiln dust (CKD) tips and other brownfield former industrial land. The peninsula part of the Project Site is both a 'historic' and 'authorised' landfill site. The main product of this landfill waste is CKD. Land disposal of CKD creates highly alkaline conditions. This can lead to absorption of metals including barium, beryllium, cadmium, chromium and lead in groundwater. Accordingly, mobilisation of contaminants will need to be avoided.

Construction

Water body[1]	Description, notes or more information
WFD water body name	*The Thames (Thames Middle)*
Water body ID	*GB530603911402*
River basin district name	*The Thames River Basin District*
Water body type (estuarine or coastal)	*Estuarine*
Water body total area (ha)	*4391.26 ha*
Overall water body status (2015)	*Moderate*
Ecological status	*Moderate*
Chemical status	*Fail*
Target water body status and deadline	*Moderate, 2015*
Hydromorphology status of water body	*Not assessed*
Heavily modified water body and for what use	*Yes, coastal protection, flood protection, navigation, ports and harbours*
Higher sensitivity habitats present	*Saltmarsh (130.06ha)*
Lower sensitivity habitats present	*Intertidal soft sediment (838.78 ha)*
Phytoplankton status	*Good*
History of harmful algae	*Not monitored*
WFD protected areas within 2km	*No*

[1] Water body information can be found in the Environment Agency's catchment data explorer and the water body summary table. Magic maps provide additional information on habitats and protected areas. Links to these information sources can be found in the WFD assessment guidance for estuarine and coastal waters.

Specific risk information

Consider the potential risks of your activity to each of these receptors: hydromorphology, biology (habitats and fish), water quality and protected areas. Also consider invasive non-native species (INNS).

Section 1: Hydromorphology

Consider if hydromorphology is at risk from your activity.

Use the water body summary table to find out the hydromorphology status of the water body, if it is classed as heavily modified and for what use.

Consider if your activity:	**Yes** **Impact assessment required**	**No** **Impact assessment not required**	**Hydromorphology risk issue(s)**
Could impact on the hydromorphology (for example morphology or tidal patterns) of a water body at high status		✓	*NO* *Does not apply as water body is at Moderate status.*
Could significantly impact the hydromorphology of any water body	✓		*YES* *Introduction of structures to the water course could affect water movement and sediment transport, with potential effects on sediment deposition/accretion. This would also be affected by dredging (only applicable to Option C). Hydrodynamic modelling is being undertaken to determine potential effects in more detail.*
Is in a water body that is heavily modified for the same use as your activity	✓		*YES* *Thames Middle is heavily modified for navigation, ports and harbours which is the purpose of the new jetties and wharf refurbishment.*

Record the findings for hydromorphology and go to section 2: biology.

Section 2: Biology

Habitats

Consider if habitats are at risk from your activity.

Use the water body summary table and Magic maps, or other sources of information if available, to find the location and size of these habitats.

Higher sensitivity habitats [2]	**Lower sensitivity habitats [3]**
chalk reef	cobbles, gravel and shingle
clam, cockle and oyster beds	intertidal soft sediments like sand and mud (838.78ha)
intertidal seagrass	rocky shore
maerl	subtidal boulder fields
mussel beds, including blue and horse mussel	subtidal rocky reef
polychaete reef	subtidal soft sediments like sand and mud
Saltmarsh (130ha)	
subtidal kelp beds	
subtidal seagrass	

[2] *Higher sensitivity habitats have a low resistance to, and recovery rate, from human pressures.*
[3] *Lower sensitivity habitats have a medium to high resistance to, and recovery rate from, human pressures.*

Consider if the footprint[4] of your activity is:	**Yes**	**No**	**Biology habitats risk issue(s)**
0.5 km^2 or larger		✓	*NO*
1% or more of the water body's area		✓	*NO*
Within 500m of any higher sensitivity habitat	✓		*YES – Both the Kent and Essex sites are within 500 m of saltmarsh. The site contains and is directly adjacent to saltmarsh.*
1% or more of any lower sensitivity habitat		✓	*NO. The amount of intertidal soft sediment lost due to the Proposed Development is approximately 0.12% of its extent in the Thames Middle water body*

[4] *Note that a footprint may also be a temperature or sediment plume. For dredging activity, a footprint is 1.5 times the dredge area.*

Fish

Consider if fish are at risk from your activity, but only if your activity is in an estuary or could affect fish in or entering an estuary.

Consider if your activity:	**Yes**	**No**	**Biology fish risk issue(s)**
Is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary	✓		*YES* *The piling works would generate underwater noise and vibration which could affect fish movement/migration. Any effects associated with vessels would be of much lower significance than for piling.*
Could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)	✓		*YES* *The piling works would generate underwater noise and vibration which could affect fish movement/migration. Any effects associated with vessels would be of much lower significance than for piling.* *Structures in the estuary margins could affect fish movement*
Could cause entrainment or impingement of fish		✓	*NO* *No water abstraction is currently proposed*

Record the findings for biology habitats and fish and go to section 3: water quality.

Section 3: Water quality

Consider if water quality is at risk from your activity.

Use the water body summary table to find information on phytoplankton status and harmful algae.

Consider if your activity:	Yes	No	Water quality risk issue(s)
Could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)	✓		*YES* *Mainly relevant if dredging is conducted (only for Option C)*
Is in a water body with a phytoplankton status of moderate, poor or bad		✓	*NO* *Phytoplankton status Good*
Is in a water body with a history of harmful algae		✓	*NO* *History of harmful algae is recorded as 'Not monitored'*

Consider if water quality is at risk from your activity through the use, release or disturbance of chemicals.

If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if:	Yes	No	Water quality risk issue(s)
The chemicals are on the Environmental Quality Standards Directive (EQSD) list	✓		*YES* *The construction works could disturb sediments that could release chemicals on the EQSD list.* *Mainly relevant if dredging is conducted (only for Option C)*
It disturbs sediment with contaminants above Cefas Action Level 1	✓		*Yes* *The construction works could disturb sediments that could release chemicals with concentrations above Cefas Action Level 1* *Mainly relevant if dredging is conducted (only for Option C)*

If your activity has a mixing zone (like a discharge pipeline or outfall) consider if:	Yes	No	Water quality risk issue(s)
The chemicals released are on the Environmental Quality Standards Directive (EQSD) list	✓		*YES* *There there may be surface water discharges during construction, once the surface water outfalls have been constructed. Further detail required to be able to assess according to Environment Agency's surface water pollution risk assessment guidance*
[5] Carry out your impact assessment using the Environment Agency's surface water pollution risk assessment guidance, part of Environmental Permitting Regulations guidance. Record the findings for water quality go on to section 4: WFD protected areas.			

Section 4: WFD protected areas

Consider if WFD protected areas are at risk from your activity. These include:

- special areas of conservation (SAC)
- special protection areas (SPA)
- shellfish waters
- bathing waters
- nutrient sensitive areas

Use Magic maps to find information on the location of protected areas in your water body (and adjacent water bodies) within 2km of your activity.

Consider if your activity is:	Yes	No	Protected areas risk issue(s)
Within 2km of any WFD protected area[6]		✓	*NO* *The site is not within 2km of any WFD Protected Areas. It is within a Marine Conservation Zone, however this is not classified as a WFD protected area. An MCZ assessment report has been produced for this project (ES Appendix 13.8).*

[6] Note that a regulator can extend the 2km boundary if your activity has an especially high environmental risk.

Record the findings for WFD protected areas and go to section 5: invasive non-native species.

Section 5: Invasive non-native species (INNS)

Consider if there is a risk your activity could introduce or spread INNS.

Risks of introducing or spreading INNS include:

- materials or equipment that have come from, had use in or travelled through other water bodies
- activities that help spread existing INNS, either within the immediate water body or other water bodies

Consider if your activity could:	Yes	No	INNS risk issue(s)
Introduce or spread INNS	✓		*Yes* *Introduction of equipment/materials from other areas. Construction vessels are likely to have travelled through other water bodies and could spread/introduce INNS.*

Record the findings for INNS and go to the summary section.

Summary

Summarise the results of scoping here.

Receptor	Potential risk to receptor?	Note the risk issue(s) for impact assessment
Hydromorphology	Yes	*Thames Middle is heavily modified for navigation, ports and harbours which is the purpose of the new jetties and wharf refurbishment.* *Introduction of structures to the water course could affect water movement and sediment transport, with potential effects on sediment deposition/accretion. This would also be affected by dredging (only applicable to Option C). Hydrodynamic modelling is being undertaken to determine potential effects in more detail.*
Biology: habitats	Yes	*The Project Site is within 500m of saltmarsh (a higher sensitivity habitat)*
Biology: fish	Yes	*There is a potential for construction works to impact upon fish within the estuary (in particular piling activity)*

Receptor	Potential risk to receptor?	Note the risk issue(s) for impact assessment
Water quality	Yes	*There could potentially be an effect on water clarity and other parameters is dredging is undertaken (only relevant for Option C). There is a risk of the release of chemicals on the EQSD list and of sediments with contaminants above the Cefas Action Level 1 (especially if dredging is undertaken under Option C). Possible surface water discharges during construction phase for the Proposed Development*
Protected areas	No	*The site is not within 2km of any WFD Protected Areas.*
Invasive non-native species	Yes	*Construction vessels are likely to have travelled through other water bodies.*

Scoping Template for <u>OPERATION PHASE</u>

Your activity	Description, notes or more information
Applicant name	London Resort Company Holdings Limited (LRCH)
Application reference number (where applicable)	To be confirmed
Name of activity	<u>Kent Project Site</u>: Discharges into the tidal Thames from surface water outfalls (5 locations) and wastewater treatment outfall. During operation it is anticipated that there would be 27 passenger vessel movements per day between upstream locations and London Resort (extension of existing route) and 42 passenger vessel movements per day between London Resort and Tilbury (new passenger ferry services), (Appendix 10.1: *Preliminary Navigation Risk Assessment*, document ref: 6.2.10.1). These vessels, however, are generally expected to remain within the tidal Thames waterbody. Maintenance dredging if required <u>Essex Project Site:</u> Discharges into the tidal Thames from one surface water outfall. As indicated above for the Kent Project Site there will be ferry operation between the Essex and Kent Project Sites.
Brief description of activity	As indicated above
Location of activity (central point XY coordinates or national grid reference)	Kent Site: TQ599758 (559902, 175893) Essex Site: TQ643751 (564384, 175108)
Footprint of activity (ha)	Kent Site: 70 ha

	Essex Site: 12 ha
Timings of activity (including start and finish dates)	December 2024 onwards
Extent of activity (for example size, scale frequency, expected volumes of output or discharge)	Ferry between the Essex Project Site and the Kent Project Site is expected to operate with 27 passenger vessel movements per day between upstream locations and London Resort (extension of existing route) and 42 passenger vessel movements per day between London Resort and Tilbury (new passenger ferry services).
Use or release of chemicals (state which ones)	Surface water outfalls and the wastewater treatment outfall could release chemicals but it is assumed that discharges will be made under Environmental Permit and will comply with relevant legislation, so effects on water quality are anticipated to be negligible. The Kent Project Site has former cement kiln dust (CKD) tips and other brownfield former industrial land. The peninsula part of the Project Site is both a 'historic' and 'authorised' landfill site. The main product of this landfill waste is CKD. Land disposal of CKD creates highly alkaline conditions. This can lead to absorption of metals including barium, beryllium, cadmium, chromium and lead in groundwater. Accordingly, mobilisation of contaminants will need to be avoided.

Operation

Water body[1]	**Description, notes or more information**
WFD water body name	*The Thames (Thames Middle)*
Water body ID	*GB530603911402*
River basin district name	*The Thames River Basin District*
Water body type (estuarine or coastal)	*Estuarine*
Water body total area (ha)	*4391.26 ha*
Overall water body status (2015)	*Moderate*
Ecological status	*Moderate*
Chemical status	*Fail*
Target water body status and deadline	*Moderate, 2015*
Hydromorphology status of water body	*Not assessed*
Heavily modified water body and for what use	*Yes, coastal protection, flood protection, navigation, ports and harbours*
Higher sensitivity habitats present	*Saltmarsh (130.06ha)*
Lower sensitivity habitats present	*Intertidal soft sediment (838.78 ha)*
Phytoplankton status	*Good*

History of harmful algae	*Not monitored*
WFD protected areas within 2km	*No*

[1] Water body information can be found in the Environment Agency's catchment data explorer and the water body summary table. Magic maps provide additional information on habitats and protected areas. Links to these information sources can be found in the WFD assessment guidance for estuarine and coastal waters.

Specific risk information

Consider the potential risks of your activity to each of these receptors: hydromorphology, biology (habitats and fish), water quality and protected areas. Also consider invasive non-native species (INNS).

Section 1: Hydromorphology

Consider if hydromorphology is at risk from your activity.

Use the water body summary table to find out the hydromorphology status of the water body, if it is classed as heavily modified and for what use.

Consider if your activity:	**Yes** **Impact assessment required**	**No** **Impact assessment not required**	**Hydromorphology risk issue(s)**
Could impact on the hydromorphology (for example morphology or tidal patterns) of a water body at high status		✓	*NO* *Does not apply as water body is at Moderate status.*
Could significantly impact the hydromorphology of any water body		✓	*NO* *Potential effects from boat wash but considered to not be significant at the waterbody scale*
Is in a water body that is heavily modified for the same use as your activity	✓		*YES* *Thames Middle is heavily modified for navigation, ports and harbours which is the purpose of the new jetties and wharf refurbishment. Presence of structures in the water course could affect water movement and sediment transport, with potential effects on sediment deposition/accretion.*

Record the findings for hydromorphology and go to section 2: biology.

Section 2: Biology

Habitats

Consider if habitats are at risk from your activity.

Use the water body summary table and Magic maps, or other sources of information if available, to find the location and size of these habitats.

Higher sensitivity habitats [2]	**Lower sensitivity habitats** [3]
chalk reef	cobbles, gravel and shingle
clam, cockle and oyster beds	intertidal soft sediments like sand and mud (838.78ha)
intertidal seagrass	rocky shore
maerl	subtidal boulder fields
mussel beds, including blue and horse mussel	subtidal rocky reef
polychaete reef	subtidal soft sediments like sand and mud
Saltmarsh (130ha)	
subtidal kelp beds	
subtidal seagrass	

[2] *Higher sensitivity habitats have a low resistance to, and recovery rate, from human pressures.*
[3] *Lower sensitivity habitats have a medium to high resistance to, and recovery rate from, human pressures.*

Consider if the footprint[4] of your activity is:	**Yes**	**No**	**Biology habitats risk issue(s)**
0.5 km^2 or larger		✓	*NO*
1% or more of the water body's area		✓	*NO*
Within 500m of any higher sensitivity habitat	✓		*YES – Both the Kent and Essex sites are within 500 m of saltmarsh. The site contains and is directly adjacent to saltmarsh. Boat wash from vessels could potentially reach areas of saltmarsh.*
1% or more of any lower sensitivity habitat		✓	*NO*

[4] *Note that a footprint may also be a temperature or sediment plume. For dredging activity, a footprint is 1.5 times the dredge area.*

Fish

Consider if fish are at risk from your activity, but only if your activity is in an estuary or could affect fish in or entering an estuary.

Consider if your activity:	**Yes**	**No**	**Biology fish risk issue(s)**
Is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary		✓	*YES* *Fish are expected to be well attenuated to vessel noise and vibration in the Thames Estuary.*
Could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)		✓	*YES* *Fish are expected to be well attenuated to vessel noise and vibration in the Thames Estuary.* *Structures in the estuary margins could affect fish movement*
Could cause entrainment or impingement of fish		✓	*NO* *No water abstraction is currently proposed*

Record the findings for biology habitats and fish and go to section 3: water quality.

Section 3: Water quality

Consider if water quality is at risk from your activity.

Use the water body summary table to find information on phytoplankton status and harmful algae.

Consider if your activity:	Yes	No	Water quality risk issue(s)
Could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)		✓	*YES* *Surface water outfalls and the wastewater treatment outfall could release chemicals but it is assumed that discharges will be made under Environmental Permit and will comply with relevant legislation, so effects on water quality are anticipated to be negligible*
Is in a water body with a phytoplankton status of moderate, poor or bad		✓	*NO* *Phytoplankton status Good*
Is in a water body with a history of harmful algae		✓	*NO* *History of harmful algae is recorded as 'Not monitored'*

Consider if water quality is at risk from your activity through the use, release or disturbance of chemicals.

If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if:	Yes	No	Water quality risk issue(s)
The chemicals are on the Environmental Quality Standards Directive (EQSD) list	✓		*YES* *If maintenance dredging is required (only under Option C), there could be some release of chemicals from*

			sediment into the water column.
It disturbs sediment with contaminants above Cefas Action Level 1	✓		*Yes* *If maintenance dredging is required (only under Option C), there could be some release of chemicals from sediment into the water column.*

If your activity has a mixing zone (like a discharge pipeline or outfall) consider if:	**Yes**	**No**	**Water quality risk issue(s)**
The chemicals released are on the Environmental Quality Standards Directive (EQSD) list	✓		*YES* *There will be surface water discharges. Further detail required to be able to assess according to Environment Agency's surface water pollution risk assessment guidance*
[5] Carry out your impact assessment using the Environment Agency's surface water pollution risk assessment guidance, part of Environmental Permitting Regulations guidance. Record the findings for water quality go on to section 4: WFD protected areas.			

Section 4: WFD protected areas

Consider if WFD protected areas are at risk from your activity. These include:

- special areas of conservation (SAC)
- special protection areas (SPA)
- shellfish waters
- bathing waters
- nutrient sensitive areas

Use Magic maps to find information on the location of protected areas in your water body (and adjacent water bodies) within 2km of your activity.

Consider if your activity is:	Yes	No	Protected areas risk issue(s)
Within 2km of any WFD protected area[6]		✓	*NO* *The site is not within 2km of any WFD Protected Areas. It is within a Marine Conservation Zone, however this is not classified as a WFD protected area. An MCZ assessment report has been produced for this project (ES Appendix 13.8).*

[6] *Note that a regulator can extend the 2km boundary if your activity has an especially high environmental risk.*

Record the findings for WFD protected areas and go to section 5: invasive non-native species.

Section 5: Invasive non-native species (INNS)

Consider if there is a risk your activity could introduce or spread INNS.

Risks of introducing or spreading INNS include:

- materials or equipment that have come from, had use in or travelled through other water bodies
- activities that help spread existing INNS, either within the immediate water body or other water bodies

Consider if your activity could:	Yes	No	INNS risk issue(s)
Introduce or spread INNS	✓		*YES* Ferry between the Essex Project Site and the Kent Project Site is expected to operate with 27 passenger vessel movements per day between upstream locations and London Resort (extension of existing route) and 42 passenger vessel movements per day between London Resort and Tilbury (new passenger ferry services),

Record the findings for INNS and go to the summary section.

Summary

Summarise the results of scoping here.

Receptor	Potential risk to receptor?	Note the risk issue(s) for impact assessment
Hydromorphology	Yes	*Thames Middle is heavily modified for navigation, ports and harbours which is the purpose of the new jetties and wharf refurbishment.* *Presence of structures in the water course could affect water movement and sediment transport, with potential effects on sediment deposition/accretion. Hydrodynamic modelling has been undertaken to determine potential effects.*

Receptor	Potential risk to receptor?	Note the risk issue(s) for impact assessment
Biology: habitats	Yes	*The Project Site is within 500m of saltmarsh (a higher sensitivity habitat)*
Biology: fish	No	*Fish are expected to be well attenuated to vessel noise and vibration in the Thames Estuary.*
Water quality	Yes	*There could potentially be an effect on water clarity and other parameters is maintenance dredging is undertaken (only relevant for Option C). There is a risk of the release of chemicals on the EQSD list and of sediments with contaminants above the Cefas Action Level 1 if maintenance dredging is undertaken (under Option C only).*
Protected areas	No	*The site is not within 2km of any WFD Protected Areas.*
Invasive non-native species	Yes	*Ferry between the Essex Project Site and the Kent Project Site is expected to operate with 84 movements per day and a new passenger services between central London and the London Resort will comprise 54 movements per day.*