Environmental Impact Assessment Report

Volume 3

Chapter 20 Hydrology and Hydrogeology

codling
wind park

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Abbreviations

Abbreviation	Term in Full
BS	British Standard
BTEX (compounds)	Benzene, Toluene, Ethylbenzene and Xylene
CEA	Cumulative Effects Assessment
CEMP	Construction Environmental Management Plan
CFRAM	Catchment Flood Risk Assessment and Management
CWP	Codling Wind Park
CWPL	Codling Wind Park Limited
DoEHLG	Department of the Environment, Heritage and Local Government
EC	European Commission
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
ESB	Electricity Supply Board
ESBN	ESB Networks
FOS	Fred. Olsen Seawind
GDSDS	The Greater Dublin Strategic Drainage Study
GIS	Geographic Information System
GSI	Geological Survey Ireland
HDD	Horizontal Directional Drilling
HEFS	High-end Future Scenario
HWM	High water mark
IAM	Impact Assessment Matrix
ICPSS	Irish Coastal Protection Strategy Study
ICWWS	Irish Coastal Wave and Water Level Modelling Study
IGI	The Institute of Geologists Ireland
IACs	Inter-array cables
kV	Kilovolt
LO–LO	Lift on–Lift off
MOD	Meters Above Ordinance Datum
MRFS	Mid-range Future Scenario
MW	Megawatts

NPWS	National Parks and Wildlife Services
NHA	Natural Heritage Area
NRA	National Roads Authority
OD	Ordinance Datum
ODM	Ordnance Datum (Malin)
OPW	Office of Public Works
OSSs	Offshore Substation Structures
OSI	Ordinance Survey Ireland
OfTI	Offshore Transmission Infrastructure
OTI	Onshore Transmission Infrastructure
PAHs	Polycyclic Aromatic Hydrocarbons
pNHA	Proposed Natural Heritage Area
PoMs	Programme of Measures
RBMPs	River Basin Management Plans
RO–RO	Roll On–Roll Off
SAC	Special Area of Conservation
SDZ	Strategic Development Zone
SI	Site Investigation
SPA	Special Protection Area
SFRA	Strategic Flood Risk Assessment
SSFRA	Site Specific Flood Risk Assessment
SUDS	Sustainable Urban Drainage System
TJB	Transition Joint Bay
VOCs	Volatile Organic Compounds
WFD	Water Framework Directive
WWTP	Wastewater Treatment Plant
WTG	Wind Turbine Generator
ZoI	Zone of Influence

Definitions

Glossary	Meaning
the Applicant	The developer, Codling Wind Park Limited (CWPL).
array site	The area within which the wind turbine generators (WTGs), inter-array cables (IACs) and the offshore substation structures (OSSs) are proposed.
aquifer	A permeable geological stratum or formation that can both store and transmit water in significant quantities.
Codling Wind Park (CWP) Project	The proposed development as a whole is referred to as the Codling Wind Park (CWP) Project, comprising of the offshore infrastructure, the onshore infrastructure and any associated temporary works.
Codling Wind Park Limited (CWPL)	A joint venture between Fred. Olsen Seawind (FOS) and Électricité de France (EDF) Renewables, established to develop the CWP Project.
combi-wall	A piling wall that is comprised of high modulus structural components interspaced by lighter sheet piles. The high modulus components – known as king piles – can be tubular, box, bearing or other types of fabricated piles.
Compound A	A temporary construction compound support area and storage facility for the landfall works and to support the installation of the onshore export cables. It will operate as a hub for the onshore construction works as well as acting as a staging post and secure storage for equipment and component deliveries.
Compound B	A temporary construction compound / laydown area for general onshore export cables and onshore substation construction activities.
Compound C	A temporary construction compound for the onshore substation site. Contractor welfare facilities will be located in this compound as well as some material storage space.
Compound D	A temporary construction compound and laydown area to facilitate the construction of the bridge over the cooling water channel.
Construction phase	Phase during which the construction of the offshore / onshore transmission infrastructure for the Codling Wind Park (CWP) Project will take place.
decommissioning phase	Phase during which the decommissioning activity for the offshore / onshore transmission infrastructure for the Codling Wind Park (CWP) Project will take place.
down-gradient	The direction in which groundwater or surface water flows. Opposite of up-gradient.
EirGrid	State-owned electric power transmission system operator in Ireland and nominated Offshore Transmission Asset Owner.

Glossary	Meaning
Environmental Impact Assessment	A systematic means of assessing the likely significant effects of a proposed project, undertaken in accordance with the EIA Directive and the relevant Irish legislation.
Environmental Impact Assessment Report	The report prepared by the Applicant to describe the findings of the EIA for the CWP Project.
Environmental Protection Agency	National agency responsible for protecting and improving the environment of Ireland under the Environmental Protection Agency Acts 1992 as amended.
ESB Networks (ESBN)	Owner of the electricity distribution system in the Republic of Ireland, responsible for carrying out maintenance, repairs and construction on the grid.
ESBN network cables	Three onshore export cable circuits connecting the onshore substation to the proposed ESBN Poolbeg substation, which will then transfer the electricity onwards to the national grid.
export cables	The cables, both onshore and offshore, that connect the offshore substations with the onshore substation.
fissure	Natural crack in rock which allows water movement.
generating station	Comprising the wind turbine generators (WTGs), inter-array cables (IACs) and interconnector cables.
groundwater	That part of the subsurface water that is in the saturated zone, i.e., below the water table.
groundwater protection response	Control measures, conditions or precautions recommended as a response to the acceptability of an activity within a groundwater protection zone.
groundwater Protection Scheme	A scheme comprising two main components: a land surface zoning map which encompass the hydrogeological elements of risk and a groundwater protection response for different activities. A Groundwater Protection Scheme is a set of guidelines developed through collaboration between the GSI and local authorities to protect groundwater. It involves creation of a groundwater protection zoning map and protection responses to manage risk associated with existing and new potentially polluting activities. A Groundwater Protection Scheme is not part of a policy baseline but serves as a set of guidelines and mitigation measures to be implemented by developers to ensure protection and beneficial use of groundwater.
groundwater protection zones	Zones delineated by integrating aquifer categories or source protection areas and associated vulnerability ratings. The zones are shown on a map, each zone being identified by a code e.g., SO/H (outer source area with a high vulnerability) or Rk/E (regionally important aquifer with an extreme vulnerability). Groundwater protection responses are assigned to these zones for different potentially polluting activities.
horizontal directional drilling (HDD)	HDD is a trenchless drilling method used to install cable ducts beneath the ground, through which onshore export cables can

Glossary	Meaning
	be pulled. HDD enables the installation of cables beneath obstacles such as roads, waterways and existing utilities.
high water mark (HWM)	The high water mark is a line of high water of ordinary or medium tides of the sea or tidal river or estuary.
inter-array cables (IACs)	The subsea electricity cables between OSSs.
karst feature	Landscape feature which results from karstification (solution of limestone) such as a turlough, swallow hole, cave, etc. Type of topography characterised by closed depressions or sink holes and an absence of surface drainage, resulting from underground solution of rocks and diversion of surface waters to underground routes.
landfall	The point at which the offshore export cables are brought onshore and connected to the onshore export cables via the transition joint bays (TJB). For the CWP Project, the landfall works include the installation of the offshore export cables within Dublin Bay out to approximately 4 km offshore, where water depths are too shallow for conventional cable lay vessels to operate.
landfill	A site used for the deposit of waste onto or under land.
limestone	A sedimentary rock consisting chiefly of calcium carbonate ($CaCO3$), primarily in the form of the mineral calcite. It is mostly formed by the accumulation of calcareous shells, cemented by calcium carbonate precipitated from solution.
limit of Deviation (LoD)	Locational flexibility of permanent and temporary infrastructure is described as a LoD from a specific point or alignment.
Maritime Area Planning (MAP) Act 2021	An Act to regulate the maritime area, to achieve such regulation by means of a National Marine Planning Framework, maritime area consents for the occupation of the maritime area for the purposes of maritime usages that will be undertaken for undefined or relatively long periods of time (including any such usages which also require development permission under the Planning and Development Act 2000) and licences for the occupation of the maritime area for maritime usages that are minor or that will be undertaken for relatively short periods of time.
National Parks and Wildlife Service (NPWS)	The NPWS is a division of the Department of Housing, Local Government and Heritage which manages the Irish State's nature conservation responsibilities. As well as managing the national parks, the activities of the NPWS include the protection of Natural Heritage Areas, Special Areas of Conservation and Special Protection Areas.
offshore export cables	The cables which transport electricity generated by the wind turbine generators (WTGs) from the offshore substation structures (OSSs) to the TJBs at the landfall.
onshore export cables	The cables which transport electricity generated by the WTGs from the TJBs at the landfall to the onshore substation.

Glossary	Meaning
onshore development area	The entire footprint of the OTI and associated temporary works that will form the onshore boundary for the planning application.
onshore substation	Site containing electrical equipment to enable connection to the national grid.
onshore substation site	The area within which permanent and temporary works will be undertaken to construct the onshore substation.
onshore substation site boundary	The physical boundary of the onshore substation site.
onshore transmission infrastructure (OTI)	The onshore transmission assets comprising the TJBs, onshore export cables and the onshore substation. The EIAR considers both permanent and temporary works associated with the OTI.
operations and maintenance (O&M) activities	Activities (e.g., monitoring, inspections, reactive repairs, planned maintenance) undertaken during the O&M phase of the CWP Project.
operation and maintenance (O&M) phase	This is the period of time during which the CWP project will be operated and maintained.
parameters	Set of parameters by which the CWP Project is defined, and which are used to form the basis of assessments.
planning application boundary	The area subject to the application for development consent, including all permanent and temporary works for the CWP Project.
Poolbeg 220 kV substation	This is the ESBN substation that the ESBN network cables connect into, from the onshore substation. This substation will then transfer the electricity onwards to the national grid.
revetment	A facing of impact-resistant material applied to a bank or wall in order to absorb the energy of incoming water and protect it from erosion.
saturated zone	The uppermost level of saturation in an aquifer at which the pressure is atmospheric.
sheet piles	Sections of sheet materials with interlocking edges that are driven into the ground to provide earth retention and excavation support. Sheet piling is used in construction to provide both temporary and permanent walls.
Source Protection Area (SPA)	The SPA is the catchment area around a groundwater source which contributes water to that source, divided into two areas; the Inner Protection Area (SI) and the Outer Protection Area (SO).
subsoil	The material between the topsoil and the bedrock.
temporary cofferdam	A barrier to tidal inundation while the existing stone covered foreshore is temporarily removed to install the landfall cable ducts.
temporary HDD compound 1	The area within Compound C that will house the ESBN network cable HDD entry or exit pits as well as associated plant, equipment and facilities.

Glossary	Meaning
temporary HDD compound 2	The area adjacent to the Poolbeg 220 kV substation that will house the ESBN network cable HDD entry or exit pits as well as associated plant, equipment and facilities.
temporary tunnel compound 1	The area within Compound A, near the landfall, within which the Compound A tunnel launch shaft will be located.
temporary tunnel compound 2	The area within which the Shellybanks Road tunnel reception shaft will be located.
temporary tunnel compound 3	The area within the onshore substation site, within which the onshore substation tunnel launch shaft will be located.
till	Unsorted glacial deposits consisting of boulders and cobbles mixed with very finely ground-up rock such as sand, silt or clay.
transition joint bay (TJB)	This is required as part of the OTI and is located at the landfall. It is an underground bay housing a joint which connects the offshore and onshore export cables.
tunnel	The onshore export cables will be installed within a tunnel that extends from within Compound A, near the landfall, to the onshore substation site.
tunnel shaft	Located within the temporary tunnel compounds, the tunnel shafts will facilitate the two tunnel drives required to complete the construction of the tunnel.
unsaturated zone	The zone between the land surface and the water table, in which pores and fissures are only partially filled with water. Also known as the vadose zone.
vulnerability	A term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities.
water table	The uppermost level of saturation in an aquifer at which the pressure is atmospheric.
zone of influence (ZoI)	The ZoI is the catchment area around a groundwater source which contributes water to that source. Spatial extent of potential impacts resulting from the project.
zone of contribution (ZOC)	The catchment area around a groundwater source which contributes water to that source.

20 Hydrology and Hydrogeology

20.1 Introduction

1. Codling Wind Park Limited (hereafter 'the Applicant') is proposing to develop the Codling Wind Park (CWP) Project, a proposed offshore wind farm (OWF) located in the Irish Sea approximately 13–22 km off the east coast of Ireland, at County Wicklow.

2. This chapter forms part of the Environmental Impact Assessment Report (EIAR) for the CWP Project. The purpose of the EIAR is to provide the decision-maker, stakeholders and all interested parties with the environmental information required to develop an informed view of any likely significant effects resulting from the CWP Project, as required by the European Union (EU) Directive 2011/92/EU (as amended by Directive 2014/52/EU) (the EIA Directive).

3. This EIAR chapter describes the potential impacts of the CWP Project's onshore transmission infrastructure (OTI) on hydrology and hydrogeology during the construction, operation and maintenance (O&M) and decommissioning phases. The OTI is situated on the Poolbeg Peninsula and includes the transition joint bays (TJBs), onshore export cables, the onshore substation, and the Electricity Supply Board Networks (ESBN) network cables to connect the onshore substation to the Poolbeg 220 kV substation. This chapter will also describe the potential impacts of the works at the landfall (landward of the high water mark (HWM)), where the offshore export cables are brought onshore and connected to the onshore export cables at the TJBs (hereafter these works are referred to as the 'OTI').

4. This chapter is primarily focused on the hydrogeological environment, given the absence of surface water features within the onshore development area. Where effects arise offshore as a result of an onshore activity, these are assessed as part of **Chapter 7 Marine Water Quality**.

5. Hydrology is the study of the water environment (the hydrological cycle) and surface water bodies (such as rivers, lakes and reservoirs). Hydrogeology deals with groundwater and the underground (or geological) part of the hydrological cycle. The consideration of hydrology and hydrogeology presents a complete assessment of water resources for the onshore components. A **Site Specific Flood Risk Assessment (SSFRA)** and a **Water Framework Directive (WFD) Compliance Assessment** have been prepared for the onshore components. The **SSFRA** is presented in **Appendix 20.2** and the **WFD Compliance Assessment** is presented in **Appendix 7.3 WFD Assessment**.

6. In summary, this EIAR chapter:

- Details the EIA scoping and consultation process undertaken and sets out the scope of the impact assessment for hydrology and hydrogeology;
- Identifies the key legislation and guidance relevant to hydrology and hydrogeology with reference to the latest updates in guidance and approaches;
- Confirms the study area for the assessment and presents the impact assessment methodology for hydrology and hydrogeology;
- Describes and characterises the baseline environment for hydrology and hydrogeology, established from desk studies, project survey data and consultation;
- Defines the project design parameters for the impact assessment and describes any embedded mitigation measures relevant to the hydrology and hydrogeology;
- Presents the assessment of potential impacts on hydrology and hydrogeology and identifies any assumptions and limitations encountered in compiling the impact assessment; and
- Details any additional mitigation and / or monitoring necessary to prevent, minimise, reduce or offset potentially significant effects identified in the impact assessment.

7. The assessment should be read in conjunction with **Appendix 20.1**, **Cumulative Effects Assessment**, which considers other plans, projects and activities that may act cumulatively with the CWP Project and provides an assessment of the potential cumulative impacts on hydrology and hydrogeology.

8. A summary of the cumulative effects assessment (CEA) is presented in **Section 20.11**.

9. Additional information to support the assessment includes:

- **Appendix 20.2 Site Specific Flood Risk Assessment (SSFRA)**; and
- **Appendix 20.3 Groundwater quality and levels data**.

20.2 Consultation

10. Consultation with statutory and non-statutory organisations is a key part of the EIA process. Consultation with regard to hydrology and hydrogeology has been undertaken to inform the approach to and scope of the assessment.

11. The key elements to date have included EIA scoping, consultation events and meetings with key stakeholders. The feedback received throughout this process has been considered in preparing the EIAR. Feedback received in relation to hydrology and hydrogeology mainly focused on transitional water which is addressed in **Chapter 7 Marine Water Quality** and flood risk which is addressed in **Appendix 20.2**. EIA consultation is described further in **Chapter 5 EIA Methodology**, the **Planning Documents** and in the **Public and Stakeholder Consultation Report**, which has been submitted as part of the planning application.

12. **Table 20-1** provides a summary of the key issues raised during the consultation process relevant to hydrology and hydrogeology and details how these issues have been considered in the production of this EIAR chapter.

Table 20-1 Consultation responses relevant to hydrology and hydrogeology

Consultee	Comment	How issues have been addressed
Scoping responses		
Inland Fisheries Ireland 21 January 2022	Cumulative impacts should take cognisance of the Dublin Port Maintenance Dredging Programme & Strategic Infrastructure Projects planned; Trenchless technique preferred for the cable installation; Instream works in inland fisheries waters should only take place during the period July to September; Detailed method statements will reduce the risk to the local environment; Queried whether it is anticipated to do some post works monitoring to show no impact of the works on the environment.	Offshore effects (Transitional Waters) are considered in Chapter 7 Marine Water Quality. The offshore cumulative effects assessment provided in **Appendix 7.1** has considered the Dublin Port Maintenance Dredging Programme & Strategic Infrastructure Projects. No instream works will be required in inland fisheries waters within the onshore development area.
Geological Survey of Ireland (GSI)	Provided a response letter and sources for relevant data sets.	Information sources identified are utilised throughout the assessment.

Consultee	Comment	How issues have been addressed
June 2021 & May 2023	Use of GSI data or maps should be attributed correctly to 'Geological Survey Ireland'	The GSI datasets and maps are attributed in **Section 20.6**.
Topic specific meetings		
Dublin City Council (DCC): Flood Risk Assessment 10 November 2022	Approach to flood risk mitigation was reviewed. Consideration needed in respect of: 1. Access to / from the substation during an emergency event. 2. Wave action; 3. Confirm no knock-on effects to surrounding area from flood mitigation; 4. Site surface water drainage proposals.	An SSFRA has been undertaken for the onshore components and addresses the access, wave action etc. The SSFRA addresses access to the substation, wave action and considers the potential for knock-on effects to surrounding areas. The Report is provided in **Appendix 20.2**. Site surface water drainage proposals are detailed in the **Onshore Substation Site Drainage and Water Supply Design Report** which has been submitted with the planning application documents.
Other		
National Parks and Wildlife Service 21 January 2022	No comment in relation to hydrology and hydrogeology	Not applicable

20.3 Legislation and guidance

20.3.1 Legislation

13. The key legislation that is applicable to the assessment of hydrology and hydrogeology is summarised below. Further detail is provided in **Chapter 2 Policy and Legislative Context**.

Directives

- European Union (EU) Directive (2000/60/EC) Water Framework Directive;
- European Union (EU) Directive 2011/92/EU (as amended by Directive 2014/52/EU) on the assessment of the effects of certain public and private projects on the environment (the EIA Directive);
- Groundwater Directives (80/60/EEC) and (2006/60/EEC);
- The Drinking Water Directive (98/83/EC);
- European Union (92/43/EEC) Habitats Directive; and
- European Union (EU) Directive 2008/98/EC Waste Framework Directives.

National Legislation

- Local Government (Water Pollution) Acts 1977 to 2007;
- S.I. No. 293 of 1988: European Communities (Quality of Salmonid Waters) Regulations;
- S.I. No. 722 of 2003: European Communities (Water Policy) Regulations (as amended);
- S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended);
- S.I. No. 122 of 2014: European Union (Drinking Water) Regulations 2014 (as amended);
- S.I. No. 9 of 2010: European Communities Environmental Objectives (Groundwater) Regulations 2010 (as amended);
- S.I. No. 477 of 2011: European Communities (Birds and Natural Habitats) Regulations 2011 (as amended);
- The Planning and Development Act, 2000 (as amended); and
- The Planning and Development Regulations, 2001 (as amended).

20.3.2 Policy

14. The overarching planning policy relevant to the CWP Project is described in EIAR **Chapter 2 Policy and Legislative Context**.

15. The assessment of the CWP Project against relevant planning policy is provided in the **Planning Report**. This includes planning policy relevant to hydrology and hydrogeology.

20.3.3 Guidance

16. The principal guidance and best practice documents used to inform the assessment of potential impacts on hydrology and hydrogeology are summarised below:

- Office of Public Works (OPW) (2019). The Flood Risk Management Climate Change Sectoral Adaptation Plan;
- The Institute of Geologists Ireland (IGI) (2013). Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- Office of Public Works (OPW) and Department of the Environment, Heritage and Local Government (DoEHLG) (2009). The Planning System and Flood Risk Management Guidelines;
- National Roads Authority (NRA) (2008a). Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- National Roads Authority (NRA) (2008b). Environmental Impact Assessment of National Road Schemes – A Practical Guide;
- CIRIA (2006). Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors. CIRIA C532. London; and
- CIRIA C750 'Groundwater control – design and practice' 2nd Ed *(CIRIA, 2016*). CIRIA C750. London.

17. In addition to specific hydrology and hydrogeology guidance documents, the following guidelines were considered and consulted in the preparation of this chapter:

- Environmental Protection Agency (EPA) (2022). Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (hereafter referred to as the EPA Guidelines);
- Department of Environment, Community and Local Government (2018). Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (August 2018);

- Department of Communications, Climate Action and Environment & Sustainable Energy Authority of Ireland (2017). Guidance on EIS and NIS Preparation for Offshore Renewable Projects;
- European Commission (2017). Environmental Impact Assessment of Projects – Guidance on the preparation of the Environmental Impact Assessment Report; and
- EPA (2003). Advice Notes on Current Practice in the Preparation of Environmental Impact Statements.

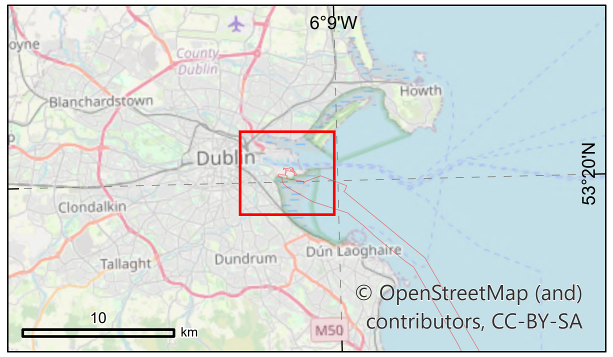
20.4 Impact assessment methodology

18. **Chapter 5 EIA Methodology** of this EIAR provides a summary of the general impact assessment methodology applied to the CWP Project, which includes the approach to the assessment of transboundary and inter-related effects. The approach to the assessment of cumulative impacts is provided in **Chapter 5**, **Appendix 5.1 Cumulative Effects Assessment Methodology**.

19. The following sections set out the methodology used to assess the potential impact on hydrology and hydrogeology.

20.4.1 Study area

20. The study area for hydrology and hydrogeology is outlined in **Figure 20-1** and has been defined on the basis of a 2 km radius from the onshore development area, as suggested in the IGI Guidelines (2013).



Legend

- Planning application boundary
- Onshore substation boundary (operational)
- 2 km buffer from the onshore development area
- High water mark

codling wind park	Project: Codling Wind Park	Contractor: TOBIN Website: www.tobin.ie

Figure 20.1
Hydrology and hydrogeology study area for the onshore development area

CWP doc. number: CWP-TOB-ENG-08-01-MAP-0984		
Internal descriptive code: DU.BAY - ALL.RLB..STUDY.AREA.FOR.LSG - EIAR.FIG.19.01	Size: A3 Scale: 1:20,000	CRS: EPSG 2157

Rev.	Updates	Date	By	Chk'd	App'd
00	Final for issue	2024/08/15	SP	DM/EA	ES

20.4.2 Data and information sources

Site specific surveys

21. Site walkover surveys of the onshore development area were undertaken by the hydrology and hydrogeology team on 28 June 2022, 5 May 2023 and 1 August 2023. This included a visit to the onshore substation site, Construction Compounds C and D, a walk along Pigeon House Road toward the Dublin Waste to Energy (DWtE) Facility, a visit to the landfall area and Construction Compounds A and B. A walkover of the adjacent Irishtown Nature Park and beach area was also undertaken.

22. Onshore geotechnical site investigations (SI) were also undertaken within the onshore development area in 2022, 2023 and 2024. Further details on these are outlined in **Section 20.6.2**.

Desk study

23. A comprehensive desk-based review was undertaken to inform the baseline for hydrology and hydrogeology. Baseline data sources used to inform the assessment are set out below in **Table 20-2**.

Table 20-2 Key Baseline Datasets

Source	Data sets
Geological Survey Ireland (GSI)[1]	Groundwater and surface water data: • Karst features; • Groundwater wells and springs; • Group scheme and public supply source protection areas; • Group water scheme abstraction points; • Surface water features; • Groundwater recharge; • Groundwater vulnerability; • Subsoil permeability; • Aquifers including gravel aquifer, bedrock aquifers and bedrock aquifer faults; and • Hydrostratigraphic rock unit groups.
Office of Public Works (OPW)[2]	Spatial data used to determine regional and site specific flood extents: • CFRAM Coastal Flood Extents; • CFRAM River Flood Extents; • ICPSS Coastal Flood Extents; and • ICWWS Extreme Water Level Estimation Points.
Environmental Protection Agency (EPA)[3]	Online map viewer consulted to obtain information on the regional baseline environment: • Surface water features;

[1] Date accessed: 11/10/2022, 30/10/2023
[2] Date accessed: 11/10/2022,30/10/2023.
[3] Date accessed on 11/10/2022, 30/10/2023

Source	Data sets
	• Monitoring and flow, including surface and groundwater monitoring data; • Water framework directive catchment areas; • Water framework directive waterbody quality status and risk status; and • Water pressures.
National Parks and Wildlife Service (NPWS)[4]	Online map viewer consulted to obtain information on environmentally protected sites: • Natura 2000 site information
Ordnance Survey of Ireland (OSI)[5]	Online map viewer consulted to obtain information on historical features and land use: • 6” historical map dated 1829 to 1841; • 25” historical map dated 1897 to 1913; and • 6” historical map dated 1830s to 1930s (Cassini map).
Causeway Geotech	Information on site specific groundwater conditions: • Review of Causeway Geotech 2018 SI data (2018). • Site Investigation (SI) was undertaken by Causeway Geotech, (2018) for a separate development on behalf of L&M Keating at the location of the onshore substation (Berth 47a) in December 2018. • It included five boreholes all drilled to a depth of 20 m (BH01 to BH05), each with a groundwater monitoring installation and eight trial pits excavated to a maximum depth of 3.6 m across the site. • This SI also included soil and groundwater sampling. • Results are included in **Appendix 19.4** of **Chapter 19 Land Soils and Geology**.
Fehily Timoney (2019)	Tier 1 Risk Assessment Poolbeg Historical Landfill: Assessment and collation of data in relation to historical infilling on the peninsula – Tier 1 risk assessment.

Onshore geotechnical site investigations

24. Onshore SI for the CWP Project were undertaken in 2022, 2023 and 2024. The SI provided information on groundwater quality for the onshore substation, the landfall area, the onshore export cables, Compound A and Compound C.

25. The SI reports associated with these works are presented in **Chapter 19 Land, Soils and Geology**, **Appendix 19.2** to **19.3**.

[4] Date accessed: 11/10/2022, 30/10/2023

[5] Date accessed 18/10/2023

26. The SI works were conducted in accordance with:

- British Standards Institute (2015) BS 5930:2015+A1:2020, Code of practice for ground investigations;
- BS EN 1997-2: 2007: Eurocode 7 – Geotechnical design – Part 2 Ground investigation and testing;
- Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland; and
- Laboratory testing was conducted in accordance with British Standards Institute BS 1377:1990 parts 2, 4, 5, 7 and 9.

27. The locations of SI undertaken by Causeway Geotech for the CWP Project in 2022, 2023 and 2024 are shown in **Figure 20-8**, **Figure 20-9** and **Figure 20-10**.

28. The SI included boreholes, groundwater monitoring installation, slit trenches and trial pits. This SI also included soil and groundwater sampling, detailed below. Results are included in **Appendix 19.2** to **19.3** in **Chapter 19 Land, Soils and Geology**.

Landfall and onshore export cable SI

29. The 2022 landfall and onshore export cable SI comprised:

- 2 boreholes by sonic drilling methods;
- 2 standpipe installation in two boreholes; and
- Soil testing.

30. The 2023 / 2024 landfall and onshore export cable SI comprised:

- 12 boreholes – rotary drilling method;
- 5 groundwater and gas standpipe installations;
- 18 machine-dug trial pits / silt trenches; and
- Soil and groundwater testing.

Substation and ESBN network cable SI

31. The 2018 SI was undertaken at the onshore substation site prior to the CWP Project and compromised:

- 5 boreholes by rotary drilling methods;
- 5 standpipe installation in 5 boreholes;
- 8 machine-dug trial pits; and
- Soil testing.

32. The 2022 SI undertaken at the onshore substation site and ESBN network cable comprised:

- 6 boreholes – light cable percussion method and sonic drilling method;
- 6 groundwater standpipe installations in 6 boreholes;
- 3 gas standpipe installations in 3 boreholes;
- 11 machine-dug trial pits;
- Seasonal groundwater level monitoring;
- 3 rounds of groundwater quality monitoring; and
- Soil testing.

33. The 2023 / 2024 SI undertaken at the onshore substation site and ESBN network cable comprised:

- 4 boreholes – light cable percussion method and sonic drilling method;
- 10 machine-dug trial pits / slit trenches;
- Seasonal groundwater level monitoring;

- 3 rounds of groundwater quality monitoring; and
- Soil testing.

20.4.3 Impact assessment

34. The significance of potential effects has been evaluated using a systematic approach, based upon identification of the importance / value of receptors and their sensitivity to the project activity, together with the predicted magnitude of the impact.

35. The terms used to define receptor sensitivity and magnitude of effect are adopted from the EPA Guidelines, the IGI (2013) and NRA (2008a) guidelines in order to implement a specific methodology for the assessment.

Sensitivity of receptor

36. For each effect, the assessment identifies receptors sensitive to that effect, and implements a systematic approach to understanding the impact pathways and the level of effects on given receptors.

37. The definitions of receptor sensitivity for the purpose of the hydrology and hydrogeology assessment are provided in **Table 20-3**. Sensitivity is adapted from the NRA (2008a) guidelines.

Table 20-3 Criteria for determination of receptor sensitivity

Sensitivity	Criteria	Typical Examples
Extremely High and Very High	Attribute has a high quality or value on an international, national or regional scale.	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g., Special Area of Conservation (SAC) or Special Protection Area (SPA) status; Groundwater supports river, wetland or surface water body ecosystems, protected by national legislation – e.g., NHA status; Surface water body ecosystem protected by EU legislation e.g., SAC or SPA status; Surface water body ecosystem protected by national legislation – e.g., NHA status; Regionally important aquifer with multiple wellfields; Regionally important potable water source supplying >2,500 homes; Inner source protection area for regionally important water source; A nationally important amenity site for a wide range of leisure activities; A water body of High WFD Status – WFD Status period 2016–2021.
High	Attribute has a high quality or value on a local scale.	Regionally important aquifer; Groundwater provides large proportion of baseflow to local rivers; Locally important potable water source supplying >1,000 homes; Outer source protection area for regionally important water source;

Sensitivity	Criteria	Typical Examples
		Inner source protection area for locally important water source; A locally important amenity site for a wide range of leisure activities; A water body of Good WFD Status – WFD Status period 2016–2021.
Medium	Attribute has a medium quality or value on a local scale.	A water body of Moderate WFD Status – WFD Status period 2016– 2021; Locally important aquifer – potable water source supplying >50 homes; Outer source protection area for locally important water source.
Low	Attribute has a low quality or value on a local scale.	A watercourse with a limited range of fluvial processes and is hydrologically modified; Poor bedrock aquifer; Locally important aquifer – no groundwater abstraction / potable supply; Potable water source supplying <50 homes; A locally important amenity for a wide range of leisure.

Magnitude of impact

38. The scale or magnitude of potential impacts (both beneficial and adverse) depends on the degree and extent to which the CWP Project activities may change the environment, which usually varies according to project phase (i.e., construction, operation and maintenance and decommissioning).

39. Factors that have been considered to determine the magnitude of potential effects include:

- The extent of the development which require works that may have a direct effect on the hydrology and hydrogeology, such as excavation works;
- The level of deviation from baseline conditions; and
- The duration of impacts on hydrology and hydrogeology.

40. The criteria for defining magnitude of effect for the purpose of the hydrology and hydrogeology assessment are provided in **Table 20-4**. The magnitude criteria are adapted from NRA guidelines (2008a) and professional experience.

Table 20-4 Criteria for defining magnitude of hydrogeology effects

Magnitude	Criteria	Examples
High adverse	Results in loss of attribute and / or quality and integrity of attribute.	Removal of large proportion of aquifer; Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems; Potential high risk of pollution to groundwater from routine run-off.
Medium adverse	Results in an impact on integrity of attribute or loss of part of attribute.	Removal of moderate proportion of aquifer;

Magnitude	Criteria	Examples
		Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems; Potential medium risk of pollution to groundwater or surface water from routine run-off.
Low adverse	Results in minor impact on integrity of attribute or loss of small part of attribute.	Removal of small proportion of aquifer; Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems; Potential low risk of pollution to groundwater or surface water from routine run-off; Minor loss of fishery; Slight reduction in amenity value.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity.	No measurable effect on the integrity of the attribute; Results in an effect on receptor but of insufficient magnitude to affect either use or integrity.

Significance of effect

41. As set out in **Chapter 5 EIA Methodology** of this EIAR, an Impact Assessment Matrix (IAM) is used to determine the significance of an effect. In basic terms, the potential significance of an effect is a function of the sensitivity of the receptor and the magnitude of the impact, as shown in **Table 20-5**.

42. The matrix provides a framework for the consistent and transparent assessment of predicted effects across all technical chapters; however, it is important to note that the assessments are based on the application of expert judgement.

43. The matrix provides levels of effect significance, ranging from Imperceptible to Profound, as defined in the EPA EIAR Guidelines (2022). For the purposes of this assessment, effects rated as being 'Significant – Moderate' or above are considered to be significant in EIA terms. Effects rated as being 'Moderate' are effectively significant / not significant subject to professional judgement, with a rationale provided for this in the main assessment. Effects identified as less than moderate significance are not considered to be significant in EIA terms.

Table 20-5 Impact assessment matrix for determination of significance of effect

Sensitivity of Receptor	Magnitude of Impact			
	High Adverse	Medium Adverse	Low Adverse	Negligible
Extremely High and Very High	Profound	Profound - Significant	Significant - Moderate	Not Significant
High	Profound - Significant	Significant - Moderate	Slight - Not Significant	Imperceptible
Medium	Significant	Moderate	Slight	Imperceptible
Low	Moderate - Slight	Slight - Not Significant	Not Significant	Imperceptible

20.5 Assumptions and limitations

44. The boundaries of the classified GSI mapping currently do not extend to Dublin Port or the onshore development area. This limitation arises as some of the current GSI mapped extents correspond to the 6 inch or 25 inch OSI maps, which do not reflect the more recent reclaimed nature of the Poolbeg Peninsula. For example, the aquifer, soils and subsoils are classified based on the site-specific information obtained during the 2018–2024 SI works.

45. Limited access was available to the landfall berm for site investigations (SI) due to the presence of Japanese Knotweed. However, it has been assumed that the material is historical Made Ground/waste and is similar to the wider landfall site.

46. No further overarching assumptions or limitations have been identified that apply to the assessment for hydrology and hydrogeology. Where routine assumptions have been made in the course of undertaking the assessment, these are noted in the following sections.

20.6 Existing environment

47. The following sections provide a description of the baseline conditions for a regional and site specific overview of the onshore water environment i.e., hydrology, flood risk and hydrogeology. Hydrology is the study of the water environment (the hydrological cycle) and surface water bodies (such as rivers, lakes and reservoirs). Hydrogeology deals with groundwater and the underground (or geological) part of the hydrological cycle. The offshore water environment i.e., estuaries, is addressed and described in **Chapter 7 Marine Water Quality**.

20.6.1 Study area overview

48. The area within 2 km of the onshore development area stretches from Dublin Port north to Sandymount. The Dublin Port north area is served by the Dublin Tunnel and the national rail network (freight). The area is heavily developed with industrial units related to Dublin Port and other industrial related activities. Activities include ferry services, petroleum storage and roll on–roll off (RO–RO) and lift on–lift off (LO–LO) as well as logistics companies and bitumen importation facilities. There are a number of Control of Major Accident Hazards (COMAH) establishments in this area.

49. The area surrounding the onshore development area also includes Irishtown Nature Park. Ecocem Ireland, Hammond Land Metal Recycling, ESB Dublin Bay Power Plant, All Away Waste, DWtE Facility, Ringsend Wastewater Treatment Plant (WWTP) and Poolbeg Power Station are some of the land uses / buildings on the Poolbeg Peninsula. Further west of the onshore development area residential areas and amenities / sports facilities (such as Ringsend / Sean Moore Parks) are present at Ringsend and Sandymount.

Site history

50. The site history was determined based on a review of publicly available historical maps and aerial photography from the Ordinance Survey Ireland (OSI), which are available to view on the OSI GeoHive Map Viewer (OSI, 2022). Much of the peninsula is built on reclaimed land from the Liffey Estuary.

51. The onshore substation site is currently unused land on the southern bank of the Liffey Estuary, reclaimed by Dublin Port Company (DPC) in the late 1990s / early 2000s and surrounded on three boundaries by water and then by a mixture of industrial uses. The land was raised by a series of natural soils and made ground material during this period. Some stockpiled material was placed on the site around 2005, however the site has remained relatively unused in recent years.

52. A Tier 1 Environmental Risk Assessment was conducted by DCC in 2019, on the landfill site at Shelley Banks known as the former Ringsend Urban Landfill site. The former Ringsend Urban Landfill Site is located on public land overlooking South Dublin Bay and Shelley Banks Beach and can be accessed from Pigeon House Road via a public walkway. The former Ringsend Urban Landfill site is primarily within Irishtown Nature Park, however, the precise boundaries are unknown.

53. The Ringsend urban landfill site was operated by DCC during a building boom in the 1970s, where construction and demolition (C&D) rubble, industrial and commercial waste was deposited and operated as a land-raised scheme. The majority of the waste was reportedly sourced from the redevelopment of Wood Quay during the 1970s. It is understood to have closed in 1978. DCC has placed the landfill site on the Section 22 register (Ref: S22-02333), in accordance with the Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations, 2008.

54. A shallow clay capping was reported to have been placed on top of the interred waste, extending to the top of the rock armour on the eastern and southern boundary between 1978 and 1980.

55. In the early 1980s, DCC and local residents began establishing the Irishtown Nature Park by planting seeds, trees and tall grasses across the elevated landform, encompassing the former landfill location to the east of Compound A. Further details are included in **Chapter 19 Land, Soils and Geology**.

56. The former landfill comprises part of the coastline and was previously exposed to the sea, due to coastal erosion, mainly during high spring tide events. No evidence of organic waste or other waste was noted during the site walkovers within the onshore development area. Significant erosion of the former landfill clay barrier previously occurred when high tides breached the rock armour causing waste to be released into the South Dublin Bay area in recent years. It is believed that this occurred to the east of the landfall boundary.

57. Along the southern landfill perimeter, the rock armour and other erosion control infrastructure (i.e., concrete groins) appear to have slumped. Waste is exposed in the bank up to 4.5 m above the top of the rock armour.

58. The surface area of the landfill site is approximately 500 m from east to west and 50-100 m from north to south. It is estimated that the waste body amounts to 160,000 m^3 in volume.

Hydrology

59. The Liffey Estuary transitional waterbody is situated to the north of the onshore development area. This waterbody connects with the Tolka Estuary transitional waterbody and both waterbodies enter the Dublin Bay coastal waterbody approximately 3.5 km east of the onshore development area. The River Dodder is located within 2 km of the onshore development area and flows in a general south to north direction into the Liffey Estuary near the Tom Clarke Bridge.

60. The Grand Canal is located approximately 2.1 km west of the onshore development area and flows into the Grand Canal Basin (Liffey and Dublin Bay), which also discharges to the Liffey Estuary, near Tom Clarke Bridge.

Water Framework Directive

61. The Water Framework Directive (WFD) aims to improve and / or maintain the water quality of all waterbodies to at least good status. This applies to surface waterbodies as well as groundwater. Under the WFD, water quality is assessed based on the chemical and ecological status of the water, with surface waterbodies awarded one of five statuses i.e., high, good, moderate, poor or bad. Waterbodies are also risk assessed based on the risk of not achieving good water quality status before 2027.

62. The study area is located within the Liffey and Dublin Bay WFD surface water catchment area, with the north and south of the study area located within the Tolka and Dodder WFD sub-catchments respectively. A WFD Compliance assessment is included in **Appendix 7.3** of this EIAR. In summary, no deterioration of the water body's status is anticipated as a result of the works.

63. The EPA classifies surface waterbodies based on their current WFD water quality status and their risk of failing to meet WFD objectives by 2027. There are no surface waterbodies located within the onshore development area. The surface water bodies are presented in **Figure 20-2.** The water quality status and risk classification of surface waterbodies within the wider 2 km study area are summarised in **Table 20-6** below (EPA, 2022a).

Table 20-6 List of surface water bodies within the 2 km study area

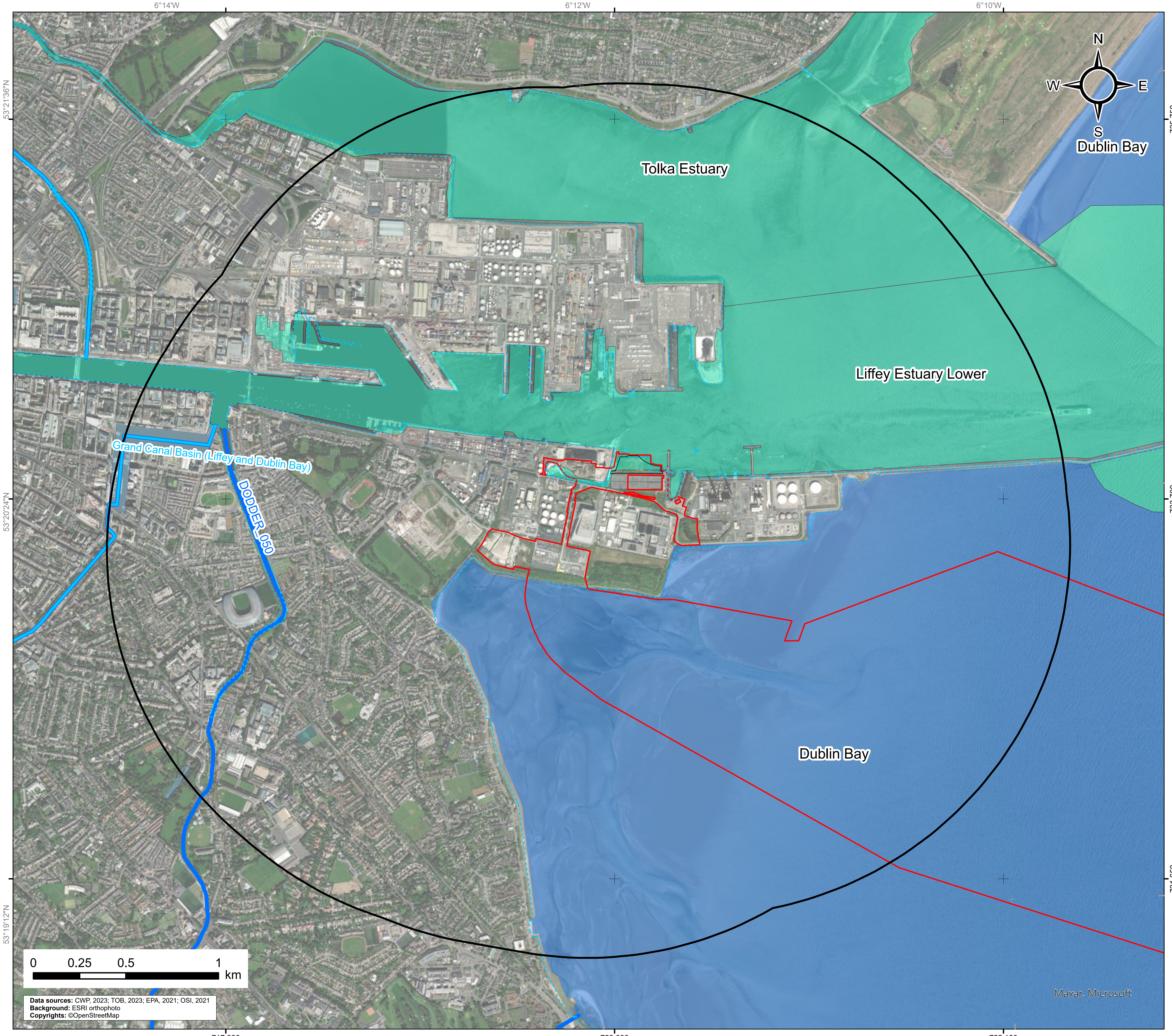
Waterbody	Waterbody Type	Water Quality Status	Risk Status
River Dodder	River	Moderate	At risk
Grand Canal Basin	Canal	Moderate	At risk
Liffey Estuary Lower	Transitional	Good	Under review
Tolka Estuary	Transitional	Moderate	At risk
Dublin Bay	Coastal	Good	Not at risk

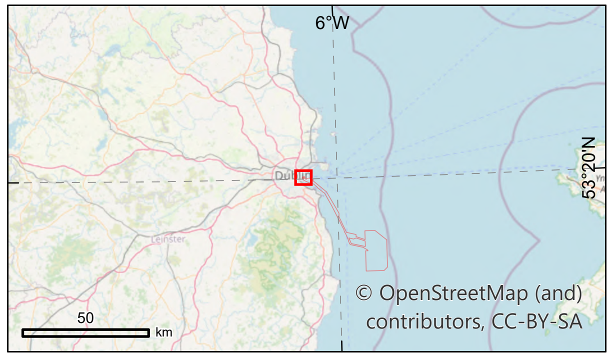
64. Tidal data is available from the Marine Institute for Dublin Port. A review of this data for 2022 and 2023 indicates that the tidal range is between approximately 2.28 mOD recorded on the 6 January 2022 at 14:00 and – 2.29 mOD recorded on the 18 March 2022 at 17:25 (Marine Institute, 2022).

65. Water levels in the Grand Canal Basin are monitored and maintained by Waterways Ireland. Data available throughout 2022 indicates that the water levels in the Grand Canal Basin are generally between 3.1 mOD and 3.45 mOD (Waterways Ireland, 2023).

66. There are no water level or flow measurements available for other surface water features within the study area. Drainage of the urban area is via a combined storm drainage network which discharges to Ringsend WWTP.

67. There are no surface water drinking supplies (Lakes or Rivers) or GSI Public Source Protection Areas (SPAs) within the Poolbeg Peninsula.





Legend

- Planning application boundary
- Onshore substation boundary (operational)
- High water mark
- 2 km buffer from the onshore development area

Surface water bodies

- WFD - Canal Water Bodies
- WFD - River water bodies
- WFD - Transitional water bodies
- WFD - Coastal water bodies
- WFD Lake water bodies

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Figure 20.2
Surface water bodies

CWP doc. number: CWP-TOB-ENG-08-01-MAP-0948

Internal descriptive code: : DU.BAY - ALL.RLB..SURFACE.WATER.BODIES - EIAR.FIG.20.02	*Size:* A3 *Scale:* 1:20,000	*CRS:* EPSG 2157

Rev.	*Updates*	*Date*	*By*	*Chk'd*	*App'd*
00	Final for issue	2024/08/15	SP	DM/EA	ES

Hydrogeology

Aquifer classification

68. The GSI classifies aquifers based on groundwater resource potential, groundwater flow type and attenuation potential. The boundaries of the classified GSI aquifer mapping do not extend to the onshore development area– refer to **Figure 20-3**. There is one area of "unclassified" aquifer on Poolbeg Peninsula, but the area is limited and provides no hydrogeological classification for the associated aquifer.

69. However, the SI and GSI data, as detailed in **Chapter 19 Land, Soils and Geology**, does confirm the presence of the Lucan Formation bedrock underlying the onshore development area. The dark limestone and shale bedrock of the Lucan Formation (refer to **Chapter 19**, **Figure 19-5**) is classified by the GSI as a locally important aquifer – bedrock which is moderately productive only in local zones (LI). As such, the aquifer underlying the Poolbeg Peninsula can also be classified as a locally important aquifer (LI).

70. This locally important gravel aquifer is located 0.9 km west of the onshore export cable (GSI, 2023). The bedrock aquifer and gravel aquifer map are presented in **Figure 20-3**.

Subsoil permeability and aquifer vulnerability

71. Subsoil permeability is a measure of the ease at which water or contaminants can move through the subsoils. A subsoil permeability category of high, medium or low is assigned to all subsoils across the country which have a minimum thickness of three meters. The subsoil permeability map is presented in **Figure 20-4**.

72. The subsoil permeability within the study area is predominantly classified as low, i.e., >10 m of low permeability soils overlie the bedrock. Mapped areas of medium and high subsoil permeability are identified 1 km south of the onshore development area which corresponds with mapped alluvium and beach sands and gravels (GSI, 2023).

73. Bedrock underlying the onshore development area is >30 mbgl and potentially up to 45 m deep. A detailed description of soils and subsoils is presented in **Chapter 19 Land, Soils and Geology**.

74. The onshore export cables will be installed within a tunnel that extends from within Compound A, near the landfall, to the onshore substation site. This tunnel will be located at a depth of 25.30m below Ordnance Datum (Malin) (ODM), within the Dublin Boulder Clay (Port Clay), and will not interact with the underlying bedrock.

75. Groundwater vulnerability is dictated by the nature and thickness of the material overlying the uppermost groundwater 'target'. This means that vulnerability relates to the thickness of the unsaturated zone in sand and gravel aquifers, and the permeability and thickness of the subsoil in areas where the sand / gravel aquifer is absent. There are five categories based on these conditions, these are low (L), moderate (M), high (H), extreme (E) and rock at / or close to surface and karst (X). A detailed description of the vulnerability categories can be found in the Groundwater Protection Schemes document (DELG/EPA/GSI, 1999) and in the draft Guidelines for Assessment and Mapping of Groundwater Vulnerability to Contamination by Geological Survey Ireland (Fitzsimons, et al., 2003).

76. The classification of groundwater vulnerability is shown in **Table 20-7**.

Table 20-7 Groundwater Vulnerability Categories (adapted from Department of Environmental and Local Government (DoELG) et al.,1999)

Vulnerability Rating	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High Permeability (Sand and Gravel)	Medium Permeability (Sandy Subsoil)	Low Permeability (Clayey Subsoil / Peat)	Sand and Gravel aquifers only	<30 radius
Extreme (E) or (X)	0–3.0 m	0–3.0 m	0–3.0 m	0–3.0 m	–
High (H)	>3.0 m	3.0–10.0 m	3.0–5.0 m	>3.0 m	N/A
Moderate (M)	N/A	>10.0 m	5.0–10.0 m	N/A	N/A
Low (L)	N/A	N/A	>10 m	N/A	N/A
Note: N/A = not applicable					

77. The groundwater vulnerability within the study area is classified as low to moderate, indicating the groundwater is naturally well protected. The site investigation results indicate that the groundwater vulnerability located beneath the onshore development area is classified as low due to >10 m of low permeability soils overlying the bedrock. This classification is based on attributes outlined in **Table 20-7**. The groundwater vulnerability map is presented in **Figure 20-5**.

Groundwater recharge

78. Groundwater recharge is the volume of water which infiltrates through the soil and is used to replenish aquifer supplies. Effective rainfall, subsoil permeability, subsoil thickness and the aquifer characteristics all contribute to groundwater recharge. Effective rainfall is the total water rainfall amount, excluding water which goes back into the atmosphere via evaporation and evapotranspiration. Effective rainfall is monitored by Met Éireann. The average effective rainfall is considered to be the average amount which fell within a 30-year period, between 1981 to 2010, and is approximately 277 mm/yr to 311 mm/yr within the study area. Based on these combined parameters, a recharge coefficient of 20 per cent has been applied to the area, providing an annual recharge amount of approximately 55.4 mm/yr to 62 mm/yr (GSI, 2023). The recharge map for the study area is presented in **Figure 20-6**.

79. Based on the GSI groundwater wells and springs database, there are a number of abstractions within the study area. The use and abstraction volume is unknown for most, but a yield amount up to 261.8 m^3/d is recorded in one borehole used for industrial purposes. This is in line with the expected yield for the aquifer type. As required by S.I. No. 261/2018 – European Union (Water Policy) (Abstractions Registration) Regulations 2018, all water abstractions >25 m^3/day are registered with the EPA. There are no registered abstractions within 500 m of the OTI or the Poolbeg Peninsula. The exact location of individual abstractions is unknown; hence a location accuracy buffer has been used to indicate the location of the abstraction within a specified area. The abstractions are summarised in **Table 20-8**.

80. Based on a review of EPA and GSI data, it is noted that there are no group water scheme and public supply source protection areas, or group water scheme abstraction points, mapped within 2 km of the onshore development area.

Table 20-8 Groundwater abstractions within the study area (GSI data)

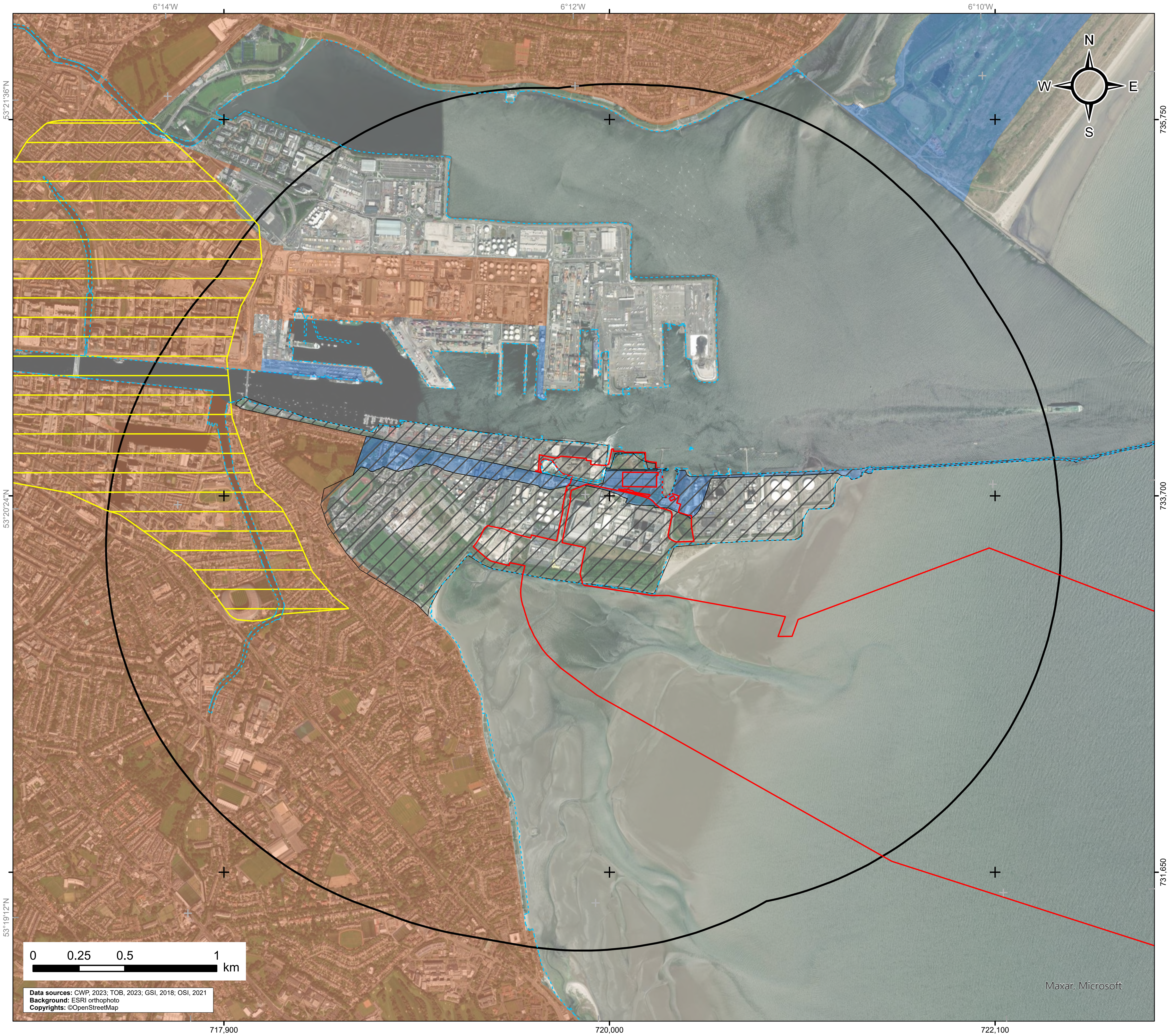
Abstraction ID	Location	Location Accuracy	Yield Class and Yield	Proximity to Onshore Development Area (approximate)
2923SEW036	Dublin Port	200 m	Null	1.1 km north of the onshore substation
2923SEW030	Dublin Docklands	200 m	Null	1.9 km northwest of Compound B
2923SEW050	Grand Canal Basin	20 m	Null	1.9 km west of Compound B
2923SEW051	Grand Canal Basin	20 m	Null	2.0 km west of Compound B
2923SEW052	Grand Canal Basin	20 m	Null	1.9 km west of Compound B
2923SEW053	Grand Canal Basin	20 m	Null	1.9 km west of Compound B
2923SEW054	Grand Canal Basin	20 m	Null	2.0 km west of Compound B
2923SEW014	Grand Canal Basin	200 m	Good – 261.8 m^3/d (Industrial use)	1.7 km west of Compound B
2923SEW037	Lansdowne Village	200 m	Moderate – 60 m^3/d	1.4 km west of Compound B
2923SEW038	Lansdowne Village	200 m	Poor – 22 m^3/d	1.4 km west of Compound B
2923SEW034	Merrion	200 m	Null	1.9 km south of Compound B

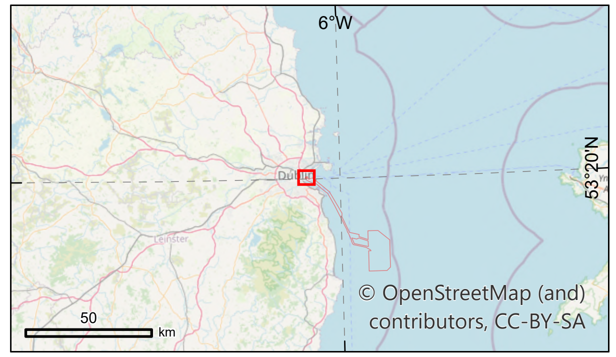
WFD groundwater classification

81. The study area is located within the Dublin Groundwater Body (EPA, 2023). The bedrock aquifer is generally unconfined but may become locally confined in areas of thicker and/or lower permeability subsoil. Groundwater flow occurs within the aquifer, which consists of a weathered zone, as well as at depth, within isolated faults and fractures. Most groundwater flow in the aquifer occurs near the surface, and flow path lengths are considered to be, on a local scale, typically less than one kilometre long. Groundwater flow is toward rivers and streams which are hydraulically connected to the aquifer and toward the coast (GSI, 2003).

82. The hydrochemical signature of groundwater in the Dublin Groundwater Body is very hard calcium bicarbonate water, with high alkalinity (300–350 mg/l $CaCO_3$) and high conductivities (550–900 µS/cm) (GSI, 2003).

83. The EPA classifies the Dublin Groundwater Body as having good water quality status, but the risk of not meeting the WFD 2027 objectives is under review (EPA, 2022a). However, this does not reflect the current local groundwater quality at the onshore development area, as detailed in **Section 20.6.2**.





Legend

- Planning application boundary
- Onshore substation boundary (operational)
- High water mark
- 2 km buffer from the onshore development area

Aquifer bedrock *

- Unclas - Unclassified
- LI - Locally important aquifer - Bedrock which is moderately productive only in local zones
- LI - Locally important aquifer – Bedrock which is moderately productive only in local zones (TOBIN classification based on mapped bedrock)

Gravel Aquifer

- Locally important gravel aquifer

* The boundaries of the aquifer mapping do not extend to Dublin port or the onshore development area boundary as the current GSI aquifer mapped extents correspond to the 6inch OSI maps which do not reflect the more recent reclaimed nature of the Poolbeg Peninsula. The underlying bedrock bedrock is classified as the Lucan Formation which is considered as a Locally Important Aquifer – Bedrock which is Moderately Productive only in Local Zones (LI). Therefore, it is assumed that the underlyng aquifer is a Locally Important Aquifer (LI).

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Project: Codling Wind Park

Contractor: TOBIN

Website: www.tobin.ie

Figure 20.3
Bedrock and gravel aquifer within 2 km of the onshore development area

CWP doc. number: CWP-TOB-ENG-08-01-MAP-0942

Internal descriptive code: DU.BAY - ALL.RLB..AQUIFERS - EIAR.FIG.20.05

Size: A3

Scale: 1:20,000

CRS: EPSG 2157

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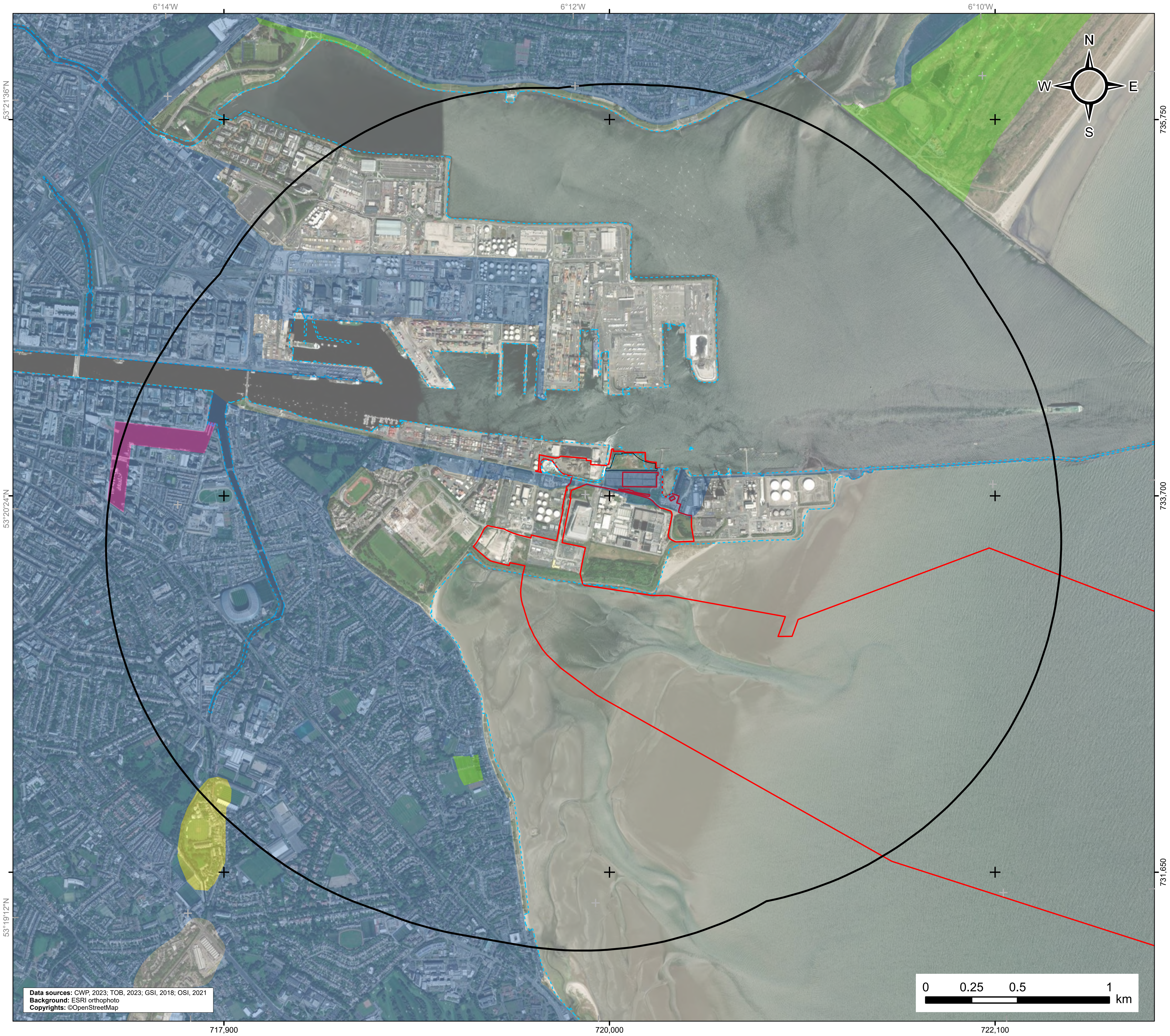

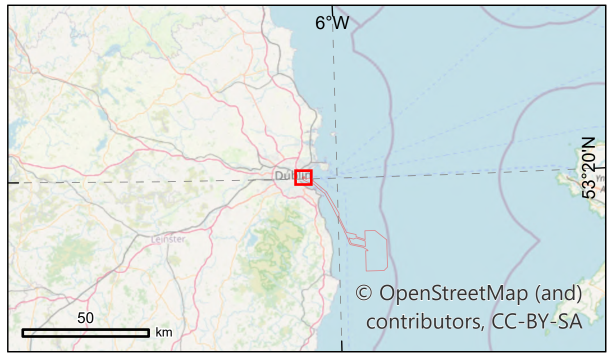

Legend

- Planning application boundary
- Onshore substation boundary (operational)
- High water mark
- 2 km buffer from the onshore development area

Subsoil permeability

- High
- Medium
- Low
- Water
- Not mapped

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Figure 20.4
Subsoils permeability within 2 km of the onshore development area

CWP doc. number: CWP-TOB-ENG-08-01-MAP-0947

Internal descriptive code: DU.BAY - ALL.RLB..SUBSOIL.PERMEAB - EIAR.FIG.20.06

Size: A3

Scale: 1:20,000

CRS: EPSG 2157

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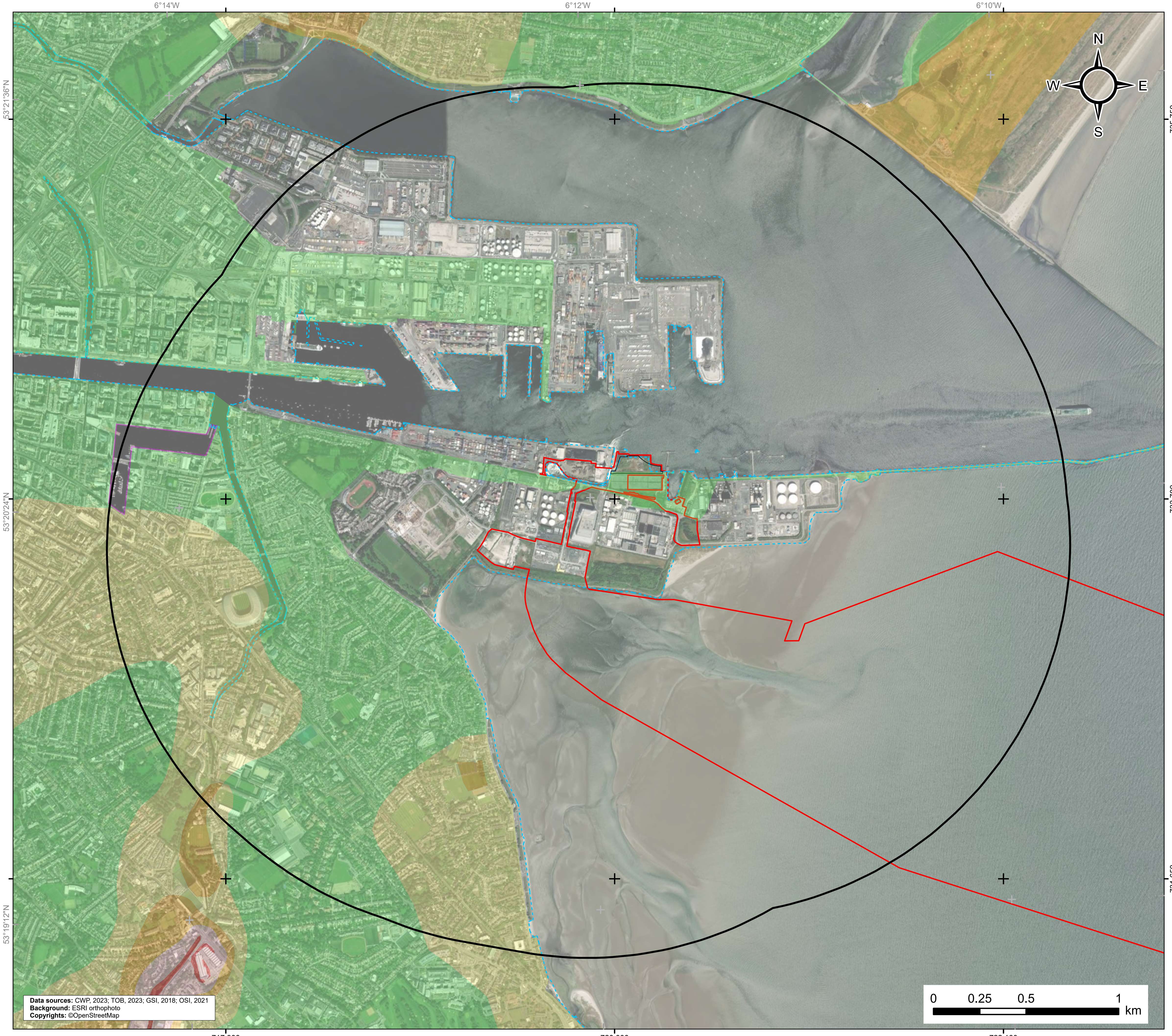

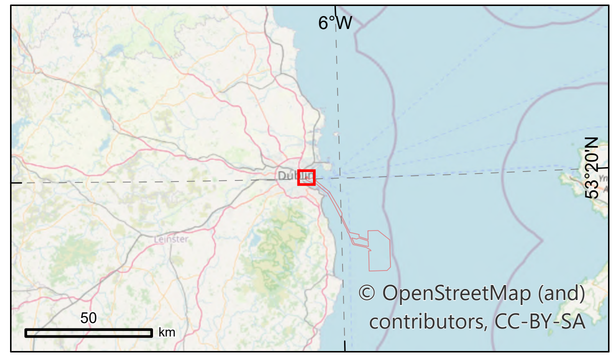

Legend

- Planning application boundary
- High water mark
- Onshore substation boundary (operational)
- 2 km buffer from the onshore development area

Groundwater vulnerability

- Rock at or near surface or karst
- Extreme
- High
- Moderate
- Low
- Water

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Project: Codling Wind Park

Contractor: TOBIN

Website: www.tobin.ie

Figure 20.5
Groundwater vulnerability within 2 km of the onshore development area

CWP doc. number: CWP-TOB-ENG-08-01-MAP-0946

Internal descriptive code: DU.BAY - ALL.RLB..GROUNDWATER.VULNER - EIAR.FIG.20.07	*Size:* A3 *Scale:* 1:20,000	*CRS:* EPSG 2157

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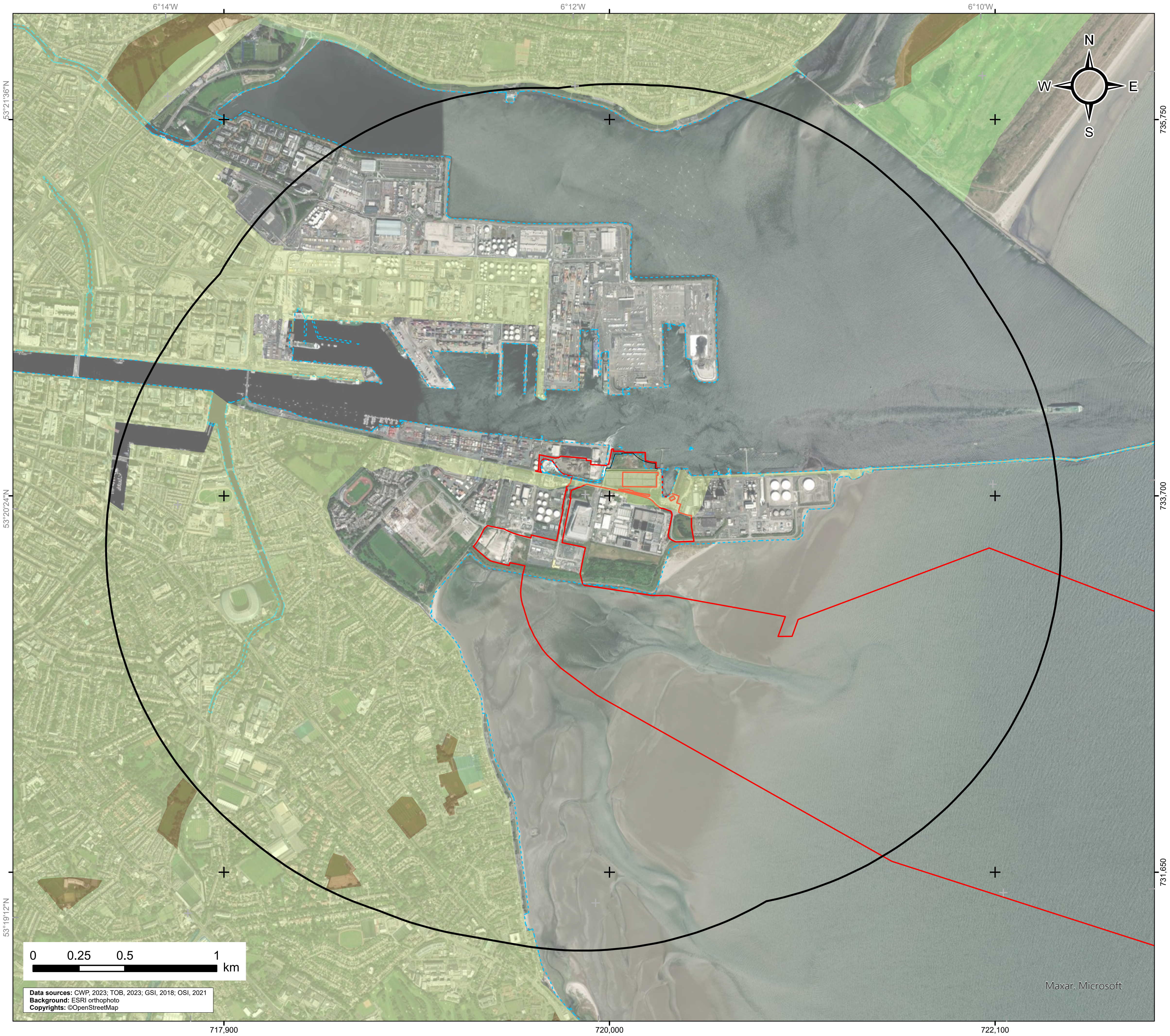

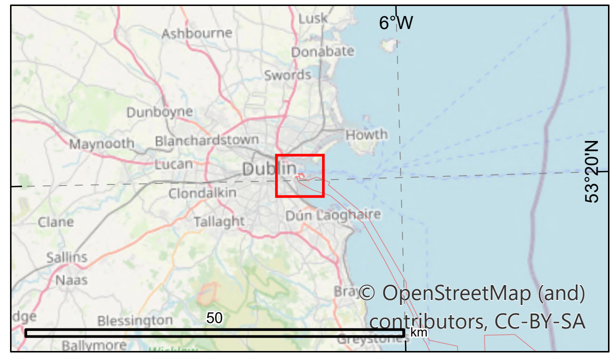

Legend

- Planning application boundary
- Onshore substation boundary (operational)
- High water mark
- 2 km buffer from the onshore development area

Groundwater recharge

Annual recharge (mm)

- 201-250
- 151-200
- 51-100
- 1-50

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Project: Codling Wind Park

Contractor: TOBIN

Website: www.tobin.ie

Figure 20.6
Groundwater recharge within 2 km of the onshore development area

CWP doc. number: CWP-TOB-ENG-08-01-MAP-0944

Internal descriptive code: DU.BAY - ALL.RLB..GROUNDWATER.RECHARGE - EIAR.FIG.20.08

Size: A3
Scale: 1:20,000

CRS: EPSG 2157

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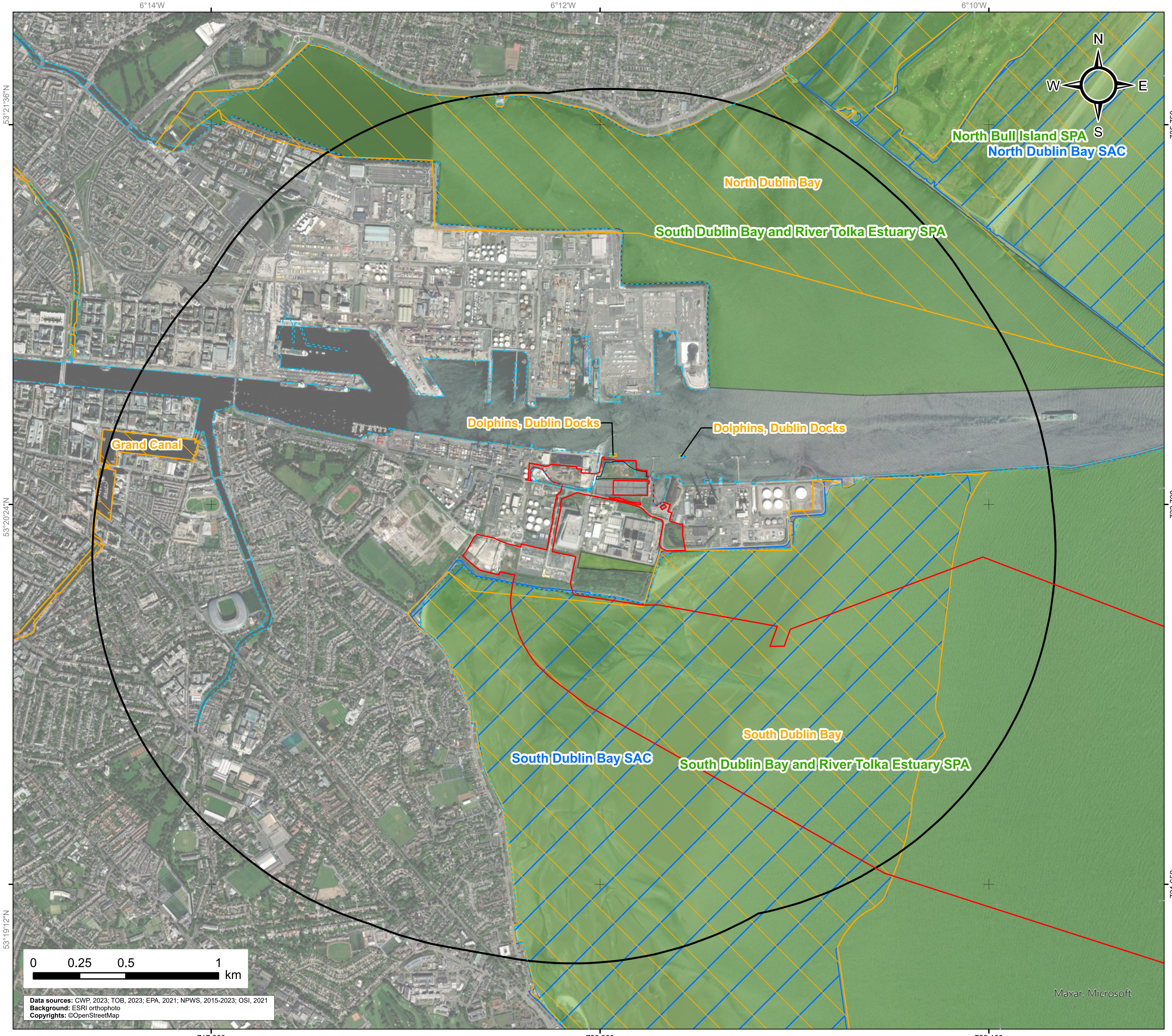
Groundwater dependent terrestrial ecosystems (GWDTE) (designated sites)

84. Ecologically designated sites are described in further detail in **Chapter 21 Onshore Biodiversity, Chapter 8 Subtidal and Intertidal Ecology**, the **AA Screening Report** and the **Natura Impact Statement (NIS)**. There are a number of international and nationally designated sites within the study area. These include:

- South Dublin Bay SAC – site code 000210;
- South Dublin Bay and River Tolka Estuary SPA – site code 004024;
- North Dublin Bay SAC – site code 000206;
- North Bull Island SPA – site code 004006;
- North Bull Island Ramsar site (406);
- Sandymount Strand / Tolka Estuary Ramsar site (832);
- Irishtown Nature Park;
- Grand Canal pNHA, site code 002104; and
- The Dolphins, Dublin Docks pNHA – site code: 000201.

85. Based on the site walkovers, SI data and a review of the ecological surveys, there are no groundwater dependent terrestrial ecosystems (GWDTE) within the onshore development area.



Data sources: CWP, 2023; TOB, 2023; EPA, 2021; NPWS, 2015-2023; OSI, 2021
Background: ESRI orthophoto
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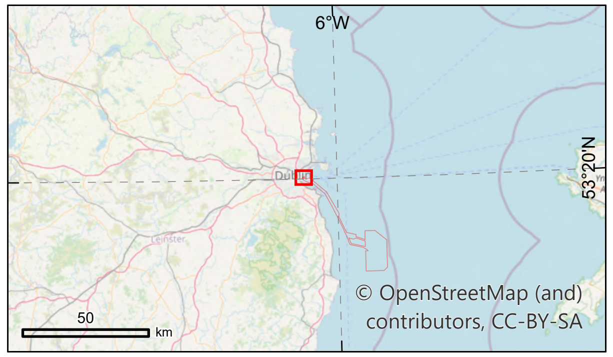

Legend

- Planning application boundary
- Onshore substation boundary (operational)
- High water mark
- 2 km buffer from the onshore development area

Designated sites

- proposed National heritage areas (pNHAs)
- Special areas of conservation (SACs)
- Special protection areas (SPAs)

Project: Codling Wind Park	Contractor: TOBIN Website: www.tobin.ie

Figure 20.7
European and nationally designated sites within 2 km of the onshore development area

CWP doc. number: CWP-TOB-ENG-08-01-MAP-0943

Internal descriptive code:	Size:	CRS:
DU.BAY - ALL.RLB..DESIGNATED.SITES - EIAR.FIG.20.09	A3 Scale: 1:20,000	EPSG 2157

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00	Final for issue	2024/08/15	SP	DM/EA	ES

20.6.2 Site specific information

86. The followings sections set out information specific to the onshore development area.

Hydrology

87. There are no surface water features within the onshore development area. Surface water runoff in the area is managed by a storm water network, including along the Shellybanks Road and Pigeon House Road, which discharge to the Liffey Estuary. A cooling water channel is located north of Pigeon House Road and west of the onshore substation. Water from the DWtE facility and Dublin Bay Power Station discharges to this channel and then flows into the Liffey Estuary. The cooling water channel is crossed by the onshore export cables.

Flood risk

88. As noted earlier, flood risk is not considered as part of the impact assessment in this chapter. A summary of the flood risk assessment has been provided in **Section 20.6.1** and a SSFRA has been completed – see **Appendix 20.2**.

Hydrogeology

Groundwater flow and level

89. The locations of SI undertaken by Causeway Geotech between 2018 to 2024 are shown in **Figure 20-8**, **Figure 20-9** and **Figure 20-10**.The SI reports associated with these works are presented in **Chapter 19 Land**, **Soils and Geology**, **Appendix 19.2** to **19.4**.

90. Groundwater flow across the onshore development area is tidally influenced due to the site's proximity to the Liffey Estuary and Dublin Bay. Groundwater monitoring standpipes and piezometers were installed at the onshore substation site during the borehole works for the 2018 SI. Groundwater levels were monitored on the 3 December 2018 and on the 10 December 2018. These works were not carried out by the Applicant.

91. Boreholes were installed by the Applicant in 2022, continuing into 2024. These were monitored on a monthly basis between May 2022 and September 2023.

92. As part of the 2022 and 2023 SI, manual groundwater monitoring was undertaken in boreholes BH15–BH17, BH20 and BH29 (onshore substation), BH14 and BH21–BH23 (landfall) and BH24–BH28 (onshore export cables). This included monitoring installations with response zones in different hydrogeological units. No groundwater monitoring standpipe was placed in BH36 at the landfall; however, water was struck within this borehole during installation.

93. The 2018 boreholes (BH01–BH05) were also monitored manually for recording of water levels between May 2022 and September 2023, with two readings in December 2018 also provided in the 2018 SI Report (**Chapter 19 Land Soils and Geology**, **Appendix 19.4**).

94. Monitoring installations in both subsoils and bedrock were also equipped with pressure transducers for automatic recording of water levels in boreholes BH01, BH03, BH15, BH20 and BH29 (onshore substation), and BH22–BH23 (landfall), and BH25 and BH27 (onshore export cables) in the period between October 2022 and September 2023.

95. The groundwater monitoring installations are summarised in **Table 20-9** below, and long-term groundwater monitoring data, from 2018 and 2022 through to 2023, is included in **Appendix 20.3**.

96. Results of the groundwater level monitoring indicates that the groundwater levels within the onshore development area are tidally influenced.

Table 20-9 Summary of groundwater monitoring installations from site investigations

Borehole ID	SI Date	Location	Strata Monitored	Groundwater Level Range (mbgl)
BH01	2018	Onshore Substation	Sand and gravel	2.51–4.58
BH02	2018	Onshore Substation	Made ground + sand and gravel	1.56–3.37
BH03	2018	Onshore Substation	Sand and gravel	1.8–3.85
BH04	2018	Onshore Substation	Made ground + sand and gravel	1.83–3.73
BH05	2018	Onshore Substation	Made ground + sand and gravel	1.99–367
P-BH14	2022	Landfall	Made ground + sand and gravel	1.02–4.35
P-BH15-S	2022	Onshore Substation	Made ground	2.3–3.4
P-BH15-D	2022	Onshore Substation	Bedrock	Standpipe Blocked
P-BH16-S	2022	Onshore Substation	Made ground	1.73–1.85
P-BH16-D	2022	Onshore Substation	Clay	2.66–4.60
P-BH17	2022	Onshore Substation	Sand and gravel	1.5–3.81
P-BH20-S	2022	Onshore Substation	Made ground	Dry
P-BH20-D	2022	Onshore Substation	Bedrock	2.50
P-BH21	2022	Landfall	Made ground + sand and gravel	3.7–4.63
P-BH22	2022	Landfall	Made ground	4.12–4.69
P-BH23	2023	Landfall	Made ground	2.05–4.65
P-BH24	2023	Onshore Export Cables	Sand	3.25–3.54
P-BH25-S	2023	Onshore Export Cables	Made ground + sand and gravel	3.44–4.03
P-BH25-D	2023	Onshore Export Cables	Sand	3.28–4.18
P-BH-27	2023	Onshore Export Cables	Sand and gravel	2.38–4.00
P-BH29-S	2023	Onshore Substation	Made ground + clay, silt + sand	2.36
P-BH29-D	2023	Onshore Substation	Sand and gravel	2.25–3.70
P-BH36	2023	Landfall	Made ground	Water Struck at 3.5.

97. **Appendix 19.2** to **Appendix 19.4** of **Chapter 19 Land, Soils and Geology** details the hydrogeology data and information related to the onshore development area.

Groundwater quality

98. As part of the 2022 and 2023 SI, sampling for groundwater quality was undertaken at various borehole locations. Specifically, boreholes BH15–BH17, BH20 and BH29 (onshore substation), BH14, BH21 and BH23 (landfall), as well as BH25 (onshore export cables) were included in the sampling analysis. Two rounds of monitoring took place in 2022 and three monitoring rounds were conducted in 2023.

99. Specifically, BH14, BH20 and BH21 were only sampled in 2022, BH16 and BH17 were sampled in both 2022 and 2023, and BH15, BH23, BH25 and BH29 were sampled exclusively in 2023.

100. Samples were analysed for physiochemical parameters, metals, hydrocarbons, volatile organic compounds and nutrient constituents. The results for groundwater quality are outlined in **Table 20-10**.

101. A number of elevated concentrations were detected in all monitoring locations. Elevated concentrations included chloride, sulphate, sodium, boron and manganese as well as elevated electrical conductivity. However, these were present in concentrations similar to those seen in saltwater. Groundwater on the Poolbeg Peninsula is brackish and influenced by the coastal location.

102. Elevated concentrations of ammonium were detected in all boreholes with the highest concentrations detected in BH14 (58 mg/l N), BH21 (22 mg/l N) and BH23 (21 mg/l N) at the landfall site. Elevated concentrations of ammonium are indicative of a source of organic landfilled material, as noted in the borehole and trial pit logs at this area. The area of high ammonium does not appear to be widespread and is likely to reflect the presence of localised organic waste material. Where anaerobic conditions are present in the groundwater, the mobility of ammonium is limited.

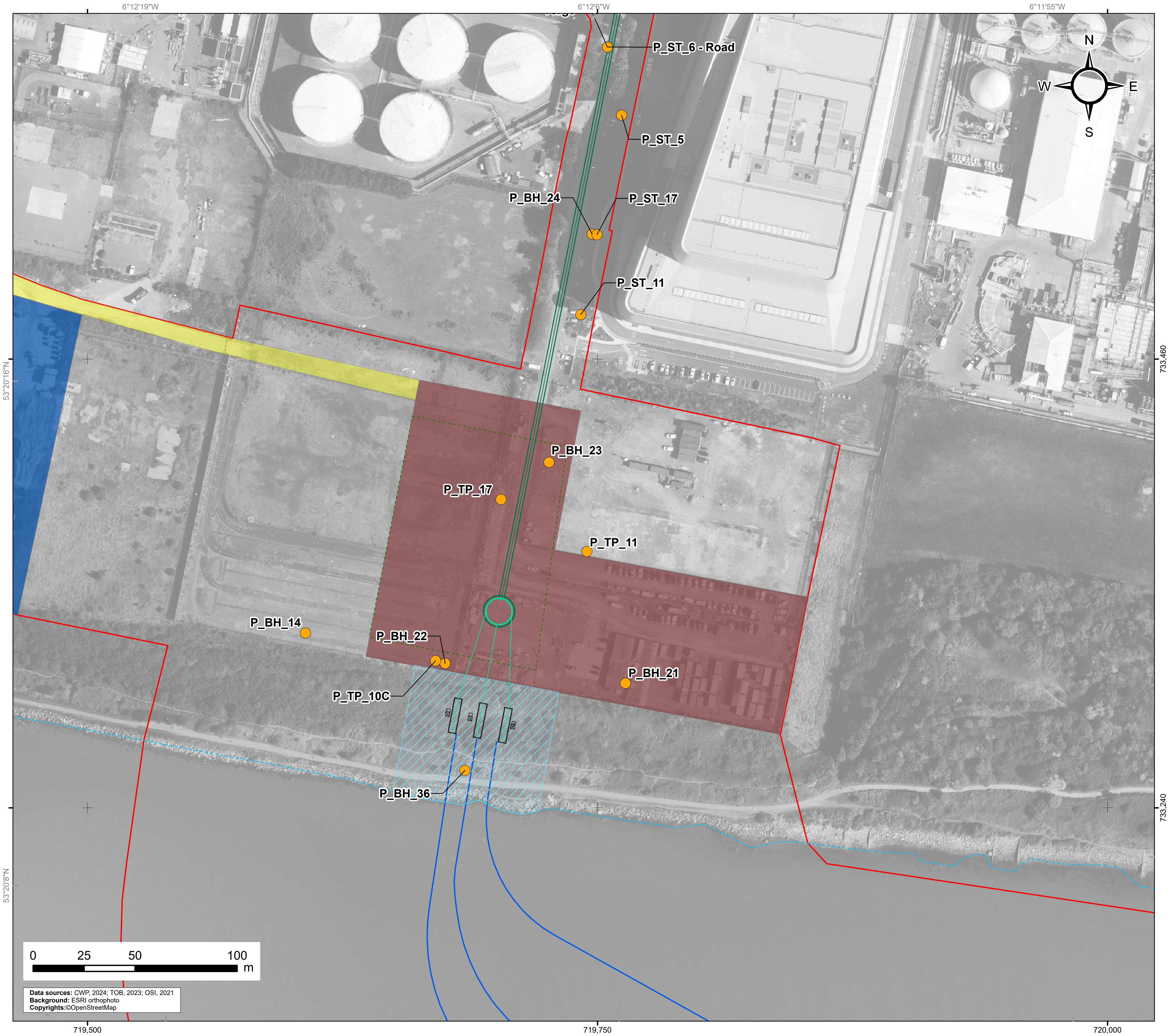
103. Unionized ammonia (NH_3) is more harmful to aquatic organisms, however both forms (i.e., ammonium and ammonia) have the potential to impact groundwater and surface water resources. The ammonium ion is predominant as NH_4 at neutral pH, which is present underlying the site. The concentration of NH_3 in water depends on both the pH and temperature of the water, with pH being the more sensitive parameter. At pH 7.3 and 11ºC, concentrations of NH_3 in P-BH21 and P-BH14 were 0.09 mg/l and 0.23 mg/l respectively.

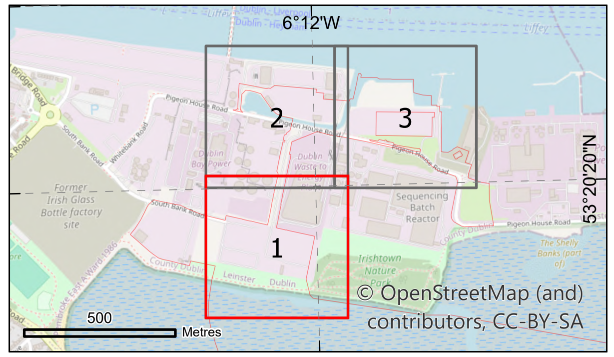
104. There were no concentrations of PAHs, MTBE or BTEX compounds in the groundwater. Hydrocarbon concentrations were below their respective limits of detection within the groundwater samples. Volatile Organic Compounds (VOCs) were not detected in groundwater monitoring boreholes. Phenols were not detected in any of the other groundwater monitoring boreholes. Full results are included in **Chapter 19 Land Soils and Geology**, **Appendix 19.2** to **Appendix 19.4**.

Table 20-10 Summary of groundwater quality

			Maximum Groundwater Concentrations								
			Boreholes								
		Drinking Water regs SI99 of 2023	P_BH14	P_BH15	P_BH16	P_BH17	P_BH20	P_BH21	P_BH23	P_BH25	P_BH29
Determinands	**Units**										
pH			7.6	8.0	8.3	8.2	8.0	7.7	7.3	7.4	7.4
Electrical Conductivity	µS/cm	2,500	19,000	44,000	41,000	30,000	28,000	9,400	27,000	32,000	22,000
Chloride	mg/l	250	7,100	18,000	13,000	11,000	10,000	2,700	11,000	12,000	8,800
Fluoride	mg/l	1.5	0.36	0.81	0.84	0.70	0.70	0.35	0.26	0.62	0.68
Ammonium	mg/l	0.5	58.0	2.90	2.30	3.70	3.30	22.0	21.0	1.50	1.30
Nitrite	mg/l	0.5	0.0	0.0	0.0	0.02	0.0	0.0	0.04	0.64	2.80
Nitrate	mg/l	50	0.0	0.0	1.0	6.90	0.0	0.0	0.0	0.0	1.50
Sulphate	mg/l	250	940	2,500	2,000	1,600	1,500	410	710	1,900	1,300
Sodium	mg/l	200	3,300	15,000	16,000	5,400	5,400	1,500	5,800	7,100	5,300
Aluminium	µg/l	200	10.0	80.0	87	12	0	200	8	12.0	6.40
Arsenic	µg/l	10	1.20	3.20	5	2	1	11	17	16.0	1.80
Boron	µg/l	1,500	2,500	7,200	6,700	3,000	2,900	1,200	34,000	37,000	26,000
Chromium	µg/l	50	0.87	26.0	25	7	0	10	1	0.68	0.0
Copper	µg/l	2,000	0.0	9.0	9	3	2	6	0	0.73	3.70
Iron	µg/l	200	770.0	120.0	280	42	11	610	20	0.0	0.0
Mercury	µg/l	1	0.0	0.0	0	0	0	0	0	0.0	0.0
Manganese	µg/l	50	1,500	2,500	2,300	3,800	3,700	1,400	1	150	1,900
Nickel	µg/l		31.0	28.0	20	16	15	13	2	6.70	16.0
Lead	µg/l	5	0.0	2.6	4	0	0	10	0	0.0	0.0
Antimony	µg/l		0.53	4.4	4	1	0	2	2	7.70	0.56
Selenium	µg/l		0.0	14.0	80	2	1	1	1	23.0	1.40
Cadmium	µg/l	5	0.0	0.63	0	0	0	1	0	0.45	0.51
Total Organic Carbon	mg/l		77.0	2.9	5	5	3	51	190	2.4	3.4
1,2 Dichloroethane	µg/l		0.0	0.0	0	0	0	0	0	0.0	0.0
Vinyl Chloride	µg/l	0.5	0.0	0.0	0	0	0	0	0	0.0	0.0
Sum 16 PAHs	µg/l	0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Benzene	µg/l	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Toluene	µg/l		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ethylbenzene	µg/l		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
m & p-Xylene	µg/l		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

											Maximum Groundwater Concentrations
			Boreholes								
		Drinking Water regs SI99 of 2023	P_BH14	P_BH15	P_BH16	P_BH17	P_BH20	P_BH21	P_BH23	P_BH25	P_BH29
o-Xylene	µg/l		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Styrene	µg/l	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1,2,4-Trimethylbenzene	µg/l		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Methyl Tert-Butyl Ether	µg/l	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phenol	µg/l		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-Chlorophenol	µg/l		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PAHS	µg/l	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pentachlorophenol	µg/l		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heptachlor	µg/l	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aldrin	µg/l	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SVOCs	µg/l		None identified	None identified	None identified	None identified	None identified	None identified	None identified	None identified	None identified





Legend

- Planning application boundary
- High water mark
- Geotechnical investigations - 2018
- Geotechnical investigations - 2022/2023
- Offshore export cable
- Onshore export cable TJB connection
- Onshore export cable
- Landfall works above the HWM
- Transition joint bay (TJB)
- Temporary tunnel shaft compound

Construction compounds

- Construction compound A
- Construction compound B
- Temporary access route for construction compound A and B

*Site investigations:
BH: Boreholes
TP: Trial Pits
ST: Slit Trenches

codling wind park

Project: Codling Wind Park

Contractor: TOBIN

Website: www.tobin.ie

Figure 20.8
Geotechnical investigation within the onshore development area:
Page 1 of 3

CWP doc. number: CWP-TOB-ENG-08-01-MAP-0935

Internal descriptive code: POOLB - PAB..INFRAS.PROP..S.GEOTECH.REAL - EIAR.FIG.20.12

Size: A3

Scale: 1:1,800

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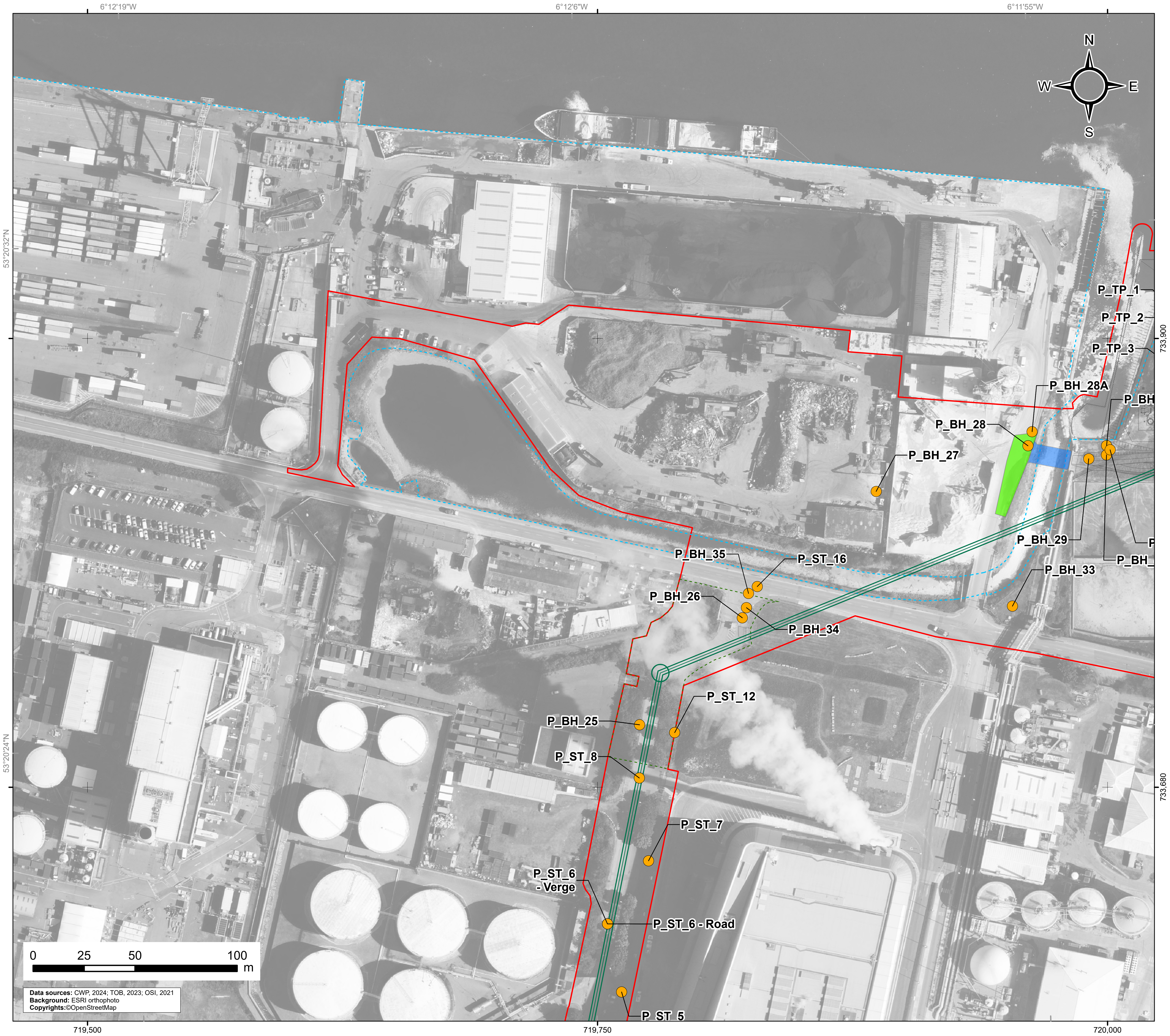

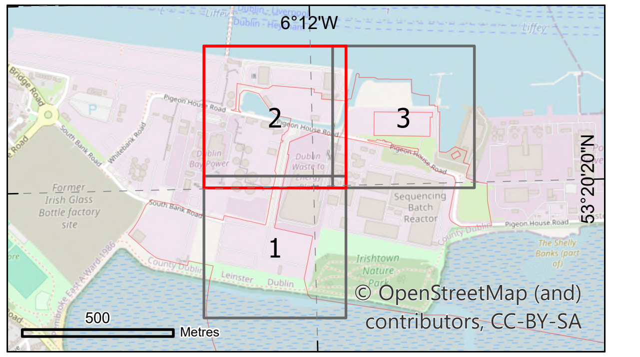

Legend

- Planning application boundary
- Onshore substation electrical layout
- High water mark
- Geotechnical investigations - 2018
- Geotechnical investigations - 2022/2023
- Offshore export cable
- Onshore export cable
- Transition joint bay (TJB)
- Access bridge to onshore substation
- Temporary tunnel shaft compound

Construction compounds

- Construction compound D

*Site investigations:
BH: Boreholes
TP: Trial Pits
ST: Slit Trenches

codling wind park	*Project:* Codling Wind Park	*Contractor:* TOBIN *Website: www.tobin.ie*

Figure 20.9
Geotechnical investigation within the onshore development area:
Page 2 of 3

CWP doc. number: CWP-TOB-ENG-08-01-MAP-0935

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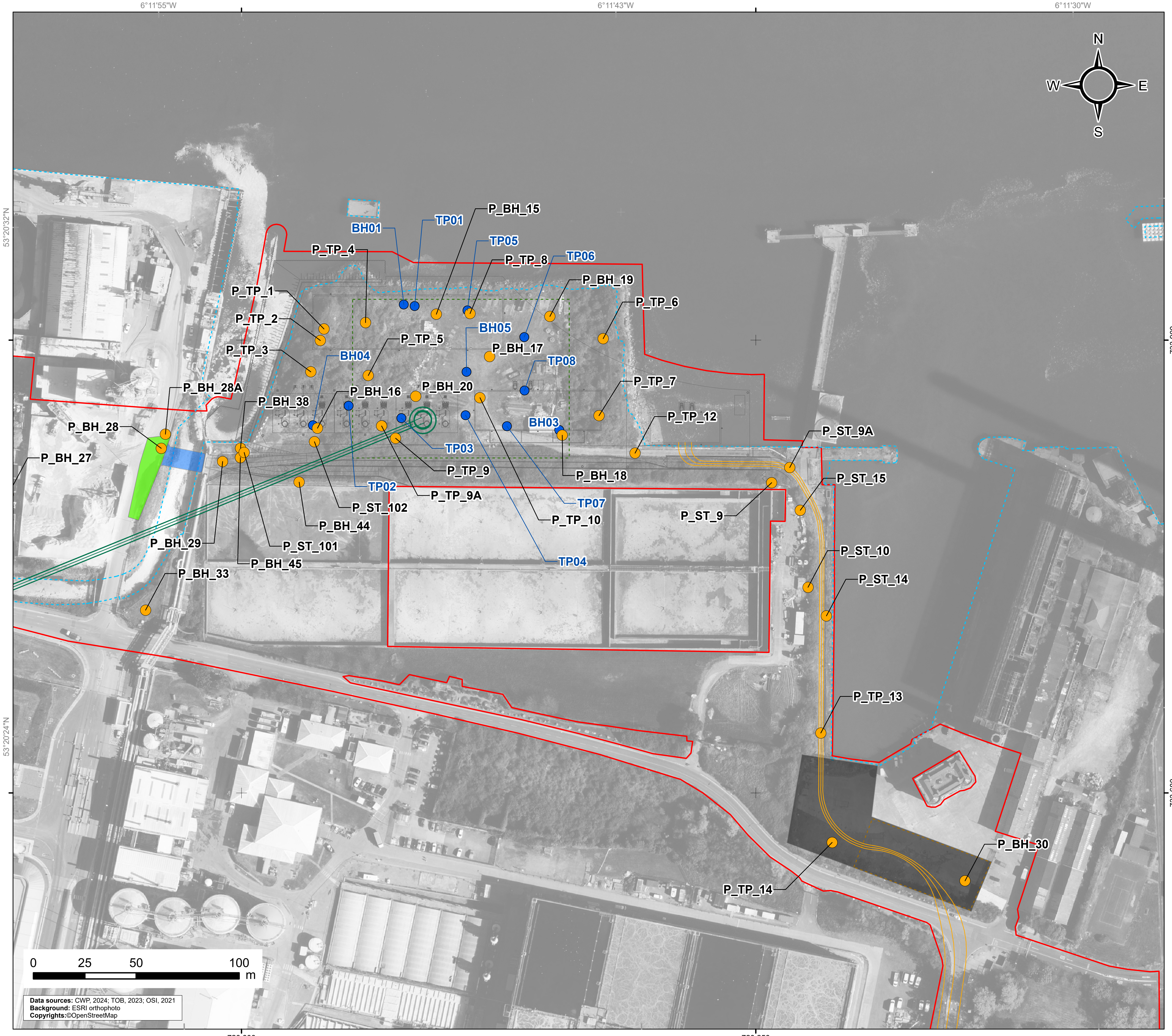

Data sources: CWP, 2024; TOB, 2023; OSI, 2021
Background: ESRI orthophoto
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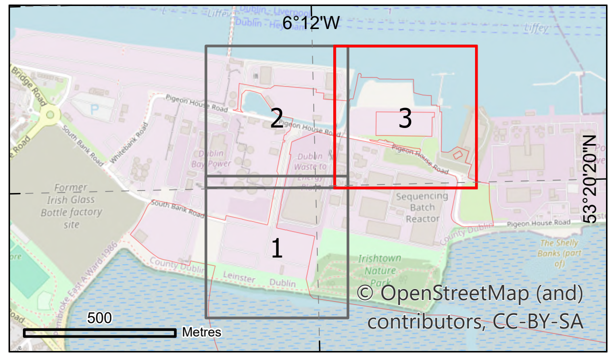

Legend

- Planning application boundary
- Onshore substation electrical layout
- High water mark
- Geotechnical investigations - 2018
- Geotechnical investigations - 2022/2023
- Offshore export cable
- Onshore export cable
- ESBN network cable
- Transition joint bay (TJB)
- Access bridge to onshore substation
- Temporary tunnel shaft compound
- Temporary HDD compound (ESBN network cables)

Construction compounds

- Construction compound C
- Construction compound D

*Site investigations:
BH: Boreholes
TP: Trial Pits
ST: Slit Trenches

codling wind park

Project: Codling Wind Park

Contractor: TOBIN

Website: www.tobin.ie

Figure 20.10
Geotechnical investigation within the onshore development area:
Page 3 of 3

CWP doc. number: CWP-TOB-ENG-08-01-MAP-0935

Internal descriptive code: POOLB - PAB..INFRAS.PROP..S.GEOTECH.REAL - EIAR.FIG.20.12	*Size:* A3 *Scale:* 1:1,800	*CRS:* EPSG 2157

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00	Final for issue	2024/08/15	SP	DM/EA	ES

20.6.3 Summary of baseline receptor sensitivity

105. **Table 20-11** presents the baseline receptors and their sensitivity.

106. There are no surface water bodies within the onshore development area. Offshore effects from onshore works are addressed in **Chapter 7 Marine Water Quality**.

Table 20-11 Baseline receptor sensitivity

Receptor	Sensitivity	Relevant Feature / Indicator
Groundwater: The bedrock aquifer (Lucan Formation, locally important) across the onshore development area.	Low	No groundwater abstraction. The groundwater is brackish and is not suitable for use either as drinking or process water. The bedrock aquifer is located at approximately >30 mbgl. A low permeability clay horizon underlies the made ground / sand and gravel and limits potential for connection between the OTI and bedrock aquifer.

Future predicted baseline

107. Without the implementation of the CWP Project, the predicted future baseline is not expected to change. However, it is noted that the onshore development area falls within the lands subject to development by DPC as part of their Masterplan programme. Additionally, the northern part of the Poolbeg Peninsula, on which the onshore substation is located, is zoned Employment (Heavy) – Zone Z7 in the Dublin City Development Plan 2022–2028. Furthermore, part of the landfall area falls into the Poolbeg West Strategic Development Zone (SDZ). On this basis, the onshore development area could see some development (and interaction with the hydrology and hydrogeology environment) in future years, subject to planning permission.

108. Based on a review of the baseline environment, it was considered that climate change and natural trends will have an impact on the hydrology and hydrogeology environment in terms of rising flood levels. A climate change allowance was incorporated into the assessment of flood risk as part of the SSFRA which is summarised in **Section 20.6.4** and provided in **Appendix 20.2**.

20.7 Scope of the assessment

109. An EIA scoping report for the OTI was published on the 06 May 2021. The scoping report was uploaded to the CWP Project website and shared with regulators, prescribed bodies and other relevant consultees, inviting them to provide relevant information and to comment on the proposed approach being adopted by the Applicant in relation to the onshore elements of the EIA.

110. Based on responses to the scoping report, further consultation and refinement of the CWP Project design, the potential impacts to hydrology and hydrogeology scoped into the assessment are listed below in **Table 20-12**. There are no freshwater streams within the onshore development area. Due to the location, adjacent to transitional waters and marine environments, offshore surface water receptors and effects are addressed in **Chapter 7 Marine Water Quality**.

Table 20-12 Potential impacts scoped into the assessment

Impact No.	Description of effect	Notes
Construction		
Impact 1	Risk of leaks or spills impacting on groundwater quality.	Construction phase activities could give rise to leaks/ spills of material, such as cement, fuels, oils, or bentonite slurry, resulting in an impact to groundwater quality.
Impact 2	Mobilisation of historical contamination, resulting in impacts to groundwater quality.	The onshore development area is located in an industrial area with a history of land reclamation and landfilling. There is a potential to mobilise existing contamination, resulting in an impact to groundwater quality.
Impact 3	Discharge of water generated during the construction phase, resulting in impacts to groundwater quality.	When not managed, water discharges from construction activities could result in impacts to groundwater quality. This would include consideration of: o The water in the three tunnel shafts, when the flooded/wet caisson excavation works are completed. o Groundwater that may be encountered in excavations such as the TJBs.
Operation and maintenance		
Impact 1	Alteration of groundwater flow regime as a result of the presence of installed structures.	Alteration of the existing groundwater flow as a result of the presence of installed structures (below ground) such as the tunnel.
Decommissioning		
Impact 1	Accidental spillage or release of hydrocarbons or chemicals resulting in impacts to groundwater quality.	Decommissioning phase activities could give rise to leaks/ spills of material, such as cement, fuels, oils, or bentonite slurry.
Impact 2	Mobilisation of historical contamination, resulting in impacts to groundwater quality.	Decommissioning phase activities could mobilise existing contamination, resulting in an impact to groundwater quality.

111. Based on the scoping report, statutory consultation and refinement of the CWP Project design, a number of potential impacts to water have been scoped out.

112. These are listed below in **Table 20-13**.

Table 20-13 Potential impacts scoped out of the assessment

Description of effect	Justification for scoping out
Impacts on public and private water supplies	The onshore development area is not located in the source protection zone of any public water supplies (PWSs). Groundwater beneath the site is brackish and not suitable for public consumption.
Discharge to ground impacting on groundwater quality	There are no proposed wastewater discharges to ground during the operational and maintenance phase.
Release of foul water which could result in impacts to groundwater quality (construction and decommissioning phase)	The temporary construction compounds will be established with appropriate services including water and wastewater (i.e. welfare facilities). These provisions will be organised and installed by the appointed contractor in advance of the commencement of the construction activities. There will be no release of foul water to the surrounding environment. The potential for impacts to groundwater quality have been scoped out of the assessment.
Release of storm water or foul water which could result in impacts to groundwater quality (O&M phase)	An Onshore Substation Site Drainage and Water Supply Design Report, submitted as part of this planning application, has been prepared to summarise the storm water and foul water drainage proposals for the CWP Project during the O&M phase, as well as the proposed potable water supply proposals. The Onshore Substation Site Drainage and Water Supply Design Report includes details of: - Storm water network design; - Storm water collection and disposal systems; - Foul water collection and disposal systems; and - Estimated potable water demand. The **Onshore Substation Site Drainage and Water Supply Design Report** will be implemented by the Applicant and its appointed contractor(s) and will be secured through conditions of the development consent. The potential for impacts to groundwater quality have been scoped out of the assessment.
Maintenance of the OTI which could result in leaks / spills of fuels and oils (O&M phase)	The onshore substation will be generally unmanned during the O&M phase. Some maintenance activities will involve the use of fluids / oils and fuels, which have the potential to impact on groundwater quality, should leaks/ spills occur. However, the onshore substation will be constructed in accordance with the relevant design standards. The site will be capped with imported fill to build up the platform level during the initial construction phase and this fill will largely be covered with hardstanding material for the O&M phase. For equipment and tanks containing hazardous fluids, secondary containment in form of sufficiently sized bunds will be provided to prevent spillage and escape into the environment Spill kits will be in place and equipment will be appropriately maintained. Any potential spills are likely to be contained within the onshore substation buildings or would access the site drainage systems, which

Description of effect	Justification for scoping out
	will include a Class 1 bypass separator and Class 1 full retention interceptor. Overall, the potential for impacts to groundwater quality during the O&M phase is not predicted to have significant effects and therefore has been scoped out of the assessment.

20.8 Assessment parameters

20.8.1 Background

113. Complex, large-scale infrastructure projects with a terrestrial and marine interface, such as the CWP Project, are consented and constructed over extended timeframes. The ability to adapt to changing supply chain, policy or environmental conditions, and to make use of the best available information to feed into project design, promotes environmentally sound and sustainable development. This ultimately reduces project development costs and therefore electricity costs for consumers and reduces CO_2 emissions.

114. In this regard, the approach to the design development of the CWP Project has sought to introduce flexibility where required, among other things to enable the best available technology to be constructed and to respond to dynamic maritime conditions, while at the same time specifying project boundaries, components and parameters wherever possible, having regard to known environmental constraints.

115. **Chapter 4 Project Description** describes the design approach that has been taken for each component of the CWP Project. Wherever possible, the location and detailed parameters of the CWP Project components are identified and described in full within the EIAR. However, for the reasons outlined above, certain design decisions and installation methods will be confirmed post-consent, requiring a degree of flexibility in the planning permission.

116. Where necessary, flexibility is sought in terms of:

- Up to two options for certain permanent infrastructure details and layouts, such as the WTG layouts.
- Dimensional flexibility, described as a limited parameter range, i.e., upper and lower values for a given detail such as cable length.
- Locational flexibility of permanent infrastructure, described as Limit of Deviation (LoD) from a specific point or alignment.

117. The CWP Project had to procure an opinion from An Bord Pleanála to confirm that it was appropriate that this application be made and determined before certain details of the development were confirmed. An Bord Pleanála issued that opinion on 25 March 2024 (as amended in May 2024), and it confirms that the CWP Project could make an application for permission before the details of certain permanent infrastructure described in **Section 4.3** of **Chapter 4 Project Description** is confirmed.

118. In addition, the application for permission relies on the standard flexibility for the final choice of installation methods and O&M activities.

119. Notwithstanding the flexibility in design and methods, the EIAR identifies, describes and assesses all of the likely significant impacts of the CWP Project on the environment.

20.8.2 Options and dimensional flexibility

120. Where the application for permission seeks options or dimensional flexibility for infrastructure or installation methods, the impacts on the environment are assessed using a representative scenario approach. A 'representative scenario' is a combination of options and dimensional flexibility that has been selected by the author of this EIAR chapter to represent all of the likely significant effects of the project on the environment. Sometimes, the author will have to consider several representative scenarios to ensure all impacts are identified, described and assessed.

121. For hydrology and hydrogeology, the infrastructure design and installation techniques with potential to give rise to hydrological and hydrogeological impacts have been confirmed in the planning application and consequently the assessment is confined to a single scenario for all construction and O&M phase impacts.

122. Design parameters relevant to the assessment of hydrology and hydrogeology are outlined in **Table 20-14**.

20.8.3 Limit of deviation

123. Where the application for permission seeks locational flexibility for infrastructure, the impacts on the environment are assessed using a LoD. The LoD is the furthest distance that a specified element of the CWP Project can be constructed.

124. LoD within the onshore development area (landward of the high water mark) are noted below in **Table 20-15.** This chapter assesses the specific preferred location for permanent infrastructure, however, the potential for the LoD to give rise to any new or materially different effects compared to those presented in **Section 20.10** of this chapter has been considered.

125. For hydrology and hydrogeology, a conclusion is provided in **Table 20-15**, which confirms that the LoDs for the permanent infrastructure relevant to hydrology and hydrogeology will not give rise to any new or materially different effects. The LoDs are therefore not considered further within this assessment.

Table 20-14 Design parameters relevant to assessment of hydrology and hydrogeology

Impact	Detail	Value	Notes / Assumptions
Construction			
Impact 1: Risk of leaks or spills impacting on groundwater quality.	**Landfall**		Construction phase activities could give rise to leaks/ spills of material, such as cement, fuels, oils, or bentonite slurry, resulting in an impact to groundwater quality.
	Temporary Infrastructure		
	Dimensions of temporary access ramp to the intertidal area for plant and equipment (including route from Compound A) (L x W) (m)	60 x 10	
	Typical duration of temporary access ramp (months)	24	
	Duration of temporary footpath diversion (weeks)	8	
	Temporary cofferdam dimensions (L x W) (m)	40 x 75	
	Installation methods and effects		
	Number of TJBs	3	
	TJB chamber dimensions (L x W x D) (m)	18 x 4 x 3	
	Number of link box chambers	6	
	Link box dimensions (L x W x D) (m)	2 x 2 x 3	
	Installation methods and effects		
	Area of site clearance at the TJBs (m^2)	2,200	
	Area of site clearance between TJBs and the HWM (m^2)	2,200	
	Area of site clearance for temporary access ramp (m^2)	600	

Onshore Export Cables	
Temporary Infrastructure	
Number of tunnel shafts and temporary tunnel compounds	3
Combined area for temporary tunnel compounds for the onshore export cables (m^2) *(Note: temporary tunnel compounds 1+3 are located within Compound A and the onshore substation site respectively.)*	20,215
Installation methods and effects	
Tunnel internal diameter (ID) (m)	3.0
Tunnel outer diameter (OD) (m)	3.6
Onshore substation launch shaft dimensions (m) below ODM	28.63
Main compound launch shaft dimensions (m) below ODM	27.5
Shellybanks road reception shaft dimensions (m) below ODM	27.5
Tunnel invert level (m) below ODM	25.30
Installation method for the TJB connection (connection between the TJBs and tunnel shaft)	Open cut
TJB connection length (m)	39
Overall duration to complete tunnel construction and cable duct installation (months)	21
Onshore Substation	
Installation methods and effects	

	Total footprint of temporary site clearance inc. access roads (m^2)	20,090	
	ESBN network cables		
	Installation methods and effects		
	Duration of the installation works for the ESBN networks cables (months)	6	
	Number of open cut sections	1	
	Number of HDD Sections	1	
	Total Length of Open Cut / HDD trenching	400	
	Total length of open cut section (m)	265	
	Total length of HDD section (m)	135	
	Depth of the HDD installation at its deepest (m bgl)	10	
	Construction Compounds		
	Compound A area (m^2)	19,800	
	Compound B area (m^2)	32,300	
	Compound C area (m^2)	3,350	
	Compound D area (m^2)	360	
Impact 2: Mobilisation of historical contamination, resulting in impacts on groundwater quality.	Refer to **Impact 1** for parameter details.		The onshore development area is located in an industrial area with a history of land reclamation and landfilling. There is a potential to mobilise existing contamination, resulting in an impact to groundwater quality.
	Onshore transmission infrastructure		

Impact 3: Discharge of water generated during the construction phase, resulting in impacts to groundwater quality	Construction programme		When not managed, water discharges from construction activities could result in impacts to groundwater quality.
	Refer to **Impact 1** for parameter details.		
	Overall estimated duration for the construction phase of the onshore transmission infrastructure (months)	36	
Operations and maintenance			
Impact 1: Alteration of groundwater flow regime as a result of the presence of installed structures	**Landfall**		This impact relates to the potential alteration of groundwater due to the presence of installed structures (below ground).
	Permanent Infrastructure		
	Number of TJBs	3	
	TJB chamber dimensions (L x W x D) (m)	18 x 4 x 3	
	Number of link box chambers	6	
	Link box dimensions (L x W x D) (m)	2 x 2 x 3	
	Onshore Export Cables		
	Permanent Infrastructure		
	Tunnel total length (m)	740	
	Tunnel inner diameter (m)	3.0	
	Tunnel outer diameter (m)	3.6	
	Onshore Substation		
	Permanent Infrastructure		
	Diameter of tubular piles (m)	2.5	
	Length of tubular piles and infill sheet piles (m)	40	

	Embedment depth of tubular piles and infill sheet piles (mOD)	-35	
	ESBN Network Cables		
	Permanent Infrastructure		
	Number of onshore export cable circuits	3	
	Total length of ESBN network cable ducts and associated cables (m)	400	
	Depth of cover along open cut section (m)	1.2	
	Depth of the HDD installation at its deepest (m bgl)	10	
Decommissioning			
Impact 1: Accidental spillage or release of hydrocarbons or chemicals resulting in impacts to groundwater quality.	It is recognised that legislation and industry best practice change over time. However, for the purposes of the EIA, at the end of the operational lifetime of the CWP Project, it is assumed that all OTI will be removed where practical to do so. In this regard, for the purposes of an assessment scenario for decommissioning impacts, the following assumptions have been made: • The TJBs and onshore export cables (including the cable ducting) shall be completely removed. • The landfall cable ducts and associated cables shall be completely removed.		

Impact 2: Mobilisation of historical contamination, resulting in effects on groundwater.	• The underground tunnel, within which the onshore export cables will be installed shall be left in situ and may be re-used for the same or another purpose. • The onshore substation buildings and electrical infrastructure shall be completely removed. • The reclaimed land, substation platform, perimeter structures and the new access bridge at the onshore substation site will remain in situ and may re-used for the same or another purpose. • The ESBN network cables (including the cable ducting) shall be completely removed. The general sequence for decommissioning is likely to include: • Dismantling and removal of electrical equipment; • Removal of ducting and cabling, where practical to do so; • Removal and demolition of buildings, fences, and services equipment; and • Reinstatement and landscaping works. Closer to the time of decommissioning, it may be decided that removal of certain infrastructure, such as the TJBs, landfall cable ducts and associated cables, onshore export cables and ESBN networks cables, would lead to a greater environmental impact than leaving the components in situ. In this case it may be preferable not to remove these components at the end of their operational life. In any case, the final requirements for decommissioning of the OTI, including landfall infrastructure, will be agreed at the time with the relevant statutory consultees. It is anticipated that for the purposes of an assessment scenario, the impacts will be no greater than those identified for the construction phase.

Table 20-15 Limit of deviation relevant to assessment of hydrology and hydrogeology

Project component	Limit of deviation	LoD impact summary
TJBs	0.5 m either side (i.e., east / west) of the preferred TJB location	No potential for new or materially different effects
Landfall cable ducts	Defined LoD boundary (see Chapter 4 Project Description)	No potential for new or materially different effects
Location of onshore substation revetment perimeter structure	Defined LoD for sheet piling at toe of the revetement	No potential for new or materially different effects

20.9 Primary mitigation measures

126. Throughout the evolution of the CWP Project, measures have been adopted as part of the evolution of the project design and approach to construction, to avoid or otherwise reduce adverse impacts on the environment. These mitigation measures are referred to as 'primary mitigation'. They are an inherent part of the CWP Project and are effectively 'built in' to the impact assessment.

127. Primary mitigation measures relevant to the assessment of hydrology and hydrogeology are set out in **Table 20-16** and in the impact assessment (**Section 20.10**). Additional mitigation includes measures that are not incorporated into the design of the CWP Project and require further activity to secure the required outcome of avoiding or reducing impact significance.

Table 20-16 Primary mitigation measures

Project Element	Description
Construction	
Onshore export cables	For installation of the onshore export cables, a flooded or wet caisson will be utilised during the excavation of the three tunnel shafts, to limit the generation of brackish groundwater. The objective of the wet caisson is to excavate in permeable ground while limiting the generation of groundwater requiring treatment and disposal. Groundwater levels in the caisson will be maintained at the existing groundwater levels. The wet caisson will progress through the sand and gravels and be completed within the underlying low permeability clay. A concrete plug will provide a sealed working base for each tunnel drive to allow safe pipe jacking operations.
OTI: site selection	In general, the CWP Project has sought to specify the location, scale and extents of permanent and temporary infrastructure, however in some cases a degree of locational flexibility is required. Locational flexibility of permanent infrastructure is described as a LoD from a specific point or alignment. LoDs, described in **Chapter 4 Project Description**, are required to take account of additional ground condition data acquired during pre-construction site investigation surveys and results from pre-construction surveys.

20.10 Impact assessment

20.10.1 Construction phase

128. The potential environmental impacts arising from the construction of the CWP Project are listed in **Table 20-12**, along with the parameters against which each construction phase impact has been assessed. A description of the potential effect on hydrology and hydrogeology receptors caused by each identified impact is given below.

Impact 1: Risk of leaks or spills impacting on groundwater quality.

129. A number of consumables such as oils, fuels, cement and bentonite will be used during the construction phase. Potential spills/leaks could impact on groundwater quality.

130. Bentonite will be used as part of the installation of the onshore export cables (associated with installation of the tunnel shafts and the tunnel boring) and ESBN network cables (use of HDD). For the tunnel and HDD works, a bentonite suspension will be used to help convey the soil cuttings out of the excavations. The bentonite and excavated material will be separated in a treatment plant, located in the temporary compounds. The bentonite will then be reused in the tunnelling/HDD process. It is noted that bentonite slurry used for the tunnelling and HDD installations is chemically inert and poses a low environmental hazard to the surrounding environment.

131. The main potential for spills/leaks are therefore associated with:

- Use and maintenance of construction traffic and machinery;
- Refuelling of construction traffic and machinery;
- The use of concrete on-site; and
- Frac out/discharge of the drilling fluids (bentonite suspension) during tunnelling and HDD activities.

Receptor sensitivity

132. The groundwater quality within the onshore development area reflects the history of infilling and reclamation on the peninsula.

133. Offshore and transitional zone receptors are addressed in **Chapter 7 Marine Water Quality**.

134. Therefore, for the purpose of this assessment, groundwater receptor sensitivity is considered Low.

Magnitude of effect

135. Construction activities will be undertaken over a 36-month period. Leaks or spills could occur during this phase and depending on the scale of the incident, there may negative impacts on groundwater quality. As there are no watercourses within the onshore development area, no potential for alteration of the bedrock aquifer and no drinking water supplies associated with the area, the magnitude of the effect is Low.

136. Pre-mitigation potential effects are:

- Negative – effects will likely reduce the quality;
- Low adverse – depending on the magnitude of such an event, it could result in a minor impact on the integrity of the groundwater;
- Unlikely – significant spillage or release of hydrocarbons or chemicals is not expected to occur;
- Temporary to short term – depending on the magnitude of such an event, the effects of a spillage would be expected to last less than seven years; and
- Reversible – i.e., potential effects can be mitigated and managed.

Significance of the effect

137. The sensitivity of the groundwater receptor was considered to be Low and the magnitude of the effect was assessed as Low. Therefore (as per the matrix in **Table 20-5**), the significance of effect is **Not Significant**, which is not significant in EIA terms.

Additional mitigation

138. Based on the predicted level of effect, additional mitigation is not required beyond the primary mitigation described in **Section 20.9**. However, the additional mitigation outlined below will also be implemented during the construction phase of the OTI.

139. The Applicant's contractors will adopt specific measures relevant to the prevention of contaminant supply to water bodies. These are secured in the **Construction Environmental Management Plan (CEMP)**, submitted as part of the planning application, and will prevent immediate discharge of contaminated water and sediment from the onshore construction works. These measures include:

- Situating concrete and cement mixing and washing areas at least 10 m away from the nearest water body. These areas will incorporate settlement and recirculation systems to allow water to be reused. All washing out of equipment would take place in a contained area and the water collected for disposal offsite.
- Storing all fuels, oils, lubricants and other chemicals in impermeable bunds with at least 110 % of the stored capacity, with any damaged containers being removed from site. Refuelling would take place in a dedicated impermeable area, using a bunded bowser, located at least 10 m away from the nearest water body, where practicable to do so.
- Ensuring that spill kits are available on site at all times as well as sandbags and stop logs for deployment on the outlets from the site drainage system in case of emergency spillages.
- Foul drainage (e.g., from construction welfare facilities) will be collected through mains connection to an existing mains sewer (if such a connection is available) or collected in an alarmed holding tank located within the planning application boundary and transported off site for disposal at a licensed facility with appropriate treatment capacity within its existing permit.

140. In the event of a widespread leak or spill, the following measures shall be implemented in addition to the most up to date standard practices at the time of the event:

- The source of the leak or spill shall be cut off as soon as possible;
- The material shall be bunded immediately to prevent further spread;
- The relevant authorities shall be contacted, including those who will be able to assist in the clean-up of the leak or spill; and
- A remediation plan shall be implemented to monitor and remediate the leak or spill.

141. Measures specific to the control of drilling fluids (i.e., bentonite) during the tunnel and HDD installation are listed below:

- The drilling fluid / bentonite will be non-toxic and naturally biodegradable (i.e., Clear Bore Drilling Fluid or similar will be used);
- The area around the bentonite batching, pumping and recycling plant will be bunded using terram and sandbags in order to contain any spillages;
- Drilling fluid returns will be contained within a sealed tank / sump to prevent migration from the works area;
- The drilling process / pressure will be constantly monitored to detect any possible leaks or breakouts into the surrounding environment. This will be gauged by observation and by monitoring the pumping rates and pressures. If any signs of breakout occur, then drilling will be immediately stopped;
- Spills of drilling fluid will be cleaned up immediately and stored in an adequately sized skip before being taken off site;
- Daily monitoring of the works area and the water treatment and pumping system, will be completed by a suitably qualified person during the construction phase. All necessary preventative measures will be implemented to ensure no entrained sediment is discharged.

Residual effect

142. With the adoption of the additional mitigation measures outlined above, the magnitude of impact will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible**, which is not significant in EIA terms.

Impact 2: Mobilisation of historical contamination, resulting in impacts to groundwater quality.

143. This impact relates to the excavation of potentially contaminated materials during the construction phase, which could mobilise historical contamination and result in impacts to groundwater quality.

144. The key activities requiring the management of excavated soil materials are the:

- Initial site clearance and site-preparation activities;
- Open-cut excavations through the berm at the landfall and installation of the landfall cable ducts;
- Excavation of the three temporary tunnel shafts;
- Arisings from the tunnel boring works for the onshore export cables;
- Preparation of the platform level at the onshore substation site, including management of existing stockpiles at this site;
- Excavation of the DPC turning circle at the onshore substation site;
- Open-cut excavations for the ESBN network cables; and
- HDD works for the ESBN network cables.

145. The deepest excavations are for the three tunnel shafts. The excavation of the tunnel shafts will go through the Made Ground, the sand and gravel deposits and finishing in the clay horizon above the bedrock, from where the tunnel will then be installed.

146. The potential to encounter contaminated material and impact on underlying groundwater occurs predominantly in the shallow Made Ground layer and is summarised below:

- Historically contaminated soils (i.e. organic waste material, such as domestic and light industrial waste (e.g., paper, newspaper, plastic, bottles, timber)) were recorded at the landfall site. This material may be encountered during the excavations in this area, including the TJBs, the open cut trench from the TJBs to the tunnel shaft and the tunnel shaft itself, in temporary tunnel compound 1 (in Compound A).
- No significant contamination was recorded at temporary tunnel compound 2 (reception shaft) or at temporary tunnel compound 3 (launch shaft), at the Shellybanks Road and onshore substation site respectively.

147. The groundwater quality within the onshore development area reflects a history of infilling and reclamation on the peninsula. Elevated ammonium levels were recorded in groundwater at the landfall, in particular at BH14, BH21 and BH23. This was associated with the presence of organic waste material.

148. Works during the construction phase in these areas may mobilise historical contamination and impact groundwater quality.

Receptor sensitivity

149. The groundwater quality within the onshore development area reflects the history of infilling and reclamation on the peninsula. Over 10 m of low permeability subsoils overlie the bedrock in the onshore development area. In addition, there are no surface water streams or groundwater abstractions within the onshore development area.

150. Offshore and transitional zone receptors are addressed in **Chapter 7 Marine Water Quality**.

151. Therefore, for the purpose of this assessment, groundwater receptor sensitivity is considered Low**.**

Magnitude of effect

152. There are no watercourses within the onshore development area. The deepest excavations at the landfall (i.e., tunnel shafts and tunnel) are in the low permeability clays and there will be no direct alteration of the bedrock aquifer at these locations. No drinking water supplies will be impacted. The magnitude of the effect is considered as Low. Pre-mitigation potential effects are:

- Negative – effects may reduce the groundwater quality;
- Low – the effects are not expected to significantly change existing baseline conditions;
- Likely to unlikely – any excavation may impact the shallow brackish groundwater but will not affect the bedrock aquifer;
- Temporary to short term – construction activities are phased over 36 months and construction of the tunnel undertaken over approximately 21 months; and
- Reversible – i.e., potential effects can be mitigated and managed.

Significance of the effect

153. The sensitivity of the groundwater receptor in the study area is considered to be Low and the magnitude of the effect is assessed as Low. Therefore (as per the matrix in **Table 20-5**), the significance of effect is **Not Significant**, which is not significant in EIA terms.

Additional mitigation

154. Based on the predicted level of effect, additional mitigation is not required beyond the primary mitigation described in **Section 20.9**. However, the additional mitigation outlined below will also be implemented during the construction phase of the OTI.

155. Clearance and land take will be kept to a minimum during the construction phase. The proposed construction work areas will be demarcated prior to the construction works commencing.

156. All disturbed ground will be fully reinstated/backfilled following the completion of construction works.

157. During excavation works, a watching brief will be implemented to identify the potential presence of previously unidentified contamination. Personnel appointed by the appointed contractor will be appropriately trained for these activities. Any instances of previously unidentified contamination will be recorded, and appropriate measures developed to manage the identified risks as appropriate.

158. There will be no discharges to ground during the construction phase. Dewatering may be required from excavations where groundwater is encountered. The groundwater will be pumped and tankered off-site for discharge under licence, at a licensed facility.

159. Offshore and transitional zone receptors are addressed in **Chapter 7 Marine Water Quality**. However, with regard for the interface between the groundwater and marine environment, the following mitigation will be implemented:

- As detailed in **Chapter 4 Project Description**, prior to the commencement of open cut cable duct installation at the HWM, a temporary cofferdam will be installed to act as a barrier to tidal inundation whilst the existing stone covered foreshore is temporarily removed, and the ducts installed.

- The cofferdam will be installed in such a way as to permit open cut trenching from the onshore area to the intertidal area, allowing a dry working area below the HWM. After installation of the temporary cofferdam, open cut trenching and cable duct installation will commence between the repositioned footpath and the intertidal area (within the cofferdam). A trench for each of the three No. circuits (up to 3 m in depth) will be excavated using a backhoe and / or 360° excavator, with access provided via the haul road.
- Based on water level monitoring, groundwater levels are *c*. 3.5 to 4 mbgl, therefore limited groundwater is expected to be encountered during the excavation. However, any water encountered within the open trenching will be collected at sumps and tankered off-site for discharge under licence, at a licensed facility.
- There will be no discharge of surface water or groundwater to the intertidal area.

Residual effect

160. With the adoption of the additional mitigation measures outlined above, the magnitude of effect will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible**, which is not significant in EIA terms.

Impact 3: Discharge of water generated during the construction phase, resulting in impacts to groundwater quality

161. Water generated as a result of construction works may affect groundwater quality if not managed in an appropriate manner. This includes:

- The water left in the three tunnel shafts, when the flooded/wet caisson excavation works are completed.
- Groundwater that may be encountered in excavations such as the TJBs.

162. As detailed in **Section 20.9**, for installation of the tunnel shafts, a flooded or wet caisson will be utilised, to limit the generation of brackish groundwater. Groundwater levels in each of the caissons will be maintained at the existing groundwater levels. The wet caisson will progress through the sand and gravels and be completed within the underlying low permeability clay. A concrete plug will provide a sealed working base for each tunnel drive to allow safe pipe jacking operations. Following construction of the wet caisson, water within the caisson will require disposal.

Receptor sensitivity

163. The groundwater quality within the onshore development area reflects the history of infilling and reclamation on the peninsula. Over 10 m of low permeability subsoils overlie the bedrock in the onshore development area. In addition, there are no surface water streams or groundwater abstractions within the onshore development area.

164. Offshore and transitional zone receptors are addressed in **Chapter 7 Marine Water Quality**.

165. Therefore, for the purpose of this assessment, groundwater receptor sensitivity is considered Low.

Magnitude of effect

166. As there are no watercourses on the site, no alteration of bedrock aquifer and no impact to drinking water supplies, the magnitude of the effect is Low. Pre-mitigation potential effects are:

- Negative – effects will likely reduce the water quality;
- Low adverse – water discharges from construction works could result in an impact on the local groundwater environment;
- Likely to unlikely – the works may impact the shallow brackish groundwater;
- Temporary to short term – construction works are phased and dewatering will be undertaken for a short period i.e., weeks within the 36-month construction period; and
- Reversible – i.e., potential effects can be mitigated and managed.

Significance of the effect

167. The sensitivity of receptors in the study area is considered to be Low and the magnitude of the effect is assessed as Low. Therefore (as per the matrix in **Table 20-5**), the significance of effect is **Not Significant**, which is not significant in EIA terms.

Additional mitigation

168. Based on the predicted level of effect, additional mitigation is not required beyond the primary mitigation described in **Section 20.9**. However, the additional mitigation outlined below will also be implemented during the construction phase of the OTI.

169. The groundwater from the three tunnel shafts and groundwater encountered in excavations will be pumped and tankered off-site for discharge under licence, at a licensed facility.

170. Dewatering will be undertaken in accordance with CIRIA C750 'Groundwater control – design and practice' 2nd Ed (CIRIA, 2016).

Residual effect

171. With the adoption of the additional mitigation measures outlined above, the magnitude of effect will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible**, which is not significant in EIA terms.

20.10.2 Operation and maintenance

Impact 1: Alteration of the groundwater flow regime as a result of the presence of installed structures

172. During the O&M phase, there will be underground structures which include the TJBs, cables ducts, the tunnel, backfilled tunnel shafts and piles for the perimeter structure and buildings at the onshore substation site. The presence of these structures could impact the existing groundwater flow regime.

Receptor sensitivity

173. The groundwater quality within the OTI reflects a history of infilling and reclamation of the Poolbeg Peninsula. The groundwater receptor sensitivity is Low.

Magnitude of effect

174. Installed underground structures could impact the flow patterns of the underlying groundwater. However, it is considered that that natural groundwater regime would revert to pre-construction characteristics, flowing below and around the underground structures. The magnitude of the effect is considered to be Low.

175. Pre-mitigation potential effects are:

- Negative – effects will likely impact the flow pattern;
- Low – the localised effects are not likely to significantly change existing baseline conditions;
- Likely – installation of structures may impact the underlying aquifer;
- Long-term to permanent – installed structures will remain in place for the operation of the Project; and
- Reversible – i.e., potential effects can be mitigated and managed.

Significance of effect

176. The sensitivity of receptors in the study area is considered to be Low and the magnitude of the effect is assessed as Low. Therefore, (as per the matrix in **Table 20-5**), the significance of effect is **Not Significant**, which is not significant in EIA terms.

Additional mitigation

177. Based on the predicted level of effect, additional mitigation is not required beyond the primary mitigation described in **Section 20.9**. However, the measures outlined below will also be implemented during the operational phase of the OTI.

178. Cable trenches can act as preferential pathways which could allow groundwater to migrate to the foreshore i.e., within the landfall cable ducts. While material on the peninsula at the landfall is permeable, it is proposed to limit the potential for preferential pathways along these cable trenches by using lower permeability backfill material between the TJBs and foreshore (i.e., material with lower permeability than that surrounding the cable trenches). This will prevent unintended longitudinal drainage along the trench.

Residual effect

179. With the adoption of the additional mitigation measures as outlined above, the magnitude of effect will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible**, which is not significant in EIA terms.

20.10.3 Decommissioning phase

180. It is recognised that legislation and industry best practice change over time. However, for the purposes of the EIA, at the end of the operational lifetime of the CWP Project, it is assumed that all OTI will be removed where practical to do so. In this regard, for the purposes of an assessment scenario for decommissioning impacts, the following assumptions have been made:

- The TJBs and onshore export cables (including the cable ducting) shall be completely removed.
- The landfall cable ducts and associated cables shall be completely removed.

- The underground tunnel, within which the onshore export cables will be installed shall be left in situ and may be re-used for the same or another purpose.
- The onshore substation buildings and electrical infrastructure shall be completely removed.
- The reclaimed land, substation platform, perimeter structures and the new access bridge at the onshore substation site will remain in situ and may re-used for the same or another purpose.
- The ESBN network cables (including the cable ducting) shall be completely removed.

181. The general sequence for decommissioning is likely to include:

- Dismantling and removal of electrical equipment;
- Removal of ducting and cabling, where practical to do so;
- Removal and demolition of buildings, fences, and services equipment; and
- Reinstatement and landscaping works.

182. Closer to the time of decommissioning, it may be decided that removal of certain infrastructure, such as the TJBs, landfall cable ducts and associated cables, onshore export cables and ESBN networks cables, would lead to a greater environmental impact than leaving the components in situ. In this case it may be preferable not to remove these components at the end of their operational life. In any case, the final requirements for decommissioning of the OTI, including landfall infrastructure, will be agreed at the time with the relevant statutory consultees.

183. It is anticipated that for the purposes of an assessment scenario, the impacts will be no greater than those identified for the construction phase.

20.11 Cumulative impacts

184. A fundamental component of the EIA is to consider and assess the potential for cumulative effects of the CWP Project with other projects, plans and activities (hereafter referred to as 'other development').

185. **Appendix 20-1 Cumulative Effects Assessment** presents the findings of the CEA for hydrology and hydrogeology, which considers the residual effects presented in **Section 20.10**.

186. Only potential impacts assessed as 'not significant' or above are included in the CEA (i.e. those assessed as 'imperceptible' are not taken forward as there is no potential for them to contribute to a cumulative effect).

187. As the residual impacts for the construction and O&M phases were all assessed as **Imperceptible** they were not taken forward in the CEA, as there is no potential for them to contribute to a cumulative effect.

20.12 Transboundary impacts

188. There are no transboundary impacts with regard to the hydrology and hydrogeology environment. The onshore development area would not be sited in proximity to any international boundaries. Transboundary impacts are therefore scoped out of this assessment and are not considered further.

20.13 Inter-relationships

189. The inter-related effects assessment considers the potential for all relevant effects across multiple topics to interact, spatially and temporally, to create inter-related effects on a receptor group. This includes incorporating the findings of the individual assessment chapters to describe potential

additional effects that may be of greater significance when compared to individual effects acting on a receptor group.

190. The term 'receptor group' is used to highlight the fact that the proposed approach to the inter-relationships assessment has not assessed every individual receptor considered in this chapter, but instead focuses on groups of receptors that may be sensitive to inter-related effects.

191. Chapter 5 EIA Methodology provides a matrix to show at a broad level where across the EIAR interactions between effects on different receptor groups have been identified

192. The potential inter-related effects that could arise in relation to hydrology and hydrogeology are presented in **Table 20-17**.

Table 20-17 Inter-related effects (phase) assessment for hydrology and hydrogeology

Impact / Receptor	Related chapter within this EIAR	Phase Effects and Assessment
Impact 1: Risk of leaks or spills impacting on groundwater quality.	**Chapter 19 Land, Soils and Geology**; **Chapter 7 Marine Water Quality**	Potential changes to ground conditions (including chemical quality) during construction; could affect the quality and quantity of groundwater and hydrologically connected surface water receptors. If contamination is encountered during the excavation works (i.e., during the construction phase), however mitigation measures to manage the excavation of contaminated material are presented in **Chapter 19 Land, Soils and Geology**. As a result of these mitigations, the assessment predicts no significant effects. Therefore, is not anticipated that any inter-related effects will be produced that are of greater significance than those already identified.
Impact 3: Discharge of water generated during the construction phase, resulting in impacts to groundwater quality	**Chapter 27 Traffic and Transport**	The discharge of water from the onshore development area will require transport and off-site disposal. Construction traffic volumes are assessed in **Chapter 27 Traffic and Transport** and the assessment concluded that there would be no significant residual effects on the road and junction networks. Therefore, it is not anticipated that any inter-related effects will be produced that are of greater significance than those already identified.

20.14 Potential monitoring requirements

193. No monitoring is required in relation to Hydrology and Hydrogeology.

20.15 Impact assessment summary

194. This chapter of the EIAR has assessed the potential environmental impacts on hydrogeology from the construction, operation and maintenance and decommissioning phases of the CWP Project. Cumulative, transboundary and inter-related effects were also considered.

195. With the implementation of primary and additional mitigation measures, there will be no significant residual effects on the hydrogeological environment

196. **Table 20-18**, summarises the impact assessment undertaken and confirms the significance of any residual effects.

Table 20-18 Summary of potential Impacts and residual effects

Potential Impact	Receptor	Receptor Sensitivity	Magnitude of effect	Significance of effect	Additional Mitigation	Residual effect
Construction						
Impact 1: Risk of leaks or spills impacting on groundwater quality.	Groundwater	Low	Low	Not Significant (not significant)	Additional mitigation is not required beyond the primary mitigation described in **Section 20.10**. However, additional mitigation will be implemented as detailed in **Section 20.10.1**	Imperceptible (not significant)
Impact 2: Mobilisation of historical contamination, resulting in in impacts to groundwater quality	Groundwater	Low	Low	Not Significant (not significant)	Additional mitigation is not required beyond the primary mitigation described in **Section 20.10**. However, additional mitigation will be implemented as detailed in **Section 20.10.1**	Imperceptible (not significant)
Impact 3: Discharge of water generated during the construction phase, resulting in impacts to groundwater quality	Groundwater	Low	Low	Not Significant (not significant)	Additional mitigation is not required beyond the primary mitigation described in **Section 20.10**. However, additional mitigation will be implemented as detailed in **Section 20.10.1**	Imperceptible (not significant)

<table>
<tr><th>Potential Impact</th><th>Receptor</th><th>Receptor Sensitivity</th><th>Magnitude of effect</th><th>Significance of effect</th><th>Additional Mitigation</th><th>Residual effect</th></tr>
<tr><td colspan="7">Operation and Maintenance</td></tr>
<tr><td>Impact 1: Alteration of the groundwater flow regime as a result of the presence of installed structures</td><td>Groundwater</td><td>Low</td><td>Low</td><td>Not Significant
(not significant)</td><td>Additional mitigation is not required beyond the primary mitigation described in Section 20.10. However, additional mitigation will be implemented as detailed in Section 20.10.2.</td><td>Imperceptible
(not significant)</td></tr>
<tr><td colspan="7">Decommissioning</td></tr>
<tr><td>Impact 1: Accidental spillage or release of hydrocarbons or chemicals resulting in impacts to groundwater quality</td><td>Groundwater</td><td>Low</td><td colspan="4" rowspan="2">Activities associated with decommissioning are not predicted to exceed those of the activities assessed for the construction phase. Furthermore, in most cases, impact magnitude in terms of groundwater receptors are expected to be of a shorter duration and lesser magnitude than during construction.</td></tr>
<tr><td>Impact 2: Mobilisation of historical contamination, resulting in in impacts to groundwater quality</td><td>Groundwater</td><td>Low</td></tr>
</table>

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