

21.0 Soils, Geology and Contamination

Introduction

- 21.1 This chapter of the Environmental Impact Assessment Report ('EIAR') has been prepared by Fairhurst Group LLP and presents an assessment of the likely significant effects of the proposed development with respect to the Ground Conditions.
- 21.2 This chapter discusses the impact of soils, groundwater, geology and contamination from an onshore perspective. With respect to the groundwater, this chapter discusses the impacts of onshore groundwater to Loch Ryan.
- 21.3 In addition to the above this chapter will assess the risk to the receptors from the reuse of offshore material, which may be brought on shore as part of the works.
- 21.4 To summarise, this chapter assesses:
- Exposure to onshore soil contamination for construction workers and site end users;
 - Onshore soil contamination migration to the water environment;
 - Onshore soil contamination risk to plant life;
 - Onshore ground gas pathways risk to construction workers, site end users and buildings;
 - Risk of onshore fuel spillage to the water environment and construction workers;
 - Onshore dust generation as a nuisance and risk to construction workers;
 - Aggressive onshore ground conditions risk to buildings and services; and
 - Assessing the onshore risk to receptors, in relation to the reuse of offshore material on land.
- 21.5 The implications of all other over water environmental impacts, namely surface water quality and hydromorphology, are discussed in **Chapter 11.0**, Water Quality. Coastal processes are fully discussed in **Chapter 7** whilst flood risk is discussed in **Chapter 10.0**.
- 21.6 As part of the proposed development, there will be a land reclamation exercise. Currently it is yet to be confirmed the source of the material to be used in the reclamation, however, there is the potential that a proportion of the dredged material will be utilised as part of this exercise. As such, discussion in relation to the offshore ground conditions will be made relative to the potential reclamation works.

Competency Statement

- 21.7 This chapter has been prepared by Fairhurst Group LLP, a multi-disciplinary engineering consultant.
- 21.8 The soils, geology and contamination chapter has been prepared under the instruction of:
- Kirsty Walker BSc (Hons), Technical Manager, who is a Chartered Geologist and included on the Register of Ground Engineering Professionals (roGEP). Kirsty has, in excess of 20 years 'experience working within the ground investigation and contaminated land sector including providing critical advice in relation to environmental risk assessment, waste management and remediation, whilst working closely with regulators to ensure that development sites progress through planning, building warrant and construction stage. Kirsty has previously completed various Environmental Impact Assessment (EIA) ground conditions chapters for major redevelopment projects including former docklands and former colliery sites.

Appendices

- 21.9 Appendix (Volume 21-1): Fairhurst's Stranraer Marina, Stranraer. Geo-Environmental and Geotechnical Interpretative Report. Report reference: 161378-FRH-XX-00-RP-G-000001, dated December 2024; Issue C01, dated July 2025.

Legislation, Guidance and Policy

Introduction

- 21.1 The following legislation and guidance is relevant to the proposed development in the context of this chapter.

Legislative and Policy Framework

Climate Change

- 21.10 The Climate Change (Scotland) Act 2009¹ details the Scottish Government's ambitious climate change legislation including a 2050 net zero and interim carbon targets based upon a climate change plan for a just transition.
- 21.11 Given the nature of the assessment in this chapter and the types of pollutant linkages considered, it is considered that climate change is unlikely to impact or alter the assessment process of the conclusions reached.

¹ Climate Change (Scotland) Act 2009

National Planning Policy Context

National Planning Framework 4 (NPF4)

21.12 Overarching planning policies for Scotland are contained within the 'National Planning Framework 4' (NPF4)². For this Chapter of the EIA reference should be made to the Brownfield, vacant and derelict land and empty buildings policy.

National and Regional Strategies

21.13 The following national planning policies are relevant to the proposed development:

- Environmental Protection Act 1990³.

21.14 The following regional planning policies are relevant to the proposed development:

- National Planning Framework 4 (NPF4)²;
- Contaminated Land (Scotland) Regulations 2000⁴; and
- Scottish Government Planning Advice Note PAN33⁵.

Local Policy and Guidance

Dumfries and Galloway Council Local Development Plan 2 (LDP2)⁶

21.15 The Dumfries and Galloway Local Development Plan 2, October 2019 is the local policy and guidance, which is relevant to the proposed development, with policy IN10 relevant to this chapter.

Guidance

21.16 The following guidance documents are relevant to the proposed development:

- Scottish Executive, 2000, Planning Advice Note 33, 'Development of Contaminated Land'⁷;
- Scottish Executive, 2000, Planning Advice Note 33, 'Development of Contaminated Land'⁸;
- CL:AIRE Development Industry Code of Practice (2008)⁹;
- Hazardous Waste, Interpretation of the Definition and Classification of Hazardous Waste, Scottish Environment Protection Agency (SEPA) Technical Guidance WM2, 3rd Edition, 2013¹⁰;
- Land Contamination Risk Management (LCRM) Report (October 2020; Updated July 2023)¹¹;

² Scottish Government: National Planning Framework 4: February 2023

- BS 10175:2011 (A2:2017) 'Investigation of Potentially Contaminated Sites'¹²;
- BS 5930:2015 (A1;2020) 'Code of Practice for Ground Investigations'¹³;
- BS ISO 18772:2008 Soil Quality – Guidance on leaching procedures for subsequent chemical and eco-toxicological testing of soils and soil materials¹⁴;
- Environment Agency, 2000, Technical Report P5-056/TR, 'Technical Aspects of Site Investigation' Vol. I and II¹⁵;
- BS8485:2015+A1:2019, 'Code of Practice for the characterisation and remediation from ground gas in affected developments'¹⁶;
- BS8576:2013, 'Guidance on investigations for ground gas – permanent gases and Volatile Organic Compounds'¹⁷;
- BS 3882:2015, Specification for Topsoil;¹⁸
- BS 6349-1-4:2013 British Standard Maritime Works, Part 1-4: General – Code of practice for materials¹⁹;
- BRE Special Digest 1, Concrete in Aggressive Ground, (3rd Edition), 2005²⁰;
- BRE 2004 Standard Cover Systems for Land Regenerations (2004)²¹;
- CIRIA C716 Remediating and mitigating risks from volatile organic compound (VOC) vapours from land affected by contamination²²;
- CIRIA C665, Assessing Risks Posed by Hazardous Ground Gas to Buildings, 2007²³;
- CIRIA 682 The VOCs handbook, Investigating, assessing and managing risks²⁴;
- CIRIA C674 "The use of concrete in maritime engineering – a good practice guide"²⁵;
- Guidance for the Selection of Water Supply Pipes to be Used in Brownfield Site UKWIR Report Ref No. 10/WM/03/21²⁶;
- New Waste Acceptance Criteria Protocols in accordance with Landfill (Scotland) Regulations 2003 on 16th July 2004²⁷;
- SEPA Land Remediation and Waste Management Guidelines 2012²⁸;
- SEPA, WAT PS 10 01 Assigning Groundwater Assessment Criteria for Pollutant Inputs, v 3.0, August 2014²⁹;
- SEPA, Supporting Guidance (WAT-SG-53) Environmental Quality Standards and Standards for Discharges to Surface Waters, Version v6.1, February 2018³⁰;

- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017³¹ (as amended);
- The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017³²; and,
- The Public Water Supplies (Scotland) Regulations 2014³³.

Sources

- BGS online viewers (geology and hydrogeology) - www.bgs.ac.uk³⁴;
- National Library of Scotland (NLS) Historical Maps - <http://maps.nls.uk>³⁵;
- Scottish Environment Protection Agency (SEPA) - www.sepa.org.uk³⁶;
- Canmore: National Record of the Historic Environment (Part of Historic Environment Scotland) – www.canmore.org.uk³⁷; and
- UK Radon - <http://www.ukradon.org/information/ukmaps>³⁸.
- Stranraer Marina, Best Practicable Environmental Option (BPEO) Report. Envirocentre, July 2025³⁹

Methodology Used For Assessment

Introduction

21.17 This section presents the methodology utilised to assess the potential effects of the proposed development in relation to the Ground Conditions.

Consultation

Scope

21.18 The EIA Scoping Report identified the key issues to be addressed by this chapter are as follows:

- Confirm site geology as identified in British Geological Survey³⁴ maps through intrusive ground investigation;
- Establish contaminant status of sediments to be dredged to ascertain if they are suitable for re-use within the site for reclamation;
- Undertake contaminated land assessment in accordance with Environment Agency and SEPA guidance. This will include an assessment of the dredged sediments to ascertain if they will pose an unacceptable risk to site end users and environmental receptors if used for reclamation. A land and marine based ground investigation will be undertaken to establish ground conditions and to collect soil, sediment and groundwater samples for laboratory analysis for a wide suite of contaminants including selected metals, Polycyclic Aromatic Hydrocarbons (PAHs), Total Petroleum Hydrocarbons (TPH), Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), cyanide and asbestos;
- In the event that dredged material is utilised as part of the reclamation works, consultation with Marine Scotland and/or SEPA will be required to obtain the appropriate license;
- Over water ground investigation to establish the suitability of the dredged material for potential re-use in the land reclamation; and
- An assessment of the material against the criteria set out in the SEPA Land Remediation and Waste Management Guidelines.

21.19 Following submission of the Scoping Report, a Scoping Opinion prepared by Marine Scotland, dated February 2023, was received, which states the following in relation to this chapter:

'The Scottish Ministers are content that to the extent that the effects relate to the marine licensable activities of the Proposed Works, then the identified impacts are scoped in for further assessment within the EIA Report for the construction stage only.'

³⁴ BGS online viewers (geology and hydrogeology) - www.bgs.ac.uk

'This is in relation to the impact of ground contamination and an assessment of the suitability of dredged sediments to be reused for land reclamation as the proposed potential impacts to be scoped in to the assessment. '

- 21.2 Whilst the Scoping Opinion stated that any further assessment required to address risk during construction phase, in our opinion, given the potential for complete pollutant linkages at the operational phase, it was considered prudent to also assess these impacts.

Study Area

- 21.20 The site is located within the existing Stranraer Marina and Harbour, Stranraer, with the National Grid Reference (NGR) for the approximate centre of the site being NX 05928 61099. The general location of the site is shown in **Figure 21-1**.
- 21.21 Stranraer Marina is located on the southern edge of Loch Ryan and the site occupies an area of approximately 11ha, which covers both the onshore land harbour side and offshore within the Marina itself. The area of onshore land comprises a combination of hardstanding and soft landscaping. The Harbour Office is located on the harbour side of the Marina and can be accessed from Market Street (A717).
- 21.22 The proposed development will comprise of a combination of on-land development, expansion of the existing marina facilities, construction of new/extension of existing breakwaters, land reclamation and new sections of revetment.

Baseline conditions

- 21.23 The baseline conditions have been assessed using a combination of published sources as documented within the desk study section of the Stranraer Marina, Geo-Environmental and Geotechnical Interpretative Report (Report reference: 161378-FRH-XX-00-RP-G-000001, dated December 2024; Issue C01, dated July 2025), which is included in **Appendix 21-1 (Volume 2)**, and conditions confirmed through intrusive investigation which are also reported within the Interpretative Report in **Appendix 21-1 (Volume 2)**.

Impact Assessment Methodology

- 21.24 The aim is to assess any likely environmental effects on the identified receptors resulting from both construction (temporary) and operational (permanent) phases of the proposed development; and to identify mitigation or design measures to reduce, eliminate or offset these effects where required.
- 21.25 Likely significant effects are assessed taking into account any mitigation embedded into the design of the proposed development. Any additional mitigation required is then identified and described before any residual effects are assessed. The assessment undertaken also takes into account any cumulative effects identified and ensures that the mitigation is still sufficient for any additional effects in this regard. The EIA ensures that proper consideration is given to

sensitive receptors and that environmental effects and proposed mitigation are fully known, to both the public and the Council.

21.26 The significance of the potential adverse and / or beneficial effects of the proposed development have been assessed, taking the following into account, the sensitivity of the receptor and the potential magnitude should the effect occur, with the criteria outlined below.

Construction Phase (Temporary)

21.27 The construction phase considers temporary likely effects resulting from the construction of the proposed development.

Operational Phase (Permanent)

21.28 The operational phase considers permanent likely effects resulting from the operation of the proposed development.

Sensitivity of Receptor

21.29 The sensitivity of each receptor was evaluated from its baseline quality and the importance of associated attributes. With respect to ground profile and identified receptors, there is no set matrix of conditions to assess against. As a result, professional judgement is utilised to assess the sensitivity of receptors. Any designated sites of geological importance will also have to be taken into consideration as part of this assessment.

21.30 This assessment is considered to be equivalent to that undertaken and recorded as part of the Conceptual Site Model, presented within the Geo-Environmental and Geotechnical Interpretative Report in Appendix 21-1.

21.31 The criteria for assessing the sensitivity of a receptor are detailed in **Table 21-1**.

Table 21-1: Sensitivity Criteria for Receptors

Sensitivity	Criteria
High	High importance and rarity, international or national scale and very limited potential for substitution.
Medium	Attribute has medium quality and rarity on a local scale.
Low	Attribute has a low quality and rarity on a local scale.
Negligible	Very low importance and rarity, local scale.

Magnitude of Impact

21.32 The magnitude of impact considers the scale of the predicted change to the baseline whilst taking into account the duration and whether the effect is direct or indirect. The magnitude of a potential effect is independent of the sensitivity of the attribute.

21.33 The criteria for determining the magnitude of an impact are based on **Table 21-2**.

Table 21-2: Criteria to Determine the Magnitude of Effects

Magnitude	Criteria
High	Total loss or major alteration to key features of the baseline conditions such that post development character/composition of baseline condition will be fundamentally changed.
Medium	Loss or alteration to one or more key features of the baseline conditions such that post development character/composition of baseline condition will be materially changed.
Low	Results in some measurable change in attributes quality or vulnerability compared to the baseline conditions. Changes arising from the alteration will be detectable but not material; underlying the character/composition of baseline condition will be similar to the pre-development situation.
Negligible	Very little change from baseline conditions. Change is barely distinguishable approximately to a 'no change' situation.
Beneficial	Benefit to, or addition of, key characteristics, features or elements compared to baseline conditions.

Significance of Effect

21.34 The overall significance of effects, detailed in **Table 21-3**, was determined taking into account sensitivity and magnitude, as set out above.

Table 21-3: EIA Matrix - Assigning Significance of Effect

Sensitivity of Receptor	Magnitude of Impact				
	High	Medium	Low	Negligible	Beneficial
High	Substantial	Moderate/Substantial	Slight/Moderate	Slight	Beneficial
Medium	Moderate/Substantial	Moderate	Slight	Negligible/Slight	Beneficial
Low	Moderate	Slight/Moderate	Negligible/Slight	Negligible	Beneficial
Negligible	Negligible	Negligible	Negligible	Negligible	Beneficial

21.35 Effects assigned as being Substantial, Moderate/Substantial, Moderate, or Slight/Moderate are considered significant. Effects assigned as Slight, Negligible/Slight, or Negligible are considered not significant.

Limitations to Assessment

- 21.36 As would be the case with any site, materials uncharacteristic, to those recorded within this assessment, including the presence of gross contamination may be present in any areas not already investigated. Should any materials differing to those described in the baseline conditions be encountered, additional environmental risk assessments should be undertaken, as appropriate.

Baseline Conditions

Ground Conditions

Made Ground

- 21.37 The British Geological Survey (BGS) Online GeoIndex viewer³⁴ has recorded the presence of Made Ground within the onshore area of the site, which is considered to relate to the former reclamation of this area.
- 21.38 The geological map³⁴ evidence has not recorded the presence of Made Ground offshore.
- 21.39 The onshore intrusive site works, undertaken across two separate phases, with the first being in June / August 2021 and the second in August / September 2024, have confirmed the presence of Made Ground across this section of the site, which extends to depths of between 0.80m bgl and 6.70m bgl. The Made Ground was recorded to be variably granular and cohesive in nature and often contained inclusions of anthropogenic material including fragments of red brick, concrete, pipe, rubber, timber, plastic and pottery.
- 21.40 In addition to onshore works, the aforementioned intrusive works (June / August 2021 and August / September 2024) carried out offshore intrusive investigation, with no Made Ground encountered.

Superficial Geology

- 21.41 The British Geological Survey (BGS) Online GeoIndex viewer³⁴ records the superficial geology underlying the majority of the onshore area to comprise of Marine Beach Deposits, documented to consist of clay, silt, sand and gravel. The southern onshore area is recorded to be underlain by Raised Marine Beach deposits comprising gravel, sand, and silt.
- 21.42 The BGS Online GeoIndex viewer³⁴ records the offshore superficial deposits are also documented to comprise of Marine Beach deposits, again consisting of clay, silt, sand and gravel.
- 21.43 The onshore intrusive investigation recorded the superficial geology underlying the Made Ground site to comprise granular and cohesive Marine deposits, with the base proven to a maximum depth of 11.70m bgl. The Marine deposits were found to be underlain by a combination of granular and cohesive Glacial deposits. All exploratory holes were terminated in the Glacial Deposits, with these proven to a maximum depth of 23.50m bgl.
- 21.44 The offshore intrusive investigation recorded the superficial geology to consist of Marine Deposits. These deposits were present from seabed and to a maximum depth of 8.40m bgl,

³⁴ BGS online viewers (geology and hydrogeology) - www.bgs.ac.uk

with these comprising of granular and cohesive strata. The Marine deposits were in turn underlain by granular and cohesive Glacial deposits that were proven to a maximum depth of 30.00m bgl.

Bedrock Geology

- 21.45 The British Geological Survey (BGS) Online GeoIndex viewer³⁴ records the bedrock underlying both the onshore and offshore investigation areas as belonging to the Loch Ryan Formation of Permian Age. This formation is documented to comprise coarse breccia-conglomerate of greywacke clasts in a red sandstone matrix and thin beds of sandstones.
- 21.46 Bedrock was not encountered during the onshore and offshore intrusive investigations.

Hydrogeology

- 21.47 The BGS hydrogeological digital map (1:625,000)³⁴ indicates that the Loch Ryan Formation belonging to the Stewarty Group parent unit (Bedrock), underlying the site, is classed as a moderately productivity aquifer with unfractured low permeability Breccias.
- 21.48 The SEPA Water Environment Hub Interactive Map³⁶ records the bedrock aquifer to belong to the Stranraer groundwater body which is present beneath the site (SEPA ID: 150557), with the overall environmental condition recorded as being poor.
- 21.49 The groundwater vulnerability (Scotland) map³⁹ as shown in **Figure 21-1** indicates the groundwater underlying the Site to have a vulnerability class of 4a indicating it is vulnerable to pollutants not readily adsorbed or transformed.

³⁴ BGS online viewers (geology and hydrogeology) - www.bgs.ac.uk

³⁶ Scottish Environment Protection Agency (SEPA) - www.sepa.org.uk

³⁹ BGS. User Guide: Groundwater Vulnerability (Scotland) GIS dataset, Version 2. Revised Report. Open Report OR/15/002. 2015.

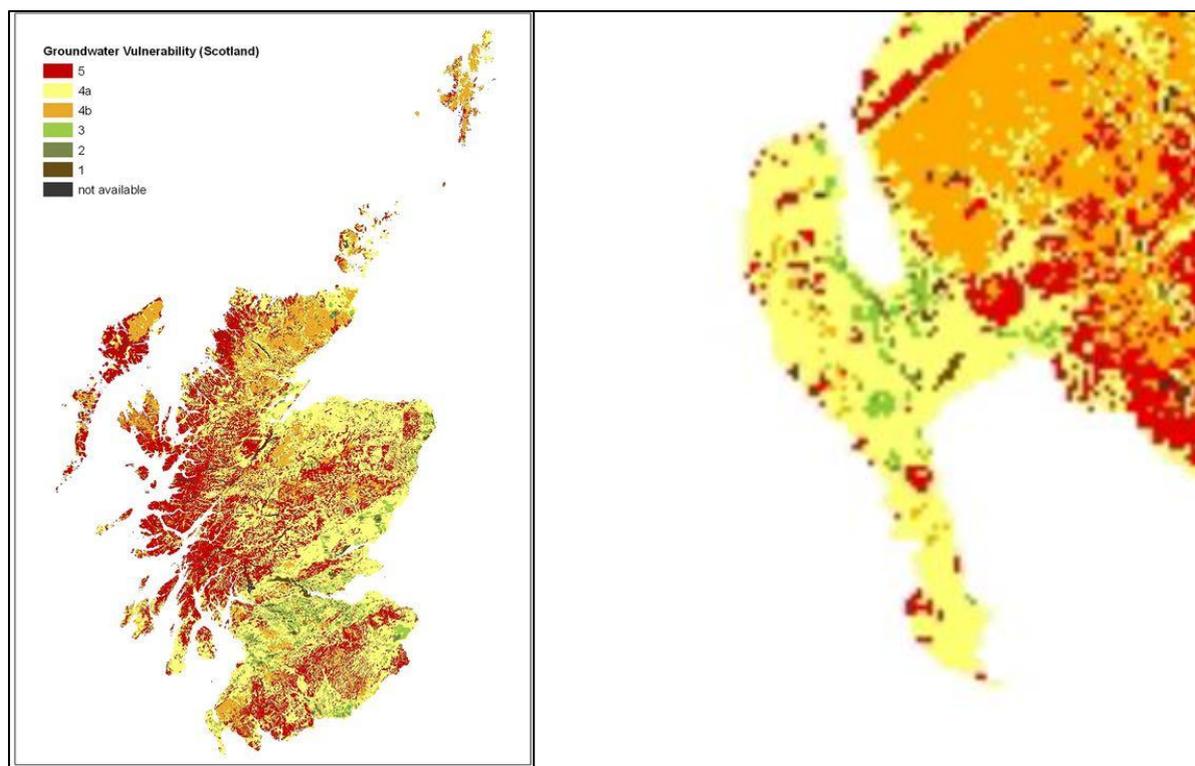


Figure 21-1: Groundwater Vulnerability (Scotland) Map, Version 2³⁹ with the site shown within the enlarged area

21.50 The superficial deposits have been classified as a groundwater body by SEPA, with their Water Environment Hub Interactive Map³⁶ stating these form the Stranraer Sand and Gravel groundwater body (SEPA ID: 150736). In accordance, with SEPA Position Statement (WAT-PS-10-01)²⁹, given that this site is within the immediate vicinity of a major groundwater discharge zone, namely Loch Ryan, resource potential considerations are not appropriate and the superficial groundwater can be discounted as a receptor.

Hydrology

21.51 The closest classified surface water body is the Loch Ryan, which is within the site boundary forming the offshore area. The SEPA Water Environment Hub Interactive Map³⁶ records the overall condition of Loch Ryan (SEPA ID: 200011) to be good, with this water body being classified as 'Coastal'. Given the proximity and scale of Loch Ryan, it is considered that the onshore groundwater will flow in a northerly direction towards this.

²⁹SEPA, WAT PS 10 01 Assigning Groundwater Assessment Criteria for Pollutant Inputs, v 3.0, August 2014

³⁶ BGS. User Guide: Groundwater Vulnerability (Scotland) GIS dataset, Version 2. Revised Report. Open Report OR/15/002. 2015.

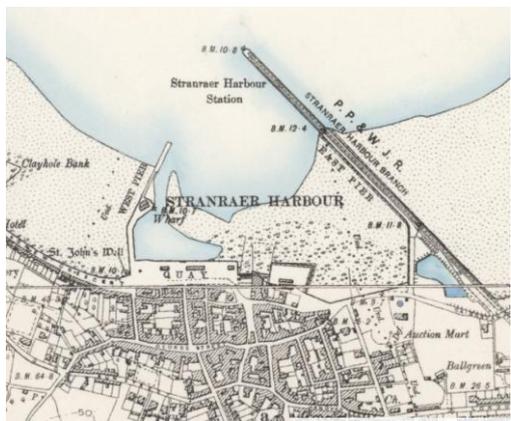
Site History

21.52 Information regarding the history of the site and surrounding area has been obtained from the Groundsure Report (Report reference GS-8353837, dated November 2021 included within the Geo-Environmental and Geotechnical Interpretative Report included as **Appendix 21-1 (Volume 2** of the EIAR) and the NLS maps³⁵.

Table 21-4: Historical Map Review of the Site and Surrounding Area

Date of OS Map	Notable Features	Potential Contamination Sources	
		On Site	Off Site (within 500m)
1849	<p>Onshore: An area of proposed car park/workshop is shown to be located within the foreshore, present between high water tide and low water tide extents. A dashed line is shown to cut the eastern section of this area, running SW/NE terminating in Loch Ryan. Pier adjacent to this area is present, labelled West Pier and contains a small building labelled Steam Boat Wharf.</p> <p>Offshore: Majority of existing marina/harbour is shown to be a combination of water and 'mud' and located between the high tide and low tide extents.</p> <p>Off site: East Pier is located to the east of the existing harbour, and at this time labelled New Pier. This is shown to contain a railway line and station. Stranraer present to the south of the site and comprises of a series of unlabelled structures, likely combination of residential/ commercial and industrial buildings.</p>	-	<p>Railway land</p> <p>Made Ground associated with development of surrounding area</p>

³⁵ National Library of Scotland (NLS) Historical Maps - <http://maps.nls.uk>

Date of OS Map	Notable Features	Potential Contamination Sources	
		On Site	Off Site (within 500m)
1893/94	<p>Onshore: Area of existing Market Street car park is shown to contain three small warehouses.</p> <p>Offshore: Area adjacent to West Pier now contains water, which prior was mentioned to contain 'mud'.</p> <p>Off site: Gasworks present in the order of 10m to the south of existing Market Street Car Park and contains one gasometer. Stranraer has expanded and considered to comprise of a combination of residential/commercial and industrial use.</p>  <p>Figure 21-3: 1893 Map Exert³⁵</p>	Warehouses	Gasworks Made Ground associated with surrounding unlabelled development
1907/08	<p>Onshore: Dashed line is now labelled as sewage line.</p> <p>Offshore: Area now labelled Stranraer Harbour.</p> <p>Off site: Gasworks now contains 2 No. gasometers. A slaughterhouse is present to the southeast of the site (area of proposed reclaimed land that will contain a car park).</p>	Made Ground associated with installation of sewage pipe	Additional Gasometer Slaughterhouse
1938	No significant on site or within the area immediately surrounding it.	-	-
1953	No significant on site or within the area immediately surrounding it.	-	-

³⁵ National Library of Scotland (NLS) Historical Maps - <http://maps.nls.uk>

Date of OS Map	Notable Features	Potential Contamination Sources	
		On Site	Off Site (within 500m)
1967	<p>Onshore: To the north of the proposed car park/workshops a new sea wall is present. Area of proposed car park is now labelled Marine Lake. The warehouses previously shown not present and considered to have been demolished.</p> <p>Offshore: Area now complete shown to be water, with the area of proposed reclaimed land is labelled 'mud'.</p> <p>Off site: To south of existing slipway (currently occupied by Burns House Car Park) contains a garage.</p>  <p>Figure 21-4: 1967 Map Exert³⁵</p>	Made Ground	Garage
1974/75	No significant on site or within the area immediately surrounding it.	-	-
1982/85	<p>Onshore: No significant change.</p> <p>Offshore: No significant change</p> <p>Off site: Gasworks no longer shown, with a new garage present 20m to the south of this. An area of land to the SE of site has been reclaimed with East Pier having expanded, with a section closest to the harbour marked Ross Pier. The East Pier is shown to contain a ferry terminal. A sewage works is present to the SE of the area of proposed reclamation.</p>	-	Garage Sewage Works Made Ground with construction/extension of East Pier/Ross Pier
1990	No significant on site or within the area immediately surrounding it.	-	-

³⁵ National Library of Scotland (NLS) Historical Maps - <http://maps.nls.uk>

Date of OS Map	Notable Features	Potential Contamination Sources	
		On Site	Off Site (within 500m)
1994	<p>Onshore: The area of Marine Lake has been reclaimed and is now shown to be open land, with the existing car park to the south of this. West Pier has expanded. Market Street Car Park, labelled Seacat Terminal, with a small structure in this area.</p> <p>Offshore: No significant change</p> <p>Off site: Garage in area of Burns House car park now labelled Depot.</p>	<p>Made Ground associated with reclamation of land and construction/extension of West Pier</p> <p>Made Ground associated with Seacat Terminal Construction</p>	Depot
2003	<p>Onshore: The area of former Marine Lake now labelled Agnew Park.</p> <p>Offshore: No significant change</p> <p>Off site: Sewage works no longer present, with area now labelled Bus Depot. Garage/Depot in area of Burns House car park no longer present.</p>	-	<p>Bus Depot</p> <p>Made Ground associated with demolition of former structures.</p>
2010	<p>Onshore: Seacat Terminal no longer shown and area a car park.</p> <p>Offshore: Breakwater present in the north of the area is shown.</p> <p>Off site: No significant change.</p>	<p>Made Ground associated with demolition of former Seacat Terminal</p> <p>Construction of Breakwater</p>	-
2021	<p>Onshore: Northern most section of West Pier is no longer present. A path cuts through the area of the proposed car park, as per existing layout.</p> <p>Offshore: No significant change.</p> <p>Off site: Ross Pier no longer present and neither is the bus depot.</p>	Made Ground	Made Ground

Date of OS Map	Notable Features	Potential Contamination Sources	
		On Site	Off Site (within 500m)
Current	<p>Onshore: The Harbour Office building is located on the harbour side of the Marina. A boatyard is located to the west of the harbour building. The Breastworks car park and harbour marina car park are located on the south of the site. Soft landscaping covers the remaining onshore area.</p> <p>Offshore: No significant change.</p> <p>Off site: No significant change.</p>	-	-

Contamination

- 21.53 The proposed car park / workshop / Solway Coast and Marine Pilot Project (SCAMPP)/coastguard building are located on an area of reclaimed land, as such, Made Ground is documented to be present and was considered to be a potential on-site source of contamination.
- 21.54 During the desk study review, potential off-site sources of contamination were identified, including a historic gasworks, garages, bus depot and sewage works.
- 21.55 Based on the findings of the desk study, it was considered appropriate that the chemical testing be undertaken in a predominantly non-targeted manner. The scope of the testing was developed to determine the contaminant concentrations of the Made Ground Deposits, the underlying superficial deposits and the on-land groundwater.
- 21.56 Chemical testing of the onshore soils has been undertaken and the results have been compared against the Tier 1 Assessment Criteria for a Commercial development, which is considered to be appropriate for the proposals for the site, to assess the risk to human health. The vast majority of the analysis found the concentrations of the various contaminants to be within the relevant Tier 1 Screening Criteria for the proposed end-use of the site. However, one concentration of lead was found to exceed the relevant screening criteria, with this recorded within a sample of made ground recovered from TP05 at a depth of 0.50m bgl.
- 21.57 As it currently stands, it is the intention that a proportion of the dredged material will be re-used within the land reclamation works, albeit, this is yet to be confirmed. For the purposes of this assessment, we have assumed that dredge material will be utilised in the reclamation exercise. Therefore, chemical testing has been undertaken on a series of soil samples collected from the proposed dredged zone, with the obtained laboratory test results compared against the Tier 1 Assessment Criteria for a Commercial Development. The purpose of this was to assess the

risk to human health. No exceedances of the relevant screening criteria were recorded within the offshore soil samples, thus, indicating that these do not represent risk to human health.

- 21.58 The phytotoxic assessment has recorded the presence of elevated levels of copper and zinc, from made ground samples across the onshore area of the Site. As such, it is considered that there is a potential risk to future plant life. Despite this, there are currently areas of soft landscaping, with plant growth occurring in these areas.
- 21.59 Although elevated concentrations of metals, cyanide, PAH and TPH's were recorded above the GAC for the water environment within two exploratory boreholes, one of which is outwith the development boundary, the risk to the Water Environment was concluded to be low. Due to the nature of the contaminants, particularly the presence of cyanide, it is considered that the most likely source is the historical gasworks located offsite, immediately upgradient, and therefore, not emanating from the site.
- 21.60 The presence of volatiles are noted within the groundwater in BHB04. However, these have been assessed against the GAC for assessing the vapour risks to human health from volatile contaminants in groundwater and no concentrations were recorded to exceed the relevant assessment criteria. In addition, this position is located in an area where no future buildings are proposed, hence there are no viable pollutant linkages. As such, no remedial actions are required in this regard.

Ground Gas

- 21.61 To establish the ground gas regime, two phases of gas monitoring have been carried out.
- 21.62 During the first phase of ground gas monitoring, which was between the 1st September 2021 and 28th September 2021, five rounds were undertaken at four exploratory hole positions (BH01, BH02, BH05 and BH07). The second phase of ground gas monitoring, four rounds were undertaken at a further four exploratory hole positions (BHB01, BHB02, BHB03 and BHB04), with these undertaken between 17th September 2024 and 8th October 2024.
- 21.63 During the ground gas monitoring rounds, the maximum carbon dioxide and methane concentrations of 3.5per cent and 30.4per cent, respectively, were recorded. The maximum recorded positive flow rate of 0.3l/hr has been utilised as part of the ground gas risk assessment.
- 21.64 Based on these results, the worst-case Gas Screening Value (GSV) for carbon dioxide and methane are 0.0114l/hr and 0.304l/hr, respectively. The 'Characteristic Situation' has been determined from Table 8.5 in CIRIA C665²⁵ report, to be 'Characteristic Situation 2', as 'low' risk classification. The British Standard¹⁶ method has returned a Characteristic Situation (CS) rating of CS2.

²⁵ CIRIA C674 "The use of concrete in maritime engineering – a good practice guide"

¹⁶ BS8485:2015+A1:2019, 'Code of Practice for the characterisation and remediation from ground gas in affected developments'

21.65 Carbon monoxide concentrations have been recorded to range between 0ppm and 615ppm. Concentrations of carbon monoxide were recorded to exceed the work place exposure limits⁴⁰ within three boreholes, namely BHB01, BHB03 and BHB04, during the first round of monitoring in the 2024 phase of investigation. However, these concentrations were not sustained over the following three monitoring rounds, with a maximum concentration of 6ppm recorded during these rounds. With the exception of BHB01, BHB03 and BHB04 during the first monitoring round of the 2024 investigation, all other recorded concentrations of carbon monoxide are below the work place exposure limits⁴⁰.

Radon

21.66 The public Health UK Radon Interactive Map³⁸ indicates that the site is located in an area where the radon potential is less than 1per cent, the lowest band of radon potential. As such, radon protection measures are not required within the proposed structures on site.

Future Baseline

21.67 In an Environmental Impact Assessment (EIA), the "future baseline" refers to the anticipated environmental conditions that would exist in the absence of a proposed development or project, considering natural changes and planned developments in the surrounding area.

21.68 Although a phytotoxic risk has been recorded at the site, there are currently areas of soft landscaping, grassed areas, within the site boundary, and including the location where the risk was identified. In the absence of the proposed development and any mitigation measures, these are likely to remain unchanged with grass likely continuing to grow despite the phytotoxic concentrations within the underlying subsoil.

21.69 Groundwater levels are subject to seasonal and climatic change, and hence the levels could vary in the future, however any such changes are unlikely to impact on the future baseline, in relation to the assessment undertaken in this chapter.

21.70 In the absence of the proposed development, it is considered that the baseline conditions are unlikely to significantly differ from those outlined above.

21.71 It is our understanding that the following projects are planned in the immediate surrounding area:

- Application for a new Transport Hub – Ref: 25/1190/FUL;
- Permission for the formation of coastal habitat for seabirds on the land to the west of Loch Ryan – Ref: 24/1534/FUL;

³⁸ UK Radon - <http://www.ukradon.org/information/ukmaps>

⁴⁰ Environmental Hygiene Report EH40/2005 Workplace Exposure Limits, March 2013

- Permission for the installation of one 10 metre high street works column, 3 antennas, 1 network camera, 1 equipment cabinet and associated works - Ref:25/0778/FUL; and
- Panning permission for the change of use application at the Former Stena Port site - Ref: 24/1407/FUL.

These projects, and any future proposed developments, will require to gain regulatory approval prior to the development taking place, as such, any identified pollutant linkages will be appropriately addressed and remediated as part of the planning process. As such, the future baseline is unlikely to differ from the assessment undertaken above.

Receptors

21.72 A list of existing and future receptors is included in **Table 21-4**.

Table 21-4: Existing and Future Sensitive Receptors

Receptor	Sensitivity
Existing Receptors	
Surface waters (Loch Ryan)	High
Bedrock aquifer (Stewartry Group)	High
Current Site Users	Medium
Future Receptors	
Site End Users	Medium
Construction Workers	Low
Plants	Low
Surface waters (Loch Ryan)	High
Bedrock aquifer (Stewartry Group)	High
Buildings and services	Medium

Impact Assessment

Construction Phase

Exposure to Soil Contamination (Construction Workers)

- 21.73 Based on the recorded baseline conditions, it is considered that complete pollutant linkages through ingestion, direct contact and inhalation to construction workers locally exist at the Site, such as in the area of the localised lead exceedance at TP05.
- 21.74 Construction workers are considered to be a low sensitivity receptor. The assessment criteria which the soil geo-chemical results have been compared against are based on long-term continued exposure to the soil, which is not wholly applicable to construction works given the relatively short term exposure times. Therefore, assessing the risk to construction workers by this means is somewhat conservative.
- 21.75 With respect to the localised lead contamination, the key pathway for this determinand (long term exposure entering the blood stream) is unlikely to be applicable to construction workers, given the relatively short exposure time to contaminants on construction sites.
- 21.76 Exposure to soil contamination can result in an adverse effect on human health, however given the localised nature of the exceedances at the Site, the potential for exposure is limited. Conservatively, the magnitude of the impact is considered to be medium.
- 21.77 Therefore, the significance of the effect of exposure to soil contamination on construction workers is **slight/moderate** in the absence of additional mitigation measures.

Soil Contamination Migration (Water Environment)

- 21.78 The baseline conditions recorded limited localised soil sources at the Site which are located in the area of the proposed boatyard of the Site's development. The proposed boatyard will comprise hardstanding, therefore it is considered unlikely, by virtue of the development proposals, that complete pollutant linkages will be introduced during the construction of the development.
- 21.79 The water environment, Loch Ryan and the bedrock aquifer (Stewartry Group), is a high sensitivity receptor.
- 21.80 Given the geotechnical properties of the shallow onshore deposits, it would be prudent to assume an abnormal foundation solution for the proposed on land structures, namely piling. The piles are likely to extend through the made ground and into the underlying Glacial deposits. Given that the piles are unlikely to extend to the bedrock, these are unlikely to create a preferential pathway to this receptor. In relation to Loch Ryan, given the vertical nature of a pile, the installation of these are unlikely to result in any lateral migration of contaminants. Furthermore, no structures are proposed in the vicinity of the soil exceedances.

- 21.81 As such, it is considered that the construction of the foundations will not create a pathway to the Water Environment. Therefore, the magnitude of the impact is considered to be negligible.
- 21.82 As such, the effect of soil contamination migration to the Water Environment during the construction phase will be **slight**.

Ground Gas Pathways (Construction Workers)

- 21.83 During the construction phase, the receptor for ground gas pathways is considered to be construction workers. Whilst exposure times for construction works is generally limited, the impacts of ground gas may have on a receptor can take affect over a relatively short period of time; thus, increasing the sensitivity of a construction worker for this linkage. As such, in this scenario, a construction worker is considered to be a medium sensitivity receptor.
- 21.84 The baseline conditions recorded depleted oxygen concentrations across the site as well as carbon monoxide and carbon dioxide concentrations.
- 21.85 Low oxygen concentrations have the potential to pose an asphyxiation risk to construction workers within confined spaces. The magnitude of the impact is assessed as high.
- 21.86 Therefore, the significance of the effect of exposure to depleted oxygen conditions, along with the recorded carbon dioxide and/or carbon monoxide concentrations, on construction workers is **moderate / substantial**.

Risk of Fuel Spillages (Construction Workers and Water Environment)

- 21.87 During construction, there will be the requirement for fuel storage plant, along with the presence of operational mobile and static plant. With this there is an increased potential for fuel spills.
- 21.88 Should a spill occur on the Site during the construction works it is likely to contaminate the soil, which in turn could leach and migrate to the water environment. Given the scale of any such spill, this is likely to be localised, whereby the magnitude of this impact is considered to be medium.
- 21.89 As previously mentioned, the water environment is high sensitivity receptor.
- 21.90 As such, the significance of the effect on the water environment is **moderate/substantial** if not managed / mitigated.
- 21.91 In the event of a fuel spillage, complete pollutant linkages through ingestion, direct contact and inhalation to construction workers would exist at the Site.
- 21.92 In such scenarios, given the relatively short exposure times and the nature of the contaminants, construction workers are deemed a low sensitivity receptor.
- 21.93 Soil contamination can result in an adverse effects on human health. However, given the short exposure times, and the nature of contaminants, the impact is considered to be low.

21.94 The significance of the effect of the exposure to soil contamination from fuel spills/leaks on construction workers is **negligible/slight** in the absence of additional mitigation measures.

Dust (Construction Workers)

21.95 During any earthworks required for the development, the soils will be bare and there will be an increased risk of dust production, particularly during periods of dry weather.

21.96 As previously mentioned, construction workers are considered to be a low sensitivity receptor due to the relatively short exposure times.

21.97 Given only a single exceedance of lead was recorded within the soil chemical testing during the intrusive investigation, the presence of contamination is considered to be very localised at the Site. As such, there is limited potential for contaminated dust to be generated at the Site and the magnitude of the impact is considered to be low.

21.98 Therefore, significance of the effect is assessed as **negligible/slight** if not mitigated.

Dust (Nuisance)

21.99 As above, during any earthworks, soils will be exposed and there will be an increased risk of dust production. Although soil contamination is limited and localised at the Site, dust generation will cause a general nuisance.

21.100 In the area of the main onshore works, which could generate dust, the surrounding land typically comprises of car parking or disused hardstanding (East Pier). As such, the receptor of the general surrounding environment is considered to be of low sensitivity.

21.101 Localised soil contamination has been identified; however, any works in this area are likely to result in a relatively short time frame where soils will be exposed. As such, the magnitude of the impact is considered to be low.

21.102 The significance of the effect is therefore **negligible/slight**, if not mitigated.

Operational Phase

Exposure to Soil Contamination (Site End Users)

21.103 Based on the baseline conditions recorded, it is considered that complete pollutant linkages to site end users exist at the Site, with exposure risks through direct and dermal contact and inhalation of dust from soil contamination; albeit the complete pollutant linkages are localised and not site wide.

21.104 Given the nature of the proposed development (car park, workshops etc.), as such, this will reduce the potential for exposure to the underlying soils and end users. Therefore, the site end user's are a medium sensitivity receptor.

- 21.105 Exposure to soil contamination can result in an adverse effect on human health, however given the localised nature of the exceedances at the Site, and the limited potential for exposure (due to the nature of the development proposal). The magnitude of the impact is considered to be medium.
- 21.106 The significance of exposure to soil contamination on the human end users of the Site is **moderate** effect in the absence of additional mitigation measures.
- 21.107 With respect to the contaminant in question, namely lead, this is non-volatile in nature with the main exposure pathways being through direct contact, dermal contact and ingestion of contaminated soils. As such, in areas of hardstanding these pathways will be broken, whilst in areas of soft landscape these pathways will exist.
- 21.108 Reference is made to the proposed layout of the development and it is shown that the location of the localised lead exceedance, namely TP05, is located in an area of proposed boatyard, which will be hardstanding. As such, it is considered by virtue of the development proposals that the complete pollutant linkages will not be encountered post development of the Site and that no formal remedial actions will be required. Therefore, the significance of the effect during the operational phase is considered to be **beneficial**.

Soil Contamination (Phytotoxic Risk)

- 21.109 The phytotoxic assessment has recorded the presence of elevated levels of copper and zinc, from made ground samples across the site.
- 21.110 As such, it is considered that there is a potential risk to future plant life. However, given areas of soft landscaping are currently present, with plant growth occurring, and the recorded concentrations not representing a risk to human health, the magnitude of the impact is considered to be low.
- 21.111 Plant life is a low sensitivity receptor in the context of the proposed development.
- 21.112 The significance of the effect of soil contamination to plant life is **negligible/slight** in the absence of additional mitigation measures.

Ground Gas Pathways (Site End Users and Buildings)

- 21.113 Ground gas monitoring has characterised the Site as a CS2, due to the presence of elevated methane.
- 21.114 Ground gas pollutant linkages to site end users and buildings exist at the site, with the main exposure pathways being through inhalation, ingress and preferential pathways.
- 21.115 The receptors affected by ground gas concentrations are site end users within buildings at the Site. The building types have conservatively been classified as Type B in accordance with

Table 2 from BS 8485:2015+A1:2019¹⁶ due to the small/medium room sizes and the commercial/public ownership. In accordance, with the guidance, in such scenarios, the sensitivity of the receptors is considered to be medium.

21.116 The potential build-up of ground gas within confined spaces could pose a health risk to site end users via explosion or inhalation and asphyxiation whilst the potential build-up of ground gas in confined spaces could pose an explosion risk in buildings. The magnitude of the impact is assessed as high.

21.117 The significance of the impact is **moderate/substantial** in the absence of additional mitigation measures.

Aggressive Ground Conditions (Buildings, Services and Site End Users)

21.118 The presence of contamination in underlying soils may pose a risk to buried concrete.

21.119 Direct contact with this contamination can result in damage to the concrete fabric and services^{19, 20 & 25}. Aggressive contaminants include sulphates and sulphides, and acidic conditions. These cause cementitious bonds to break down over time, effectively causing the concrete to deteriorate in quality over time; albeit, general not to an extent that structure failure occurs. As such, the magnitude of the impact is low.

21.120 The receptor of aggressive ground conditions is buildings, which is considered to be medium sensitivity.

21.121 The significance of the effect of aggressive ground conditions on properties is **slight** without appropriate mitigation.

21.122 In areas where contaminated material may be present, water supply pipes may be at risk of failure resulting in leakage to ground and potentially the introduction of contaminants into the water supply. This can happen as a result of the permeation and accelerated deterioration of the pipe material due to chemical reaction between the pipe and contaminants in the ground in which it is laid. The magnitude of the impact is assessed as high.

21.123 The receptor is services and in turn the site end users, both of which are considered to be medium sensitivity receptors in respect of the proposed development.

21.124 The significance of the effect of aggressive ground conditions on the water supply pipes and in turn site end users is **moderate/substantial** without appropriate mitigation. Careful selection, design and installation will not only reduce the risk to human health but also conform to the requirements of the various UK Regulations relating to the supply of drinking water.

¹⁶ BS8485:2015+A1:2019, 'Code of Practice for the characterisation and remediation from ground gas in affected developments'

¹⁹ BS 6349-1-4:2013 British Standard Maritime Works, Part 1-4: General – Code of practice for materials

²⁰ BRE Special Digest 1, Concrete in Aggressive Ground, (3rd Edition), 2005

²⁵ CIRIA C674 "The use of concrete in maritime engineering – a good practice guide"

Re-use of Material (Site End Users)

21.125 As it currently stands, it is the intention that the dredged material will be re-used within the land reclamation works to form the new car park and green open space, albeit, this is yet to be confirmed. For the purposes of this assessment, we have assumed that dredge material will be utilised in the reclamation exercise. Based on the recorded baseline conditions, no exceedances of the relevant screening for a commercial end-use were recorded and therefore the material is considered to be suitable for re-use as part of the reclamation works. Given the re-use of material would minimise waste, it is considered that this would have a **beneficial** effect.

Do Nothing Scenario

21.126 It is understood that a designated Part 2A site is present off-site to the south, associated with the former gasworks. However, as shown by the baseline conditions recorded during the ground investigation, this site is having limited impact on the proposed development site.

21.127 Therefore, in the do nothing scenario, it is considered that the baseline conditions are unlikely to significantly differ from those outlined above in the future baseline. As such, the magnitude of effects in the do nothing scenario is negligible.

21.128 The sensitivity of the identified receptors vary from low to high, as outlined previously.

21.129 The significance of effect is **slight to negligible**.

Mitigation, Monitoring and Residual Effects

Mitigation/ Monitoring

Construction Phase

21.130 Construction workers should use appropriate personal protection equipment (PPE) and those relevant personnel should follow guidance on the safe redevelopment of contaminated sites as provided in the Health and Safety Executive publication HS (G) 66, 1991⁴¹, Protection of workers and the general public during the development of contaminated land.

21.131 A safe system of work will be developed for the construction works/ construction workers alongside the appropriate use of PPE, including personal gas alarms to break any complete ground gas linkage to construction workers.

21.132 A Construction Environmental Management Plan (CEMP), including pollution prevention measures and construction method statements will be in place during the construction phase. The CEMP will detail mitigation measures to be in place to prevent or minimise negative effects

relating to ground conditions, hydrogeology and soils. Pollution prevention measures will include the control of surface water run-off or shallow groundwater / perched water run-off during the works. The works on the Site will follow SEPA guidance provided in the applicable pollution prevention guidance notes:

- GGP1 'Understanding your environmental responsibilities'⁴²;
- GPP5 'Works and maintenance in or near water'⁴³;
- GPP6 'Working at construction and demolition Sites'⁴⁴;
- GPP8 'Safe storage and disposal of oils'⁴⁵;and,
- GPP22 'Dealing with spills'⁴⁶.

21.133 Measures will also be in accordance with any requirements under The Water Environment (Controlled Activities) (Scotland) Regulations 2011⁴⁷ due to the immediate proximity of the Loch Ryan. These requirements will cover any discharges or abstractions that may be required as well as specific engineering works, with particular attention to silt control and controlling run-off.

21.134 To reduce the impact of spills, spill kits will be available for all plant and operatives will be briefed on what to do in the event of a spill. Fuels will be stored in appropriate containment, such as bunds.

21.135 Best practice guidance will be followed during the construction of the Site. Mitigation measures would include the use of; silt traps, dust mitigation (dampening down), wheel washing, designated fuelling areas, etc. Further details of mitigation measures will be included within a Mitigation Schedule and CEMP.

Operational Phase

21.136 Given the recorded localised lead exceedance is located in an area of proposed hardstanding, it is considered the pollutant linkage to site end users will be broken and no formal remedial measures are required. However, should the development plan be updated and soft landscaping proposed in this area, an imported environmental capping layer, with a minimum thickness of 450mm clean material, should be installed.

21.137 Due to the risk to future plant life, a suitable growing medium will require to be introduced to all future areas of soft landscaping. It is recommended that a minimum thickness of 300mm for growing mediums should be installed, comprising of a combination of topsoil and subsoil. The soils to be utilised as a growing medium should be purchased as a product from an approved

⁴² Guidance for Pollution Prevention. Understanding your environmental responsibilities – good environmental practices: GPP 1, Version 1.2, June 2021

⁴³ Guidance for Pollution Prevention. Works and maintenance in or near water: GPP 5, Version 1.2, February 2018

⁴⁴ Guidance for Pollution Prevention. Working at construction and demolition sites: GPP 6 Version 1 April 2023

⁴⁵ Guidance for Pollution Prevention. Safe storage and disposal of used oils: GPP 8 Version 1.2 June 2021

⁴⁶ Guidance for Pollution Prevention. Dealing with spills: GPP 22 October 2018 (Version 1.)

⁴⁷ The Water Environment (Controlled Activities) (Scotland) Regulations 2011

supplier. Increased capping thicknesses will be required in areas of shrub/tree planting. The thickness and proposed make up to be confirmed with the Landscape Architect going forward. All materials used should satisfy the criteria of BS 3882¹⁸ and should be tested to confirm it is free from contamination and suitable for use.

21.138 As a result of the ground gas risk assessment, the site has been classified as a CIRIA C665²³ Characteristic Situation 2 (low risk) site and the British Standard¹⁶ method returned a CS value of CS2, with a point's score of 3.5 required for Type B Structures. As such, site specific ground gas protection measures are required to be installed within the proposed development. A combination of the following three types of protection measures are typically used to achieved the score of 3.5:

- Structural barrier of the floor slab, or of the basement slab and walls if basement is present;
- Ventilation measures; and
- Gas resistant membrane.

21.139 Based on the recorded soil sulphate concentrations and pH levels, a concrete class of DS-4/AC-3s is derived⁴⁸²⁰ is considered appropriate for buried concrete across the site.

21.140 Based on the indicative UKWIR assessment²⁶, barrier pipe, wrapped steel and wrapped ductile iron materials may be suitable, however, this will be subject to the results of specific UKWIR testing undertaken on samples retrieved from the formation level of the proposed route of the water supply pipes, once this is known.

Residual Effects

Construction Phase

21.141 There is the potential for unforeseen gross contamination to be encountered during the construction phase outwith the positions in the intrusive investigation. Should unforeseeable gross contamination be encountered, additional environmental risk assessments should be undertaken which may result in further complete pollutant linkages requiring mitigation.

Operational Phase

21.142 Following the implementation of the mitigation specified above, residual effects are considered to be negligible for all potential effects at the operational phase.

¹⁸ BS 3882:2015, Specification for Topsoil

¹⁶ BS8485:2015+A1:2019, 'Code of Practice for the characterisation and remediation from ground gas in affected developments'

²⁰ BRE Special Digest 1, Concrete in Aggressive Ground, (3rd Edition), 2005

²³ CIRIA C665, Assessing Risks Posed by Hazardous Ground Gas to Buildings, 2007

²⁶ Guidance for the Selection of Water Supply Pipes to be Used in Brownfield Site UKWIR Report Ref No. 10/WM/03/21

21.143 A Remediation Strategy and Verification plan will be prepared to ensure that remedial measures are designed and verified in accordance with current guidelines. This should include importation criteria for the growing medium. The preparation of a Remediation Strategy and Verification plan is likely to be a planning requirement.

Cumulative Effects

21.144 Existing off-site sources of contamination are present in proximity to the proposed development; however, any future development of these sites would require any pollutant linkages to be broken by appropriate remediation as part of the planning and regulatory process. This also applies to the following projects which are proposed and/or consented through planning in the immediate surrounding area:

- Application for a new Transport Hub – Ref: 25/1190/FUL;
- Permission for the formation of coastal habitat for seabirds on the land to the west of Loch Ryan – Ref: 24/1534/FUL;
- Permission for the installation of one 10 metre high street works column, 3 antennas, 1 network camera, 1 equipment cabinet and associated works - Ref:25/0778/FUL; and
- Planning permission for the change of use application at the Former Stena Port site - Ref: 24/1407/FUL.

As a result, there are considered to be no cumulative effects.

Summary and Conclusions

- 21.145 As previously discussed, at the Construction Phase, it is considered that the only potential residual effect would be unforeseen ground conditions. Should unforeseeable gross contamination be encountered, additional environmental risk assessments should be undertaken which may result in further complete pollutant linkages requiring mitigation.
- 21.146 At the Operational Phase, following the implementation of mitigation outlined in this chapter, residual effects are considered to be neutral for all potential effects of soils, geology and contamination in relation to the proposed development. An assessment summary and residual effects with respect to soils, geology and contamination in relation to the proposed development are included in **Table 21-5** below.

Table 21-5: Assessment Summary and Residual Effects

Identified Impact	Sensitivity of Receptor	Impact Magnitude	Significance of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance of Effect
Construction Phase						
Impact to construction workers from contaminated soils during construction phase	Low	Medium	Slight/Moderate	A safe system of work will be developed, alongside the use of appropriate PPE. The works should follow guidance on the safe redevelopment of contaminated sites as provided in the Health and Safety Executive publication HS (G) 66, 1991, Protection of workers and the general public during the development of contaminated land.	Negligible	Negligible
Impact to the Water Environment from contaminated soils during construction	High	Negligible	Slight	A CEMP should be in place. Measures will be put in place that are required in accordance with any requirements under The Water Environment (Controlled Activities) (Scotland) Regulations 2011. Best practice guidance will be followed, including but not limited to silt traps.	Negligible	Slight
Impact to construction workers from carbon dioxide and carbon monoxide concentrations and/or depleted oxygen within confined spaces	Medium	High	Moderate/Substantial	A safe system of work will be developed alongside the use of appropriate safety measures including personal gas alarms. The works should follow guidance on the safe redevelopment of contaminated sites as provided in the Health	Negligible	Negligible

Identified Impact	Sensitivity of Receptor	Impact Magnitude	Significance of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance of Effect
				and Safety Executive publication HS (G) 66, 1991, Protection of workers and the general public during the development of contaminated land.		
Impact to the Water Environment from potential spills/leaks during construction phase	High	Medium	Moderate/Substantial	Spill kits will be available and operatives briefed on what to do in the event of a spill. Best practice guidance will be followed, including but not limited to designated fuelling areas and appropriate containment around fuel storage.	Negligible	Slight
Impact to construction workers from soils contaminated with potential spills/leaks during construction	Low	Low	Negligible/Slight	Spill kits will be available and operatives briefed on what to do in the event of a spill alongside the use of appropriate PPE. Best practice guidance will be followed, including but not limited to designated fuelling areas and appropriate containment around fuel storage.	Negligible	Negligible

Identified Impact	Sensitivity of Receptor	Impact Magnitude	Significance of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance of Effect
Impact to construction workers from potentially contaminated dust generated during construction works	Low	Low	Negligible/Slight	Best practice guidance will be followed, including but not limited to dampening down and wheel washing alongside the use of appropriate PPE.	Negligible	Negligible
Impact to surrounding environment from dust generation	Low	Low	Negligible/Slight	Best practice guidance will be followed, including but not limited to dampening down and wheel washing.	Negligible	Negligible
Operational Phase						
Impact to site end users from contaminated soils	Medium	Medium	Moderate	Contamination is localised and in an area of proposed hardstanding, therefore by nature of the development proposals, complete pollutant linkages are broken. Should the development plan be updated and soft landscaping proposed in this area, an imported environmental capping layer, with a minimum thickness of 450mm clean material, should be installed.	Beneficial	Beneficial
Impact to plant life from contaminated soils	Low	Low	Negligible/slight	A 300mm suitable growing medium, comprising of a combination of topsoil and subsoil, will require to be introduced to all future areas of soft landscaping	Negligible	Negligible

Identified Impact	Sensitivity of Receptor	Impact Magnitude	Significance of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance of Effect
Impact to site end users and buildings from ground gas build up within the proposed structures	Medium	High	Moderate/substantial	Installation of CS2 gas protection measures within all proposed structures	Negligible	Negligible/Slight
Impact to buried concrete from aggressive ground conditions	Medium	Low	Slight	DS-4/AC-3s concrete class to be used across the site	Negligible	Negligible/Slight
Impact to water supply pipes and in turn, site end users from aggressive ground conditions	Medium	High	Moderate/substantial	Barrier pipe, wrapped steel and wrapped ductile iron pipe materials may be suitable, however, this will be subject to the results of specific UKWIR testing	Negligible	Negligible/Slight.

