

10.0 Flood Risk

Introduction

- 10.1 This chapter of the EIAR assesses the effect of the proposed development on existing flood risk within the receiving environment.
- 10.2 This assessment has been undertaken by Fairhurst and is supported by:
- **Appendix 10.1:** Stranraer Marina Expansion Flood Risk Assessment (FRA) (Fairhurst, 2025) (**Volume 2**)
 - **Appendix 10.2:** Stranraer Marina Expansion Foul and Surface Water Drainage Design Strategy Report (Fairhurst, 2025) (**Volume 2**)
- 10.3 Effects on flood risk are closely interlinked with coastal processes, which are fully considered in **Chapter 7** of this EIAR. This assessment is informed by and inclusive of information further described in this chapter.
- 10.4 Note that this chapter considers flood risk to the existing environment as a result of the proposed development, with flood risk to the proposed development itself being dealt with fully in **Appendix 10.1: FRA (Volume 2)**.

Competency Statement

- 10.5 This chapter has been prepared by Louise Connolly (MEng GMICE) and Jenny Kirkpatrick (MSc MCIWEM C.WEM CEnv). Louise has two years' experience working in the water environment sector, with specific experience in carrying out flood risk assessments, and Jenny has over 10 years' consultancy experience, including extensive experience in carrying out flood risk assessments and environmental impact assessments in relation to the water environment for a range of projects across the UK. The chapter was reviewed by Laurent Glasson (BSc MSc MCIWEM C.WEM) and Vanora Ford (BEng (Hons) CEng MICE), who are chartered water engineering specialists each with over 20 years' experience, including leading water environment EIA in both marine and terrestrial settings.

Legislation, Guidance and Policy

Introduction

- 10.6 The assessment of flood risk has been undertaken with reference to the following relevant planning policy, legislation and guidance.

Legislative and Policy Framework

- 10.7 Many standards for water and flood management are regulated via European Union (EU) environmental directives, which have since been transposed into Scottish law. The European
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Union Water Framework Directive 2000/60/EC (WFD)¹ and Floods Directive (2007/60/EC)² were transposed into Scottish law by the Water Environment and Water Services (Scotland) (WEWS) Act 2003³ and Flood Risk Management (Scotland) Act 2009 (FRM Act)⁴ respectively. This legislation controls management of the water environment, and aims to reduce the adverse consequences of flooding on communities, the environment, cultural heritage and economic activity.

10.8 This EIA takes into account the requirements of the WFD and FRM Act, as supported by the Water Environment & Water Services (Scotland) Act 2003; the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR)⁵; the Solway Tweed River Basin District River Basin Management Plan (RBMP) 2021 update⁶; and the Flood Risk Management (Flood Protection Schemes, Potentially Vulnerable Areas and Local Plan Districts) (Scotland) Regulations 2010 (FRM Regulations)⁷. Other legislation relevant to the proposed development includes:

- The Marine (Scotland) Act 2010⁸;
- The Water Environment (Miscellaneous) (Scotland) Regulations 2017⁹;
- The Environment (EU Exit) (Scotland) (Amendment etc.) Regulations 2019¹⁰;
- The Climate Change (Scotland) Act 2009¹¹.

National Planning Policy Context

10.9 Relevant national planning policy are listed below, and fully detailed in **Chapter 4**:

- National Planning Framework 4 (NPF4)¹²;
- UK Marine Policy Statement (MPS) 2011¹³; and
- Scotland's National Marine Plan (NMP) 2015¹⁴

¹ EU: Water Framework Directive 2000/60/EC (WFD): 2000

² EU: Floods Directive 2007/60/EC: 2007

³ Scottish Government: Water Environment and Water Services (Scotland) Act 2003 (WEWS): 2003

⁴ Scottish Government: Flood Risk Management (Scotland) Act 2009 (FRM Act): 2009

⁵ Scottish Government: Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR): 2011

⁶ SEPA / EA: Solway Tweed River Basin Management Plan (RBMP) (2021 update): 2021. Available at - <https://www.sepa.org.uk/media/594087/211221-final-rbmp3-solway-tweed.pdf>

⁷ Scottish Government: Flood Risk Management (Flood Protection Schemes, Potentially Vulnerable Areas and Local Plan Districts) (Scotland) Regulations 2010 (FRM Regulations): 2010

⁸ Scottish Government: The Marine (Scotland) Act 2010: 2010

⁹ Scottish Government: The Water Environment (Miscellaneous) (Scotland) Regulations 2017: 2017

¹⁰ Scottish Government: The Environment (EU Exit) (Scotland) (Amendment etc.) Regulations 2019: 2019

¹¹ Scottish Government: The Climate Change (Scotland) Act 2009: 2009

¹² Scottish Government: National Planning Framework 4 (NPF4): February 2023. Available at -

<https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2023/02/national-planning-framework-4/documents/national-planning-framework-4-revised-draft/national-planning-framework-4-revised-draft/govscot%3Adocument/national-planning-framework-4.pdf>

¹³ HM Government: UK Marine Policy Statement: March 2011. Available at -

<https://assets.publishing.service.gov.uk/media/5a795700ed915d042206795b/pb3654-marine-policy-statement-110316.pdf>

¹⁴ Scottish Government: Scotland's National Marine Plan: A Single Framework for Managing Our Seas: 2015. Available at - <https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2015/03/scotlands-national-marine-plan/documents/00475466-pdf/00475466-pdf/govscot%3Adocument/00475466.pdf>

Local Planning Policy

Dumfries and Galloway Council Local Development Plan 2 (LDP2)

- 10.10 Dumfries and Galloway Council (DGC) adopted its current Local Development Plan 2 (LDP2)¹⁵ in October 2019, as detailed in **Chapter 4**. LDP2 represents the Council's vision for development within the area over the next 20 years, providing the planning framework and guiding the future use and development of land in towns, villages and the rural area. LDP2 was published prior to the release of NPF4, and therefore makes reference to the policies set out in Scottish Planning Policy (SPP)¹⁶, which has now been superseded.
- 10.11 LDP2 outlines local authority guidance, standards and requirements relevant to managing flood risk, as well as drainage and protection of the water environment. The following relevant policies from LDP2 and supplementary guidance have been accounted for in this assessment:
- Policy NE9: Developed and Undeveloped Coast;
 - Policy NE11: Supporting the Water Environment;
 - Policy NE12: Protection of Water Margins;
 - Policy IN7: Flooding and Development;
 - Policy IN8: Surface Water Drainage and Sustainable Drainage System (SuDS);
 - LDP2 Flooding and Development Supplementary Guidance - February 2020¹⁷;
 - LDP2 Surface Water Drainage and Sustainable Drainage Systems (SuDS) - February 2020¹⁸; and
 - LDP2 Stranraer Waterfront Urban Design Strategy and Masterplan Planning Guidance – November 2019¹⁹.

Dumfries and Galloway Shoreline Management Plan

- 10.12 The Dumfries & Galloway Shoreline Management Plan (D&G SMP)²⁰ is a plan for managing flood and erosion risk along the D&G coast, looking at the short, medium and long term. Policy Unit 32 within the plan ('McCullochs Point to Innermessan (Stranraer)') includes approximately 7 kilometres (km) of shoreline around the head of Loch Ryan and encompasses the proposed development site at Stranraer Marina.

¹⁵DGC: Local Development Plan 2 (LDP2): October 2019. Available at -

https://www.dumfriesandgalloway.gov.uk/sites/default/files/2024-07/Adopted_LDP2_OCTOBER_2019_web_version.pdf

¹⁶ Scottish Government: Scottish Planning Policy (SPP): 2014. Available at:

<https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2014/06/scottish-planning-policy/documents/scottish-planning-policy/scottish-planning-policy/govscot%3Adocument/scottish-planning-policy.pdf>

¹⁷ DGC: LDP2 Flooding and Development Supplementary Guidance: February 2020. Available at -

https://www.dumfriesandgalloway.gov.uk/sites/default/files/2024-08/Flooding_and_Development_SG_LDP2_Adopted.pdf

¹⁸ DGC: LDP2 Surface Water Drainage and Sustainable Drainage Systems (SuDS): February 2020. Available at -

https://www.dumfriesandgalloway.gov.uk/sites/default/files/2024-08/Sustainable_Drainage_Systems_SG_LDP2_Adopted.pdf

¹⁹ DGC: LDP2 Stranraer Waterfront Urban Design Strategy and Masterplan Planning Guidance: November 2019. Available at -

https://www.dumfriesandgalloway.gov.uk/sites/default/files/2024-08/Stranraer_Waterfront_Urban_Design_for_LDP2_.pdf

²⁰ DGC: Dumfries & Galloway Shoreline Management Plan – Main Report: January 2023. Available at -

https://www.dumgal.gov.uk/media/27534/SMP-F05/pdf/SMP_F05.pdf

10.13 The recommended shoreline management policy in this area comprises ‘Hold the Line’ (i.e. maintaining the existing shoreline position and preventing further retreat by implementing defences or interventions) possibly in combination with ‘Managed Realignment’ (i.e. landward movement of infrastructure and properties in the future).

Guidance

10.14 Key guidance in relation to flood risk is summarised in **Table 10-1**; this has been taken into account throughout this assessment.

Table 10-1: Guidance and Best Practice

Source	Guidance
Scottish Environment Protection Agency (SEPA)	<ul style="list-style-type: none"> • SEPA Controlled Activities Regulations: A Practical Guide, Version 9.4 (2024) • SEPA Regulatory Method (WAT-RM-08) Sustainable Urban Drainage Systems, Version 6.4 (2019) • SEPA Supporting Guidance (WAT-SG-75) – Sector Specific Guidance: Water Run-Off from Construction Sites, Version 2.0 (2021) • SEPA Supporting Guidance (WAT-SG-29) – Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods (2009) • SEPA Technical Flood Risk Guidance for Stakeholders, Version 13 (2022) • SEPA Guidance: Flood Risk and Land Use Vulnerability Guidance (July 2024) • SEPA Guidance: Climate Change Allowances for Flood Risk Assessment in Land Use Planning, Version 5 (2024) • SEPA Guidance LUPS-BP-GU2a: Planning Background Paper: Flood Risk, Version 3 (2018) • SEPA Development Planning Guidance LUPS-DP-GU2a Development Plan Guidance Note on Flood Risk, Version 4 (2018) • SEPA Development Management Guidance LUPS-DM-GU2a Development Management Guidance Note on Flood Risk, Version 2 (2018) • SEPA Flood Risk Standing Advice for Planning Authorities (2024) • SEPA / Natural Scotland: Controlled Activities Regulations (CAR) Flood Risk Standing Advice for Engineering, Discharge and Impoundment Activities
Construction Industry Research and Information Association (CIRIA) Guidance	<ul style="list-style-type: none"> • C741 Environmental Good Practice on Site, 5th Edition (2023) • C609 Sustainable Drainage Systems - Hydraulic, structural and water quality advice (2004) • C753 The SUDS Manual (2015) • C768 Guidance on the Construction of SUDS (2017) • C698 Site Handbook for the Construction of SUDS (2007) • X108 Drainage of development sites - a guide (2004) • C624 Development and Flood Risk – guidance for the construction industry (2004) • C750 Groundwater Control: Design and Practice, 2nd Edition (2016)
Other Guidelines	<ul style="list-style-type: none"> • SUDS Working Party, Water Assessment and Drainage Assessment Guide (WADAG) • Scottish Water, Sewers for Scotland, v4.0 • British Standards BS6031: 2009 Code of Practice for Earth Works • SUDS Working Party, SUDS for Roads

Methodology Used For Assessment

Introduction

10.15 The baseline flood risk in the receiving environment has been established to aid in the identification of relevant sources of flooding and flood risk receptors, to establish any likely significant effects resulting from the proposed development on existing flood risk; and to identify mitigation or design measures to reduce, eliminate or offset these effects. Potential effects are assessed taking into account any embedded mitigation designed into the proposed development and additional mitigation is identified as required. Residual effects are then assessed. The EIA gives proper consideration to sensitive receptors and fully identifies environmental effects and proposed mitigation, for both the public and the determining authority.

Consultation

10.16 Key stakeholders and consultees relating to flood risk include:

- Dumfries & Galloway Council;
- SEPA
- Marine Scotland; and
- Scottish Water (SW).

10.17 Consultation responses relating to flood risk are summarised in **Table 10-2**.

Table 10-2: Consultation Responses

Consultee	Consultee Comment	Response
Scottish Ministers / Marine Scotland - Licensing Operations Team <u>Scoping Opinion</u> Feb 2023	<p>5.2 Coastal Processes</p> <p>5.2.2 <i>The Scottish Ministers agree with the Applicant's proposal to include the alteration to the wave climate, the local flow regime and the sedimentation of the harbour and its adjoining areas within the assessment of coastal processes in the EIA Report.</i></p> <p>5.2.3 <i>The Scottish Ministers direct the Applicant to the MSS advice regarding the breakwater construction and advise that if possible, once the breakwater design has been finalised, further hydrodynamic modelling should be undertaken to compare current existing conditions with conditions once the new breakwater development is in place. The Scottish Ministers advise that the model should get validated appropriately.</i></p>	EIAR Chapter 7 / Appendix 10.1: FRA (Volume 2)
Scottish Ministers / Marine Scotland - Licensing Operations Team <u>Scoping Opinion</u> Feb 2023	<p>5.3 Flood Risk</p> <p>5.3.1 <i>The Applicant's consideration of the potential impacts of the Proposed Works on flood risk is outlined in Section 4 of the Scoping Report. The Scottish Ministers agree with the potential impacts scoped in for further assessment in the EIA Report, as detailed in Section 4.3, and the conclusion outlined in Table 18.1 of the Scoping Report and advise that flood risk must be scoped in for further assessment in the EIA Report for the operational stage only.</i></p> <p>5.3.2 <i>The Scottish Ministers direct the Applicant to the representation from SEPA regarding flood risk and advise that the Applicant must adhere to the guidance detailed therein and all other points SEPA raises in this regard.</i></p>	Paragraphs 10.51 - 10.61
Marine Scotland Science (MSS) <u>Scoping Opinion</u> 29 th July 2022	<p>Physical environment / coastal processes</p> <p><i>Coastal processes need to be scoped in as the proposed project will have an impact on coastal processes in all areas around the harbour during both the construction and operation phase. The focus needs to be on the wave climate, the local flow regime and sedimentation, as proposed.</i></p>	EIAR Chapter 7 / Appendix 10.1: FRA (Volume 2)

Consultee	Consultee Comment	Response
<p>SEPA <u>Scoping Response</u> 27th May 2022</p>	<p><u>Generic Comments</u> <i>We consider that the following key issues must be addressed in the Environmental Impact Assessment process. To avoid delay and potential objection the following information must be submitted in support of the application.</i></p> <ol style="list-style-type: none"> 1. <i>Scope of the ER for marine developments</i> 2. <i>Water Framework Directive & River Basin Management Planning [see Chapter 11]</i> 3. <i>Site Layout & Nature of Construction for Marine Development [see Chapter 11, 19 and 20]</i> 4. <i>Marine Ecological Interests [see Chapter 11, 12, 13 and 14]</i> 5. <i>Coastal Processes [see Chapter 7 and 11]</i> 6. <i>Pollution Prevention & Environmental Management [see Chapter 11]</i> 7. <i>Flood Risk</i> 8. <i>Onshore Engineering Activities in the Water Environment [see Chapter 11, 19 and 20]</i> 9. <i>Onshore water abstraction [see Chapter 11 and 15]</i> 10. <i>Existing groundwater abstractions [see Chapter 21]</i> 11. <i>Air Quality [see Chapter 17]</i> <p><i>While all the issues below should be addressed in the Environmental Report (ER), there may be opportunities for several of these to be scoped out of detailed consideration. The justification for this approach in relation to specific issues should be set out within the ER.</i></p>	<p>See below for appropriate references to response under each detailed consultee comment.</p>
<p>SEPA <u>Scoping Response</u> 27th May 2022</p>	<p><u>1. Scope of the ER for marine developments</u> <i>1.1. From the information submitted it is apparent that the development will include both onshore and offshore components. As such, the development will be subject to a range of different consenting regimes. We encourage you to consider producing a single ER, which covers all aspects of the proposed development. This will enable a full assessment of the potential effects of the development as a whole, rather than assessing certain details of the development individually.</i></p>	<p>Single EIAR produced to cover the overall development</p>
<p>SEPA <u>Scoping Response</u> 27th May 2022</p>	<p><u>7. Flood Risk</u> <i>7.1. Any coastal development should be assessed for flood risk from all sources in line with Scottish Planning Policy (paragraphs 254-268). The Flood Maps for Scotland are available to view online and further information and advice can be sought from your local authority technical or engineering services department and from the planning and flood risk section of our website, which also contains information on SEPA's role in flood risk.</i> <i>7.2. If a flood risk is identified then a Flood Risk Assessment should be carried out following the guidance set out in the document Technical flood risk guidance for stakeholders.</i> <i>7.3. Climate change is placing increasing pressures on coastal marine environments. SEPA's guidance within this document helps to demonstrate SEPA's commitment to its public body duties under Section 44 of the Climate Change (Scotland) Act 2009, by assisting in ensuring that a consistent and proportionate approach is taken to maintaining the resilience of our coast to changes in our climate.</i></p>	<p>Appendix 10.1: FRA (Volume 2)</p>
<p>SEPA <u>Consultation Response</u> 4th December 2024</p>	<p>In response to a request for information relating to flooding at the proposed development site, SEPA provided the following: [1] Details on the existing Loch Ryan flood warning scheme including expected lead times prior to flood events <i>SEPA operates a coastal flood warning service (a flood warning 'scheme') for the Solway Firth area, which includes Loch Ryan. The flood warning scheme in Loch Ryan comprises of flood forecasts at the communities of Cairmryan and Stranraer. Coastal flood warnings are issued for the Loch Ryan Flood Warning Area by duty officers using flood forecasts at Cairmryan based on still water level forecasts, and at Stranraer based on still water level and wave overtopping forecasts. Flood warnings are issued to registered customers and partners three to six hours in advance of forecast flooding impacts... Due to the forecasting capability of our coastal flood warning models, there can be times where we may be able to issue a coastal flood warning with more notice than three – six hours. Where there is confidence in the data, we can issue a coastal warning up to 12 hours in advance.</i></p>	<p>Appendix 10.1: FRA (Volume 2)</p>

Consultee	Consultee Comment	Response
SEPA Consultation Response 4th December 2024	<p>[2] Any records of historic flooding within the harbour area SEPA's Observed Flood Event database currently holds 37 records of flooding within 500m of your site of interest, centred on the National Grid Reference (NGR) provided at Stranraer Marina. These occur at various locations and dates between January 1852 and February 2019.</p> <ul style="list-style-type: none"> • 16 records of surface water flooding due to heavy rainfall (pluvial flooding). • 14 records of flooding due to the sea. • Five records of flooding is unknown. • One record of groundwater flooding • One record is associated with a burst water pipe. <p>SEPA's Observed Flood Event database is a collection of flood event records known to SEPA at this time and does not constitute a complete record of all flooding that may have occurred in the area.</p>	Appendix 10.1: FRA (Volume 2)
SEPA Consultation Response 10 th February 2025	<p>In response to a request for clarification that proposed buildings would be considered to support water compatible uses in line with NPF4 glossary definitions (i.e. Docks, marinas and wharves and Lifeguard and coastguard stations), and on acceptable mitigation requirements for these buildings, SEPA responded that:</p> <p><i>When planning permission is sought it will be for Dumfries & Galloway Council, in their capacity as the Planning Authority, to determine if what is proposed falls within the category of 'water compatible uses'. On the basis that the ... relate to the Solway Coast and Marine Pilot Project, the Coastguard, what we assume are marine related workshops and the Fishermen's Compound, and that the Council's FRM Team have stated that they consider what's proposed to be 'water compatible' I would be very surprised if the Planning Authority took a different view. If we were asked for an opinion, we would be satisfied that these were water compatible uses. However, I reiterate that this is a determination for the Planning Authority to make rather than SEPA.</i></p> <p><i>The buildings would be liable to flooding as they are on ground levels below the flood level for the area of 5.31mAOD [metres Above Ordnance Datum] as defined by the [SWSA] Flood Risk Assessment (FRA). I don't think that our Flood Risk Team reviewed the Marina FRA, but the level is higher than the CFB plus climate change level. We're therefore satisfied that it's more precautionary to use the level from the FRA.</i></p> <p><i>On the basis that this is very likely to be determined to be a water compatible use it is very likely that ... we would direct the Planning Authority to our Flood Risk Standing Advice if we were formally consulted rather than provide a bespoke detailed response. We would also defer to the Council's FRM Team for their advice on freeboard and finished floor level [FFL] in this instance. We welcome the commitment to implement an appropriate flood plan to ensure appropriate evacuation and closure of buildings prior to extreme coastal events</i></p>	Appendix 10.1: FRA (Volume 2) / Paragraph 10.52
DGC / Lead Local Authority Consultation Response 13 th November 2024	<p>In response to a request for information relating to flooding at the proposed development site, DGC provided modelling reports / files and historic flood records and stated that:</p> <p><i>As general advice, the FRMT [Flood Risk Management Team] would have no issues with uses classed as Water Compatible Uses as long as flood risks are understood and addressed, in accordance with NPF4, also to demonstrate no aspects of the proposals would increase the flood risk elsewhere. The other bullet points from NPF4 Policy 22 part 'a' should also be considered where development is for water compatible uses.</i></p>	Appendix 10.1: FRA (Volume 2) / Paragraphs 10.35 - 10.63
DGC / Lead Local Authority Consultation Response 3 rd February 2025	<p>In response to a request for further clarification that all proposed buildings associated with the development are considered water compatible in line with NPF4 definitions, DGC responded that:</p> <p><i>The FRMT agrees that the proposals fall under 'Water Compatible Uses' and could be supported as per NPF4 Policy 22; as for mitigation measures we would also agree that similar measures as those required as part of the SWSA [Stranraer Water Sports Association] building application would be appropriate, i.e. Flood Resilient construction methods and appropriate Flood and emergency evacuation plans.</i></p>	Appendix 10.1: FRA (Volume 2) / Paragraph 10.52
SW Scoping Opinion 19 th May 2022	<p>Surface Water For reasons of sustainability and to protect our customers from potential future sewer flooding, Scottish Water will not accept any surface water connections into our combined sewer system.</p>	Appendix 10.2: Drainage Design Strategy Report

Consultee	Consultee Comment	Response
	<p><i>There may be limited exceptional circumstances where we would allow such a connection for brownfield sites only, however this will require significant justification from the customer taking account of various factors including legal, physical, and technical challenges. In order to avoid costs and delays where a surface water discharge to our combined sewer system is anticipated, the developer should contact Scottish Water at the earliest opportunity with strong evidence to support the intended drainage plan prior to making a connection request. We will assess this evidence in a robust manner and provide a decision that reflects the best option from environmental and customer perspectives.</i></p>	<p>(Volume 2) / Paragraph 10.54</p>

Study Area

- 10.18 The proposed development comprises both land (terrestrial) and marine elements located at the existing Stranraer harbour at the southern end of Loch Ryan, a sea loch that opens into the Firth of Clyde and the Atlantic Ocean to the north. Marine elements will be located within the harbour in Loch Ryan itself. Land-based elements will be located within the area encompassing the West Pier, the existing boat yard, the Breastworks public car park, the existing public slipway at Burns House and along the coastline to the East Pier – all within the Loch Ryan catchment. The Town Burn outfalls to Loch Ryan adjacent to the existing slipway within the development boundary.
- 10.19 The Black Stank / Bishop Burn and Sheuchan Burn also drain into Loch Ryan in the vicinity of Stranraer. The Black Stank / Bishop Burn outfalls approximately 1.4km to the east and is separated from the development area by the east pier. The Sheuchan Burn outfalls approximately 0.5km to the west of the proposed development. These two watercourses have no effective interaction with the proposed development area.
- 10.20 Coastal flooding from Loch Ryan represents the primary source of flood risk. The spatial extent of this assessment is, therefore, defined by the extent of extreme coastal flood levels, which includes areas of low-lying ground along the coast (see **Figure 10-1**), focusing on the existing harbour area. This represents the study area for this assessment.

Baseline Conditions

- 10.21 Baseline conditions have been established via a desktop survey, supplemented by site surveys, in particular to:
- Identify all potential sources of flood risk; and
 - Identify existing flood risk (from any source) to the site and to receptors elsewhere.
- 10.22 For planning purposes, NPF4 defines ‘at risk of flooding’ or ‘in a flood risk area’ as land or built form with an annual probability of being flooded of greater than 0.5% (i.e. a 1 in 200 year return period event) which must include an appropriate allowance for future climate change. As a result, the baseline conditions consider existing flood risk in a 1 in 200 year plus climate change (+CC) event, which allows consideration of changes in flood risk predicted to occur in the absence of the proposed development.

10.23 The baseline conditions have been established through reference to the information sources identified in **Table 10-3**. A site visit was carried out on 8 October 2024 to verify and augment this information.

Table 10-3: Baseline Information Sources

Topic	Sources of Information
General	<ul style="list-style-type: none"> • Ordnance Survey (OS) MasterMap, 1:25,000 and 1:50,000 and OpenMap - Local mapping. • Balfour Beatty, 2024. Stranraer Marina Topographic Survey (Drawings CRSS082-24060-IS-001-1 to 4) • Scottish Government Phase 3 LiDAR Digital Terrain Model (DTM) data • SEPA Consultation (foi@sepa.org.uk) • DGC Consultation (FOI@dumgal.gov.uk / CommunitiesFlooding@dumgal.gov.uk)
Coastal and Fluvial Flooding	<ul style="list-style-type: none"> • SEPA Flood Maps (http://map.sepa.org.uk/floodmap/map.htm) • SEPA Floodline (https://floodline.sepa.org.uk/floodupdates/) • Stranraer Potentially Vulnerable Area (PVA) – PVA 02/14/23, as defined in the Flood Risk Management Strategy - Solway Local Plan District (LPD) 2022-2028 (https://www.dumfriesandgalloway.gov.uk/sites/default/files/2024-12/Solway-Local-Flood-Risk-Management-Plan-Cycle-2.pdf) • Stranraer PVA 14/15, as defined in the Flood Risk Management Strategy - Solway Local Plan District 2016-2022 (https://www2.sepa.org.uk/frmstrategies/solway.html) • DGC Stranraer Harbour Records • TransTech Ltd, 2020. Document Reference SWSC-0720-1: Flood Risk Assessment – Proposed Water Sports Centre, West Pier, Stranraer, Dumfries and Galloway • Terrenus CDH Ltd, 2011. Document Reference 1168-200: Stranraer Waterfront Development – Coastal Flood Risk Assessment for Dumfries & Galloway Council • DGC, 2023. D&G Shoreline Management Plan (https://www.dumgal.gov.uk/media/27541/SMP-Public-Consultation-2023/pdf/SMP_Public_Consultation_2023.pdf) • Environment Agency, 2018. Coastal Design Sea Levels - Coastal Flood Boundary (CFB) Extreme Sea Levels (https://environment.data.gov.uk/dataset/84a5c7c0-d465-11e4-b0bd-f0def148f590) • RPS, 2025. Stranraer Marina Expansion - RPS Wave Modelling for Proposed Layout: Wave and Water Levels for Design and Overtopping (vC-2), with accompanying results • Mouchel, 2009. Document Reference: 785764 - Stranraer Flood Study Options Report • Kaya, 2023. Document Reference 1839/YK: 'Stranraer Flood Prevention Scheme - Modelling of Black Stank and Town Burn: Notes on Model Construction' • Environment Agency (EA) / SEPA, 2021. The River Basin Management Plan for the Solway Tweed River basin District (https://www.sepa.org.uk/media/594087/211221-final-rbmp3-solway-tweed.pdf) • SEPA, 2021. River Basin Management Plan for Scotland 2021 – 2027. (https://www.sepa.org.uk/media/594088/211222-final-rbmp3-scotland.pdf)
Infrastructure Failure	<ul style="list-style-type: none"> • SEPA Reservoir Inundation Maps (RIMs) (http://map.sepa.org.uk/reservoirsfloodmap/Map.htm) • Mouchel, 2009. Document Reference: 785764 - Stranraer Flood Study Options Report
Overland Flow	<ul style="list-style-type: none"> • SEPA Flood Maps (http://map.sepa.org.uk/floodmap/map.htm) • Scottish Government Phase 3 LiDAR DTM data • DGC Stranraer Harbour Records
Groundwater Flooding	<ul style="list-style-type: none"> • SEPA Flood Maps (http://map.sepa.org.uk/floodmap/map.htm) • Fairhurst, 2024. Geo-Environmental and Geotechnical Interpretative Report - Document No.: 161378-FRH-XX-00-RP-G-000001 (Appendix 21.1 (Volume 2)). • Causeway Geotech, 2024. Stranraer Marina Expansion: Ground Investigation (GI) Report – Document No. 24-M039
Sewer Flooding	<ul style="list-style-type: none"> • Scottish Water Asset Plans • DGC Stranraer Harbour Records
Modifying Influences	<ul style="list-style-type: none"> • United Kingdom (UK) Climate Projections (UKCP18) (https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/index) • SEPA, 2024. Guidance: Climate Change Allowances for Flood Risk Assessment in Land Use Planning, Version 5 (https://www.sepa.org.uk/media/fxjgjfmi/climate-change-allowances-guidance.docx)

Impact Assessment Methodology

- 10.24 The proposed development will introduce physical changes that have the potential to alter existing coastal processes and hydrological characteristics of the area, which may affect flood risk. This includes, but is not limited to, a significant area of reclaimed land within the harbour; an extension to the existing breakwater at the end of the West Pier; a new floating breakwater as part of the superyacht berth in the Marina; a new quay wall along the Breastworks car park; slipway improvement works; and dredging of the harbour to facilitate access.
- 10.25 Key associated issues will include:
- Alterations to drainage and hydrology; and
 - Alterations to coastal processes (fully considered in **Chapter 7**).
- 10.26 Taking this into account, this chapter of the EIAR covers the following potential effects:
- Effects on flood risk at the site; and
 - Effects on flood risk elsewhere.
- 10.27 As outlined in **Paragraph 10.3**, this chapter considers flood risk to the existing environment as a result of the proposed development, with flood risk to the proposed development itself being dealt with fully in **Appendix 10.1: FRA (Volume 2)**.
- 10.28 It is also important to note that the following assessment of effects, as identified in consultation responses, were scoped out of this assessment:
- Effects of the construction (temporary) phase on potential flood risk have been scoped out of the EIA, given the short-lived and transitory nature of this phase – this approach was accepted by the relevant Consultees identified in **Table 10-2**. The contractor will be required to produce and agree a Construction Environmental Management Plan (CEMP) to describe how construction will be managed to avoid, minimise and mitigate any potential construction effects on the environment and existing surrounding receptors, thus embedding resilience to flood risk during the construction phase.
- 10.29 The significance of the potential effects of the proposed development have been assessed with reference to two main factors: the sensitivity of the receiving environment and the potential magnitude of impact should the effect occur.

Sensitivity of Receptor

- 10.30 Receptor sensitivity has been defined based on the vulnerability of existing land use at the site and at receptors elsewhere, as defined by SEPA's 'Flood Risk and Land Use Vulnerability Guidance'²¹. **Table 10-4** presents the criteria used to define the sensitivity of the receiving environment. Given the extent of the study area receptors have been grouped into categories

²¹ SEPA: Flood Risk and Land Use Vulnerability Guidance: July 2024. Available at: <https://www.sepa.org.uk/media/nvnotwgd/land-use-vulnerability-guidance.docx>

of receptor type based on their sensitivity and land use vulnerability, rather than being assessed individually.

Table 10-4: Sensitivity of Receiving Environment

Receptor Sensitivity	Receptor type
High	Receptors associated with Most Vulnerable or Highly Vulnerable land uses, including: <i>Most Vulnerable Uses</i> – such as hospitals, care homes, nurseries, basement dwellings police stations and installations requiring hazardous substance consent; <i>Highly Vulnerable Uses</i> – such as buildings used for dwelling houses, hostels and hotels; and/or transport links which provide critical access for emergency services ; and/or critical energy infrastructure; and/or critical water and waste water infrastructure assuming receptor incorporates no appropriate flood resilience.
Medium	Receptors associated with Least Vulnerable Uses – such as shops, restaurants and cafes, hot-food takeaways, drinking establishments, offices, general industry, and assembly and leisure; and/or regionally important transport links including trunk roads and railway infrastructure.
Low	Receptors associated with Water Compatible Uses – such as flood control infrastructure, docks, marinas and wharves, water-based recreation (excluding sleeping accommodation), lifeguard and coastguard stations, amenity open space, outdoor sports and recreation and essential facilities such as changing rooms – assuming receptor incorporates appropriate flood resilience; and/or transport links which provide local access only.

Magnitude of Impact

10.31 The magnitude of an impact includes the probability, timing, scale, size, duration and / or frequency and reversibility of the potential impact. The criteria utilised to define the magnitude of impact are detailed in **Table 10-5**.

Table 10-5: Magnitude of Impact

Magnitude	Description
High	An impact, which creates flood risk at receptors not identified as at risk of flooding in baseline conditions or significantly increases predicted flood damages at receptors already at risk of flooding in baseline conditions. This has the potential to occur as a result of major changes to coastal defences, coastal processes, fluvial flow regimes and catchment hydrology (i.e. significant change in wave magnitude, fluvial conveyance capacity, loss in flood storage) and / or a major alteration to the catchment area. For the purpose of this assessment this is taken as a >100mm increase in flood depths at existing receptors.
Medium	An impact, which increases flood risk sufficiently to moderately alter predicted flood damages at receptors already at risk of flooding in baseline conditions but not impact any additional receptors. This has the potential to occur as a result of moderate changes to coastal defences, coastal processes, fluvial flow regimes and catchment hydrology (i.e. change in wave magnitude, fluvial conveyance capacity, loss in flood storage) and / or a moderate alteration to the catchment area. For the purpose of this assessment this is taken as a 50 – 100mm increase in flood depths at existing receptors.
Low	An impact, which increases flood risk to an extent which is unlikely to alter predicted flood damages at receptors already at risk of flooding in baseline conditions but not impact any additional receptors. This has the potential to occur as a result of minor or temporary changes to coastal defences, coastal process, fluvial flow regimes and catchment hydrology (i.e. change in wave magnitude, fluvial conveyance capacity, loss in flood storage) and / or a minor or temporary alteration to the catchment area. . For the purpose of this assessment this is taken as a 10 – 50mm increase in flood depths at existing receptors.
Negligible	An impact, which causes no measurable increase in flood risk to receptors. This has the potential to occur as a result of negligible changes to coastal defences, coastal processes, fluvial flow regime (i.e. changes that are within the range of accepted modelling uncertainty) and catchment hydrology (i.e. change in wave magnitude, fluvial conveyance capacity, loss in flood storage) and a negligible alteration to the catchment area, with no measurable increase in flood damages at sensitive receptors. For the purpose of this assessment this is taken as a <10mm increase in flood depths at existing receptors.

Significance of Effect

10.32 The sensitivity of the receiving environment together with the magnitude of the impact, as set out above, defines the significance of the effect, as detailed in **Table 10-6**. A higher level of significance is attached to all impacts on highly sensitive receptors, whilst a high magnitude impact on a low sensitivity receptor is generally considered to be of less significance. Significance is, however, not absolute and selection is based on professional judgement defined in relation to receptor types, context and location.

Table 10-6: EIA Matrix - Assigning Significance of Effect

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

10.33 For the purpose of this EIA, potential effects are concluded to be Substantial, Moderate, Slight or Negligible. Effects considered as being Moderate or Substantial are considered to be significant. Effects considered as being Slight / Moderate or below are not considered to be significant.

Limitations to Assessment

10.34 The information presented in this assessment is based on desk studies, survey information and a site walkover carried out on 8 October 2024. The assessment of effects has been carried out with respect to the Project Masterplan provided in **Drawing 161378-FRH-00-00-DG-Z-000001 S1 P02.1 (Volume 3)** and the project description provided in **Chapter 2**, on the basis that the mitigation and recommendations outlined in **Appendix 10.1: FRA (Volume 2)** are fully adhered to.

Baseline Conditions

Introduction

- 10.35 The site falls within the Stranraer PVA – PVA 02/14/23, as defined in the Solway Local Plan District (LPD 14) - Flood Risk Management Plan (FRMP) (Cycle 2) 2022-2028²². The PVA reports that the main source of flooding in Stranraer is coastal flooding, particularly in the vicinity of the proposed development. However, there are also risks from river and surface water flooding. Flood risk associated with the proposed development is fully assessed in **Appendix 10.1: FRA (Volume 2)** in accordance with NPF4, and in consideration of coastal flooding, fluvial flows, infrastructure failure, overland flow, sewer flooding and groundwater flooding.
- 10.36 The following provides a summary of conditions pertaining to baseline flood risk within the study area based on the findings of the FRA.

Flood Risk

- 10.37 The following potential sources of flood risk have been considered within this EIAR:
- Coastal flooding, associated with Loch Ryan;
 - Fluvial flooding, associated with the Town Burn;
 - Infrastructure failure;
 - Surface water flooding and overland flow;
 - Sewer flooding; and
 - Groundwater flooding.

Coastal Flooding

- 10.38 The location of the proposed development, and the wider Stranraer area, on the shore of Loch Ryan means that it is potentially at risk of flooding from tidal inundation and coastal waves. Extreme sea levels (ESLs) occur along the coast as the result of storm surges coinciding with high astronomical tides. The 1 in 200 year + CC return period ESL^{23,24} in the vicinity of the proposed development has been identified as 4.74mAOD, as detailed in **Appendix 10.1: FRA (Volume 2)**. Review of this ESL and available elevation data for the wider Stranraer area indicates that complete inundation of the entire Development Site and adjacent shoreline would be expected during this event, as shown in **Figure 10-1**.
- 10.39 The Stranraer waterfront and town are also susceptible to wave action as a result of wind-generated waves from Loch Ryan, which have the potential to exacerbate the effects of ESLs.

²² DGC: Solway Local Plan District (LPD 14) - Flood risk management plan (Cycle 2) 2022-2028. Available at: <https://www.dumfriesandgalloway.gov.uk/sites/default/files/2024-12/Solway-Local-Flood-Risk-Management-Plan-Cycle-2.pdf>

²³ Environment Agency (EA): Coastal Design Sea Levels - Coastal Flood Boundary Extreme Sea Levels: 2018. Available at: <https://www.data.gov.uk/dataset/73834283-7dc4-488a-9583-a920072d9a9d/coastal-design-sea-levels-coastal-flood-boundary-extreme-sea-levels-2018>

²⁴ SEPA: Climate Change Allowances for Flood Risk Assessment in Land Use Planning, Version 5: August 2024. Available at - <https://www.sepa.org.uk/media/txjgjfjmf/climate-change-allowances-guidance.docx>

A wave study and coastal flood modelling was carried out by RPS²⁵ to inform potential impacts of waves on flooding within the study area; the contents of which were reviewed to inform the FRA (see **Appendix 10.1: FRA (Volume 2)**). On the basis of this study a maximum possible flood level of 5.27mAOD for a 1 in 200 year + CC joint probability return period event has been defined when accounting for wave action.

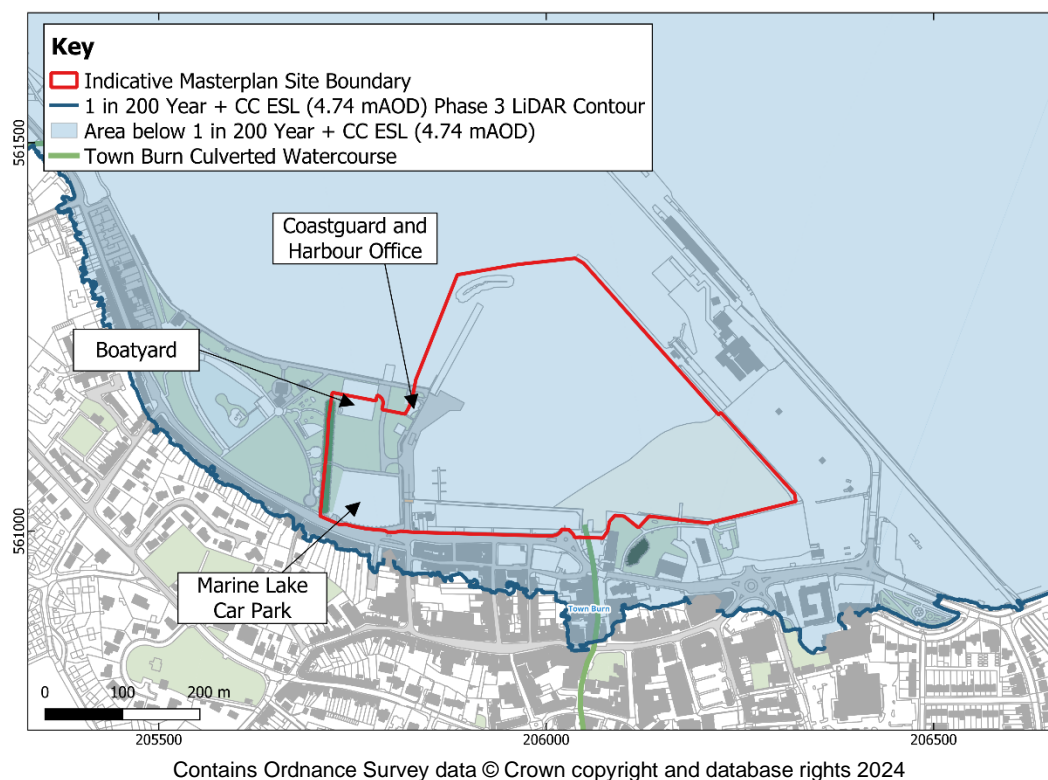


Figure 10-1: 1 in 200 year + CC Extreme Sea Level

Fluvial Flows

10.40 The Town Burn discharges directly into the marina, via a culvert outfall located adjacent to the existing slipway (**Figure 10-2**). This watercourse runs through Stranraer and is extensively culverted along its length, including the final approximately 0.5km culverted reach commencing upstream of Hanover Street and extending to the outfall at the marina. SEPA flood maps²⁶ show fluvial flood risk along the route of this watercourse, extending into the site in the 1 in 200 year and 1 in 200 year + CC event. However, SEPA maps do not consider site-specific detail or structures. Previous studies and works have been carried out for the purpose of identifying and alleviating flood risk associated with this watercourse, however, these have focused on flooding issues in the upper reaches and provide limited information on flood risk along the lower reach of most relevance to this study (see **Appendix 10.1: FRA (Volume 2)**).

²⁵ RPS: Stranraer Marina Expansion - RPS Wave Modelling for Proposed Layout - Wave and Water Levels for Design and Overtopping, vC-2: 28th March 2025. [RPS confirmed via email 05th August 2025 that model updates subsequent to completion of this study do not impact on maximum possible flood levels as identified from this study, or on conclusions reported herein regarding potential impacts of the proposed development on maximum wave heights.]

²⁶ SEPA: Flood Risk Management Maps: March 2025 update. Available at - <https://map.sepa.org.uk/floodmap/map.htm>

10.41 A qualitative assessment of available topographic information and identified culvert routes indicates that, if the capacity of the culverted reaches were to be exceeded, flows have the potential to be routed from the culvert inlets overland through the dense network of streets within Stranraer. Given the density of buildings and other obstructions to flow in the intervening space, the majority of this flow would be expected to pond in low lying ground in the vicinity of the culvert inlets – the nearest of which is over 300m from the site – and / or behind buildings and obstructions on route to the coast. However, as the general fall of the land is down towards the Marina, there is a potential for these flows to be routed towards the site along the approximate route of flooding indicated by SEPA flood maps (**Figure 10-2**).

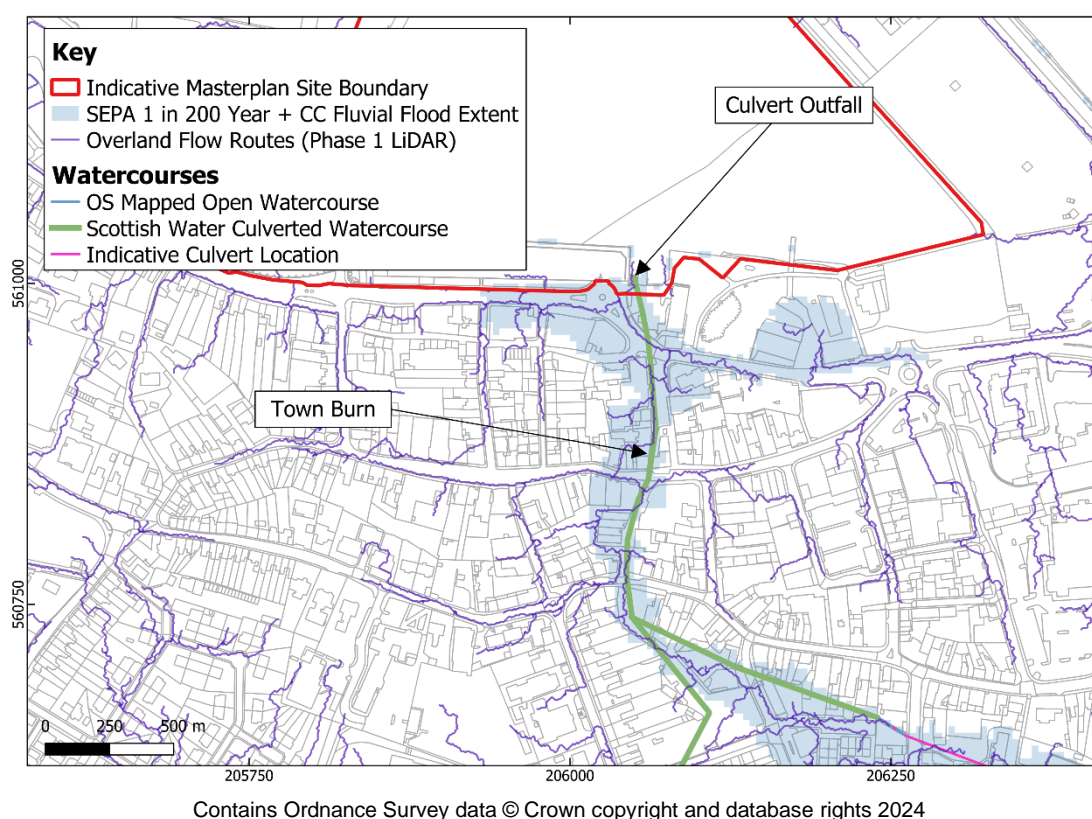


Figure 10-2: SEPA Fluvial Flood Extents (1 in 200 Year + CC)

10.42 Any flows routed towards the site would enter at the pre-existing low point within the vicinity of the Town Burn culvert outlet and drain immediately to Loch Ryan. Should backflow occur through the lower Town Burn culvert as a result of elevated tidal levels there is also potential for water to emerge at surface via pre-existing manholes, connecting drainage gullies and / or at the culvert inlet. Were this to occur, comparable flooding would be expected as in the case of the capacity of this culvert being overwhelmed.

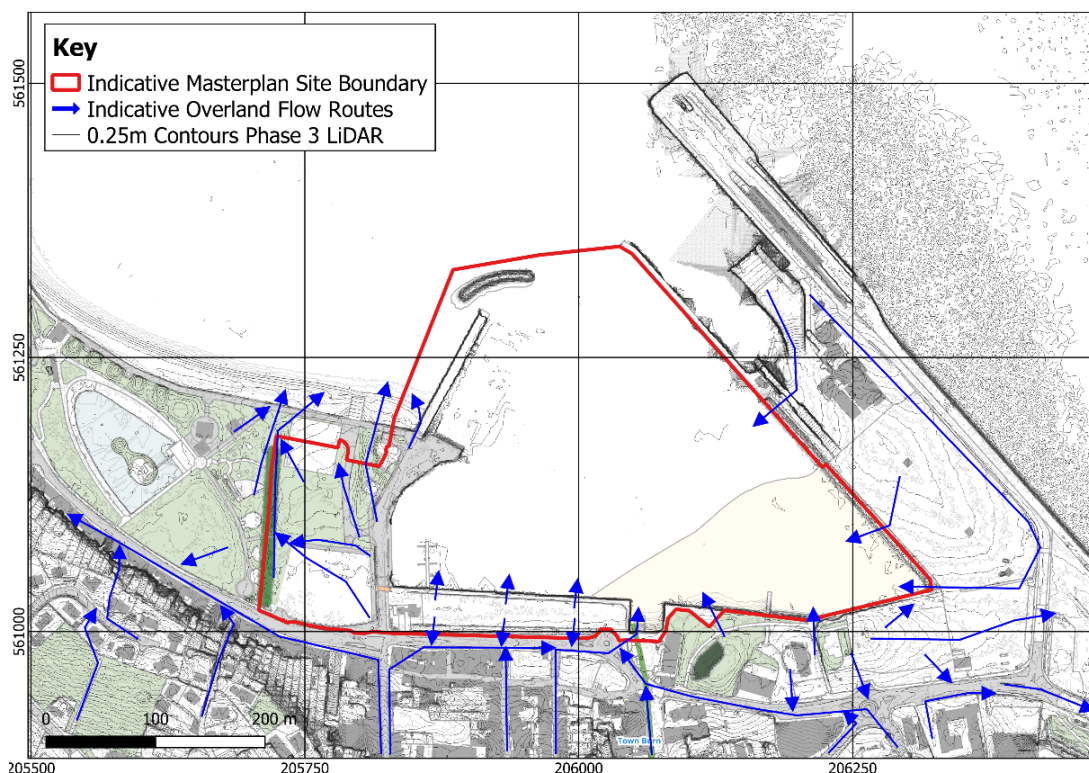
Infrastructure Failure

10.43 In the event that culverts along the Town Burn were to become blocked, there is the potential for flood levels upstream of these structures to increase, resulting in an increase in fluvial flood risk. Should this occur, comparable flooding would be expected as in the case of the capacity

of these culverts being overwhelmed. No other sources of infrastructure failure have been identified as potentially contributing to existing flood risk at the site.

Surface Water Flooding

10.44 Overland flow routes have been assessed using Phase 1 and Phase 3 LiDAR data²⁷, with indicative flow routes shown in **Figure 10-3**. This indicates that overland flow from the south towards the Marina is typically intercepted by the A717 / A718 and transmitted away from the site along these roads and / or directed to Loch Ryan via the low point at the Town Burn outfall / existing slipway. Overland flows generated within the site itself are expected to drain towards Loch Ryan to the north or to lower ground associated with the A717 / A718 to the south. This has the potential to result in localised surface water flood risk along the A717 / A718 and in pockets of low-lying ground along the waterfront, as indicated by SEPA Surface Water Flood Maps for the 1 in 200 year + CC event. However, existing sewer infrastructure is expected to convey the majority of overland flow away from low lying ground.



Contains Ordnance Survey data © Crown copyright and database rights 2024

Figure 10-3: Overland Flow Routes

Sewer Flooding

10.45 Sewer flooding can occur when prolonged or heavy rainfall exceeds the capacity of the sewer network; if tidal waters ingress the sewer network via outfalls on the seawall; if high tidal waters block the release of surface water flows via outfalls on the seawall; or if the sewer network

²⁷ Scottish Government: Scottish Remote Sensing Portal. Available at - <https://remotesensingdata.gov.scot/data#/map>

becomes blocked. Review of the SW Asset Database²⁸ indicates that there is existing drainage infrastructure within the site area. An existing drainage network serving the surrounding areas of Stranraer town is also located immediately adjacent to the site, including along the A717 / A718. Should existing sewers become blocked or the pipe capacity be exceeded, surcharging floodwater would flow overland following the same flow routes as described for surface water flooding.

Groundwater Flooding

- 10.46 The proposed development is situated outwith groundwater-influenced flood extents shown on the SEPA Flood Maps. The site is made up of reclaimed land and comprises predominantly made ground and paved surfaces and the wider Stranraer area is also heavily developed, which is expected to limit the potential for emergence of groundwater at the surface.
- 10.47 Recent GI and monitoring works^{29,30} at the site recorded groundwater levels of between 1.25 and 3.0m below ground level and noted that groundwater flow is likely to be generally northwards towards Loch Ryan. Results also indicated that groundwater at the site is under tidal influence; which illustrates hydraulic connectivity between groundwater in the area and Loch Ryan and is expected to limit the potential for groundwater emerging above ground. Groundwater flooding is therefore considered unlikely.

Receptor Sensitivity

- 10.48 Following establishment of the baseline conditions in relation to flood risk, potential flood receptors have been identified based on existing land uses within potential flood risk areas and are assigned a sensitivity in **Table 10-7**, alongside justification for this categorisation based on the criteria outlined in **Table 10-4**.

Table 10-7: Flood Risk Receptors & Associated Sensitivity

Receptor	Sensitivity	Justification
Critical Services (inc. Stranraer Police Station and Port Rodie Service Station)	High	<i>Most Vulnerable</i> land uses, with potentially significant adverse social impacts if access to emergency services is disrupted / potential environmental implications due hazardous substances contained at the service station.
Residential Properties (inc. Hotels and Hostels) & Critical Access Transport Links	High	<i>Highly Vulnerable</i> land uses, with potential health and safety (H&S) concerns, financial loss, or emotional distress associated with flooding of these properties; and transport routes for which disruption may impede access for emergency vehicles.
Water and Waste Water Infrastructure (inc. Port Rodie Sewage Pumping Station)	High	In the absence of confirmation that this contains appropriate flood resilience measures, it is assumed the pumping station has the potential to be overwhelmed which could result in H&S concerns, environmental implications and financial losses – with loss of service leading to failures in wider network.

²⁸ Scottish Water: Scottish Water Asset Database. Available at: <https://www.scottishwater.co.uk/Business-and-Developers/NEW-Connecting-to-Our-Network/Developing-housing-and-commercial-properties/Preparing/Asset-Plans>

²⁹ Causeway Geotech: Stranraer Marina Expansion: Ground Investigation (GI) Report – Document No. 24-M039: 2024

³⁰ Fairhurst: Geo-Environmental and Geotechnical Interpretative Report - Document No.: 161378-FRH-XX-00-RP-G-000001: 2024.

Receptor	Sensitivity	Justification
Commercial Properties (inc. Food and Drinking Establishments)	Medium	<i>Least Vulnerable</i> land uses, however flooding of these properties could result in H&S concerns and financial losses.
Ancillary Harbour and Marina Buildings (inc. Harbour Office, Loch Ryan Sailing Club, RNLI Stranraer Lifeboat Stations)	Medium	Although these buildings' uses are defined as being <i>Water Compatible</i> under NPF4 due to their operational requirement to be located along the shoreline, in the absence of confirmation that these contain appropriate flood resilience measures / what flood levels these were designed to withstand these have been defined as having comparable sensitivity to <i>Least Vulnerable</i> land uses (i.e. comparable to non-water compatible office buildings) for the purpose of this assessment.
Regionally Important Transport Links (inc. A717 / A718, A77 and Railway)	Medium	These represent the primary road and rail transport links to Stranraer. Disruption to these routes may impede significantly disrupt community and business continuity.
Local Access Transport Links (inc. King Street, Queen Street, Princess Street, North Strand Street and Bellevilla Road)	Low	Local roads only, where alternative access is available.
Open Ground (e.g. Agnew Park) / Car Parking Areas)	Low	<i>Water Compatible</i> land use with low vulnerability to flooding.

Future Baseline

- 10.49 Climate change, in particular rising sea levels, and evolving land use have the potential to impact future flood risk within the receiving environment. As stated in **Paragraph 10.22**, the baseline conditions described above and in **Appendix 10.1: FRA (Volume 2)** assess existing flood risk in up to a 1 in 200 year + CC event – i.e., the event that defines the flood risk area under NPF4. Changes in flood risk likely to occur in the absence of developing the project as a result of climate change, i.e. the future baseline conditions, are therefore already embedded in the design standard.
- 10.50 In terms of evolving land use, the D&G SMP (**Paragraph 10.12**) identifies 'Hold the Line' (i.e. maintaining the existing shoreline position and preventing further retreat by implementing defences or interventions) possibly in combination with 'Managed Realignment' (i.e. landward movement of infrastructure and properties in the future) as the preferred approach to managing the predicted increase in frequency of future flooding and erosion events along the D&G coast. This policy is likely to require active management and construction, to maintain or improve the standard of protection presently afforded. The proposed development is in alignment with this policy – with the rebuilding of coastal walls, and construction of offshore breakwaters capable of improving / maintaining the standard of protection provided along the coast. In the absence of the proposed development, it is expected that alternative / additional management would be implemented along this coastline in order to meet the requirements of this policy.

Impact Assessment

Introduction

10.51 This section summarises the potential effects of the proposed development on identified receptors from activities during the operational phase, taking into account any embedded mitigation designed into the project. As stated in the Impact Assessment Methodology (**Paragraph 10.28**) and consultation response provided by Scottish Ministers (**Table 10-2**), assessment of flood risk during the Construction (temporary) phase has been scoped out of the EIAR. This is largely due to the short-lived and transitory nature of this phase.

Embedded Mitigation

10.52 Baseline conditions indicate that the site is located within the 1 in 200 year + CC coastal flood extent; however, the proposed development is identified in the DGC LDP2 and comprises water compatible uses, as well as the redevelopment of a previously used site in a built up area for which the LDP has identified a need to bring into positive use. Embedded mitigation has therefore been designed into the proposed development and it is considered that the final design and site layout presented on Drawing 161378-FRH-00-00-DG-Z-000001 S1 P02.1 (**Volume 3**) appropriately mitigates flood risk.

10.53 The design of the proposed development has taken account of potential effects on flood risk, and good practice should be employed and design standards adhered to in the detailed design to fully avoid or minimise potential adverse effects during the operational phase. The proposed development incorporates embedded mitigation to manage flood risk, which has been considered when assessing the operational phase of the development (see **Paragraph 10.56**).

10.54 Note that, as this chapter considers flood risk to the existing environment as a result of the proposed development, this section considers only embedded mitigation in relation to avoiding impacts on flood risk to existing receptors. Embedded mitigation and flood resilience^{31,32,33} is recommended to mitigate flood risk to the proposed development itself, which is detailed in **Appendix 10.1: FRA (Volume 2)**. That being the case, embedded mitigation of relevance to this chapter includes:

- **Siting and Design:**
 - The proposed development includes an area of reclaimed land; an extension to the existing breakwater at the end of the West Pier; a new floating breakwater as part of the superyacht berth in the harbour; a new quay wall along the Breastworks car park; slipway development works; and dredging of

³¹ SEPA: Floodline. Available at: www.sepa.org.uk/environment/water/flooding/floodline/

³² Scottish Government Property Flood Resilience Delivery Group, 2019. Living with Flooding: An Action Plan for Delivering Property Flood Resilience in Scotland. Available at: <https://www.gov.scot/publications/living-flooding-action-plan-delivering-property-flood-resilience-scotland/>

³³ EA: Improving the Flood Performance of New Buildings - Flood Resilient Construction: May 2007. Available at: https://assets.publishing.service.gov.uk/media/602d673ee90e0709e8d085d8/Improving_the_Flood_Resilience_of_Buildings_Through_Improved_Materials_Methods_and_Details_Technical_Report.pdf

- the harbour to facilitate access. The final placement, finished levels, profiling and design of marine elements has been informed by coastal modelling (see **Chapter 7**), which has allowed for the development of a design capable of providing acceptable wave heights at all the proposed pontoon berths and of avoiding adverse impacts on coastal processes from proposed physical modifications.
- Development proposals for the slipway improvement incorporate local land reclamation and new slipway extending into the harbour. This will incorporate an extension of the existing Town Burn culvert below locally reclaimed land. This should be appropriately assessed and designed to avoid any reduction in capacity in comparison to existing conditions, in order to avoid any increase in flood risk from the Town Burn as a result of the proposed structure.
 - The grading within terrestrial areas is planned to remain comparable to existing, and the reclaimed land design should be appropriately profiled to allow this area to drain towards the coast / avoid impeding existing drainage routes.
- **Surface Water Drainage Strategy**
 - All proposed surface water drainage networks for the site are to either make use of existing surface water networks, or discharge into coastal waters via existing or new surface water outfalls. The proposals are intended to represent the existing drainage discharge rates on a like for like basis. This is detailed in **Appendix 10.2: Drainage Design Strategy Report (Volume 2)**.

Operational Phase

10.55 Site operation will represent a permanent change to the baseline environment, with any identified effects of the proposed development being long-term. Taking this into account, the following potential effects on flood risk have been assessed for the operational phase:

- Land raising and land reclamation in the flood risk area resulting in reduced floodplain storage and increasing flood risk elsewhere;
- Permanent changes in coastal processes altering wave climate;
- Permanent physical modification around the outfall of the culverted Town Burn and associated effects on flood risk upstream; and
- Permanent physical changes to surface water drainage and associated effects on runoff.

10.56 Potential operational impacts of the proposed development are discussed below and the expected magnitude of impacts and significance of resulting effects summarised in **Table 10-8**, incorporating the embedded mitigation outlined previously in **Paragraph 10.54**.

Land raising and land reclamation in the flood risk area

- 10.57 The proposed development includes an area of reclaimed land to the southeast of the site, which will be the location of a new carpark and community space, as well as discrete areas of land raising within the development. This is located within the coastal flood risk area, and so represents a reduction in floodplain storage and a potential increase in flood risk elsewhere. However, the issue of potential floodplain capacity loss at this scale is not relevant when considering coastal flood extents, as the volume of tidal inundation is so vast during an extreme event that any localised loss of capacity would not materially increase depths elsewhere. Associated impacts are, therefore, considered of Negligible magnitude resulting in a **Negligible** significance of effect.

Permanent changes in coastal processes altering wave climate

- 10.58 The RPS wave study and coastal flood modelling detailed in **Appendix 10.1: FRA (Volume 2)** was carried out for both baseline and proposed scenarios for joint probability 1 in 200 year + CC events. The results show that the design and placement of marine elements is largely expected to reduce significant wave heights within Loch Ryan in the vicinity of the harbour and marina, and identify no increase in significant waves heights along the modelled extent of the adjacent coast. This is due to increased interaction between the propagating waves and the foreshore / marine structures, which results in increased wave breaking / dissipation and reduced significant wave heights. As a result, it is concluded that proposals will not increase risk from wave action. The impact of the proposed development is therefore considered of a Negligible magnitude in terms of wave action, with some betterment identified for coastal flood risk as a local reduction in significant wave heights is identified, resulting in a **Negligible** significance of effect.

Permanent physical modification around the outfall of the culverted Town Burn and associated effects on flood risk upstream

- 10.59 Slipway development works and extension of the Town Burn culvert should be appropriately assessed at the detailed design stage, with the proposed culvert designed to avoid any reduction in culvert capacity in comparison to existing conditions. The impact of the proposed development is therefore considered of a Negligible magnitude in terms of impact on Town Burn flood risk, resulting in a **Negligible** significance of effect.

Permanent physical changes to surface water drainage and associated effects on runoff

- 10.60 All proposed surface water drainage networks for the site should either make use of existing surface water networks – representing the existing drainage discharge rates on a like for like basis – or discharge directly into coastal waters via existing or new surface water outfalls. This

strategy is intended to avoid exacerbating sewer flood risk and appropriately manage surface water runoff.

- 10.61 Additionally, ground within the site and within the area of reclaimed land should be profiled to route overland flows appropriately to avoid causing an increase in flood risk. With these measures in place the magnitude of the impact associated with changes to surface water drainage is considered Negligible in terms of flood risk, resulting in a **Negligible** significance of effect, and no further assessment is made.

Mitigation, Monitoring and Residual Effects

Mitigation / Monitoring

- 10.62 The embedded mitigation of the proposed development has removed the need for additional measures to be implemented for the operational phase.

Residual Effects

- 10.63 The residual effect of the proposed development on flood risk, therefore, remains **Negligible**.

Cumulative Effects

10.64 Existing and proposed developments within the vicinity of the proposed development are discussed in **Chapter 25** and those relevant to this assessment are summarised below.

10.65 The following committed projects, relevant to this assessment, have been identified:

- **Planning Permissions**

- 24/1407/FUL: Former Stena Port Port Rodie Stranraer - change of use of part of former port to form haulage yard (class 6), siting of office, erection of 3 metre high security fencing and access gate and installation of security lighting columns (partially retrospective)
- 23/0739/CLP: Land At Port Rodie Car Park Harbour Street Stranraer DG9 8EG - Installation of 4 electric vehicle charging points with associated charging upstands, supporting equipment cabinets and substation infrastructure
- 23/0976/FUL: Land Between West Pier And Agnew Park, Stranraer Harbour, Stranraer - Erection of boat shelter with roof mounted solar panels; extension to boat yard including formation of hardstanding area, installation of pole mounted flood lights, erection of 2 metre high security fencing and formation of gated access; formation of instructor platform, equipment lay down area, open air showers, stepped access to the beach and erection of instructor shelter
- 23/0970/FUL: Land To West Of Marina And Harbourmaster's Office Stranraer - Erection of watersports centre and installation of roof mounted solar photovoltaic panels, formation of additional parking area with associated hard and soft landscaping and formation of footpath

10.66 The following projects awaiting determination have also been identified:

- **Planning Applications - Awaiting Determination**

- 25/1190/FUL: Port Rodie Car Park Port Rodie Stranraer DG9 8EG - Erection of transport hub with roof mounted photovoltaic panels incorporating provision of secure bicycle locker storage for bicycles, e-bikes (electric bicycles) and acc-bikes (accessible electric bicycles), bike wash/pump/repair station, public toilets, bus waiting area(s), internal general purpose space and external shelter with fixed benching and installation of 5no. bike stands and 4no. electric vehicle charging units

- **Marine Licence Applications - Awaiting Determination**

- 00010825 (Marine Scotland): Construction of: Platform for instructor shelter. Removal of: 2 no. redundant sewer outfall pipes & debris, unlit beacon, removal of boulders, beach clearance

- 00010841 (Marine Scotland): Marine Construction & Pontoon Deposit - 8 (pontoons) + 3 (racing markers). Moorings are for offshore pontoons as opposed to vessels. Small craft (e.g. SUP, dinghies) will dock against the pontoons temporarily as rest stations. No vessels will be moored to the racing markers.
- 00010772 (Marine Scotland): Marine Licence Application – 18 Moorings

10.67 The enactment of the Flood Risk Management (Scotland) Act 2009 has imposed a duty on local authorities and other responsible authorities to contribute to managing flood risk in Scotland. As such, existing and proposed developments identified within the vicinity of the proposed development should, and will, have undergone appropriate flood risk assessment and should incorporate suitable mitigation to address any associated flood risk. As a result, it is anticipated that the significance of effect of the proposed development on flood risk will remain **Negligible** for the operational phase when considering the cumulative effect of these developments.

Summary and Conclusions

- 10.68 This chapter considers flood risk to the existing environment, with flood risk to the proposed development being fully assessed in **Appendix 10.1: FRA (Volume 2)**. The FRA was carried out in accordance with NPF4, and in consideration of coastal flooding, fluvial flows, infrastructure failure, overland flow, sewer flooding and groundwater flooding. The FRA details measures required to ensure the proposed development is protected, with particular focus on the risks due to coastal flooding. These measures include adopting water-resistant forms of construction / materials, in order to embed flood resilience within the design.
- 10.69 Effects of the construction (temporary) phase on potential flood risk have been scoped out of the EIAR, given the short-lived and transitory nature of this phase; however, the contractor will be required to produce and agree a CEMP to describe how construction will be managed to avoid, minimise and mitigate any potential construction effects on the environment and existing surrounding receptors, thus embedding resilience to flood risk during the construction phase.
- 10.70 Assessment of the potential effects of the proposed development on flood risk to the existing environment was carried out for the operational phase of the development, as summarised in **Table 10-8**. With consideration of embedded mitigation within the siting and design of scheme elements in cognisance of impacts on coastal processes and including a surface water drainage strategy designed to represent the existing drainage discharge rates on a like for like basis or discharge directly to coastal waters - the level of potential operational effects on flood risk has been assessed as **Negligible** and no additional mitigation is required.
- 10.71 Overall, on the basis of the design and site layout presented on Drawing 161378-FRH-00-00-DG-Z-000001 S1 P02.1 (**Volume 3**), no significant adverse effects have been identified on flood risk as a result of the proposed development, with some betterment identified in regards existing coastal flood risk as a result of local reductions in wave heights in the Marina.
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Table 10-8: Summary of Operational Phase Effects

Receptor	Receptor Sensitivity	Potential Impact	Magnitude of Impact	Significance of Effect	Additional Mitigation	Residual Magnitude of Impact	Residual Significance of Effect
Critical Services, Residential Properties, Critical Transport Links, Water & Wastewater Infrastructure	High	Potential operational effects on flood risk, include: <ul style="list-style-type: none"> • Reduced floodplain storage increasing flood risk elsewhere; • Changes in rates of wave overtopping; • Impacts on the outfall of the Town Burn and on flood risk upstream; and • Changes to surface water drainage. 	Negligible	Negligible	With consideration of embedded mitigation, potential significant operational effects on flood risk will be avoided, prevented, reduced or offset and no additional mitigation is required.	Negligible	Negligible
Commercial Properties, Ancillary Harbour & Marina Buildings, Regionally Important Transport Links	Medium		Negligible	Negligible		Negligible	Negligible
Local Access Transport Links, Open Ground & Car Parking Areas	Low		Negligible	Negligible		Negligible	Negligible