

CHAPTER ELEVEN WATER AND HYDROGEOLOGY

11.1. INTRODUCTION

The proposed application site (Phase II) is part of a phased development proposal for a significant city centre, regeneration area or Masterplan Site (MS). This MS is divided into four different phases of delivery as detailed in Section 1.6.3 in Chapter 1.0 Introduction. The overall MS layout which illustrates the indicative layout of the subject site and adjoining lands in the ownership of the applicant is displayed on Figure 1.4 in Chapter 1.0 and full details of the proposed development phases are given in Chapter 2.0.

In addition to an in-depth assessment of the Proposed Development, this assessment takes a holistic approach and examines the wider MS area, taking into account the proposed future phases of development based on the available information. This chapter considers and assesses the impacts on hydrology and hydrogeology arising from the construction and operation of the development. It also addresses the potential remedial impact of the proposed development on hydrology and hydrogeology.

11.2. ASSESSMENT METHODOLOGY

The following scope of works were undertaken by AtkinsRéalis in order to complete this assessment:

1. Desk-based study including review of available historical information and reports
2. Site walkover surveys carried out on 27th March 2025, and 24th July 2025.
3. Groundwater and surface water investigation study (including sampling and monitoring) undertaken by Priority Geotechnical Ltd in May 2025 and July 2025..

The purpose of the desk-based task was to characterise the current hydrological and hydrogeological setting of the proposed development. Relevant background information was compiled, specifically from the following data sources;

- Bing Maps Aerial photography (consulted 05/08/2025);
- Limerick Development Plan 2022-2028 (consulted 05/08/2025);
- Environmental Protection Agency (EPA) web mapping (consulted 25/06/2025);
- Geological Survey of Ireland (GSI) Datasets Public Viewer and Groundwater web mapping (consulted 26/06/2025);
- Google Maps Aerial photography (consulted 25/06/2025);
- Ordnance Survey of Ireland (OSI) web mapping geohive.ie (consulted 05/08/2025);
- Topographic-map.com (consulted 05/08/2025);
- Water Framework Directive data pages on catchments.ie (consulted 25/06/2025).
- Final Ground Investigation Report (Priority Geotechnical Ltd., 2025)

This assessment has been completed in accordance with relevant best practice guidance from the Institute of Geologists of Ireland (IGI), 'Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements' (IGI, 2013). The IGI guidance document

is an updated version of the 2002 guidelines, 'Geology in Environmental Impact Statements, A Guide' (IGI, 2002), which was revised to take account of legislative changes, and the operational experience developed by geoscientists in the production of relevant environmental assessments. This assessment has also been prepared in accordance with the relevant Environmental Protection Agency (EPA) guidance, 'Guidelines on the information to be contained in Environmental Impact Assessment Reports' published in May 2022 (as detailed further below).

11.2.1 Description of Effects

This assessment has also been prepared in accordance with, and is fully compliant with the relevant Environmental Protection Agency (EPA) guidance, '*Guidelines on the information to be contained in Environmental Impact Assessment Reports*' published in May 2022, specifically with regard to the significance of effects (as per 'Table 3.4 Descriptions of Effects' of these Guidelines) of the proposed development on the receiving water environment. Refer also to Section 1.9.4 and Tables 1.3 to 1.6 in Chapter 1 of this EIAR.

11.2.2 Water Framework Directive Assessment

Separately, a Water Framework Directive (WFD) Assessment has been prepared by AtkinsRéalis (2025), which has been submitted as part of this planning application. This report addresses the potential impact of the CRQ development on the WFD status of the WFD waterbodies that are hydrologically connected to the proposed development site, and relevant findings have been incorporated as required within this Chapter of the EIAR.

11.2.3 Limitations and Difficulties Encountered

There are no currently available records which show a connection between a spring source at the Westfield Wetlands and the proposed development site, as detailed further within the assessment. Accordingly, for the purpose of this assessment, it is conservatively assumed that there is an existing viable direct connection between the Wetlands and the proposed development (via. historic abstraction pipework).

Water samples were collected during the baseline assessment, and were analysed at Eurofins UK, a UKAS accredited laboratory. It is noted that some sample results had deviation codes, as detailed further within the assessment. Accordingly these results have been discussed and considered, noting these deviations.

This technical assessment has been prepared, taking account of the above limitations. These limitations have no material impact on the findings of this assessment. The residual impacts as stated within this chapter remain valid.

11.3. EXISTING RECEIVING ENVIRONMENT

11.3.1 Flood Risk

The site has been assessed in accordance with the "The Planning System and Flood Risk Management" Guidelines. Refer to the Flood Risk Assessment (FRA) Report (ARUP, 2025) submitted

as part of this planning application. As part of the sequential test, the OPW flood hazard maps have been consulted, as have the Catchment Flood Risk Assessment Maps produced by the OPW.

The purpose of the FRA report is to identify and assess the risk of flooding to and from the development site and to propose mitigation measures to manage flood risk throughout the lifetime of the development, taking the potential effects of climate change into account.

The key findings of the flood risk assessment (ARUP, 2025) are as follows:

- *The main risk of flooding to the site is tidal (high tides and tidal surges) from the River Shannon. Part of the site lies in areas of high to moderate risk of flooding (Flood Zones A or B). The Shipyard site and part of the Flaxmill site (Infiltration Galleries) are at high risk of tidal flooding (0.5% Annual Exceedance Probability AEP), parts of the Quarry site are at moderate risk of flooding (0.1% AEP) and the rest (majority) of the site is at low risk (<0.1% AEP). These areas correspond to Flood Zones A, B and C respectively.*
- *The site is at low risk of fluvial flooding from the River Shannon in the absence of a high tidal boundary. The Stonetown Terrace, Salesian and Quarry sites could potentially be at risk of flooding from overland flows originating from the adjacent residential development to the north.*
- *Groundwater levels within the site generally exhibit no substantive correlation with the tidal signal and the water levels in the reservoir (which themselves are correlated to the tidal signal). The exception to this is at a well location within made ground in very close proximity to the reservoir at the Quarry site, where the testing results showed that the groundwater levels are more closely related to the water levels in the reservoir (and by default, correlated to the tidal signal, noting the reservoir levels do exhibit a tidal influence, albeit a muted correlation i.e. as these levels are still well below the corresponding tide levels). Overall the risk of groundwater flooding is deemed low, particularly once the connectivity of the reservoir to the river is established and mitigated.*
- *Survey investigations have confirmed that the reservoir within the Quarry site discharges to the River Shannon. Ongoing analysis will further the understanding of the subsurface pipe network and its hydraulic connectivity to the river. It is evident from initial surveys that the flow and volumes passing through the network and reservoir are low and the tidal signal is muted, indicating a lower risk from tidal flooding. Upon completion of the network assessment, measures will be implemented to prevent backflow through the system. This shall include the strategic installation of non-return valves and/or decommissioning of redundant pipework.*
- *Highly vulnerable uses such as residential properties shall where possible be in areas at lower risk of flooding or raised upper levels. Residential areas have been located at Salesian site (low), Stonetown Terrace (low) and Quarry site (moderate). Residential plots are also proposed at the upper levels at the O'Callaghan Strand site*
- *Flood Protection Level: Development to be protected against the 1 in 200-year tidal event with allowance for climate change and a suitable freeboard.*
- *Climate Change Allowance: +500mm for less vulnerable uses and +1000mm for highly vulnerable. Freeboard Allowance: +500mm*
- *Minimum Recommended Finished Floor Levels: Lower allowance (commercial uses): 5.7m AOD; Higher allowance (residential/habitable spaces): 6.2m AOD*

- Flood resilient and resistant construction can be used to achieve the required protection, if raising of flood levels is not practically achievable.
- Safe access and egress to be provided from all buildings for emergency vehicles. The Plan proposes that North Circular Road (NCR) be raised above 5.7m AOD to provide safe access and egress.
- There is a risk of overland flows entering the Salesians, Quarry and Stonetown Terrace sites from the north during a significant rainfall event. A new perimeter drain (open or piped) can intercept any offsite overland flows from adjacent properties to the north of the site to safely divert the flow away from the properties.

The extent of predicted tidal flooding (CFRAM study) and flow paths (shown in blue) within the proposed development boundary are presented below (ARUP, 2025).

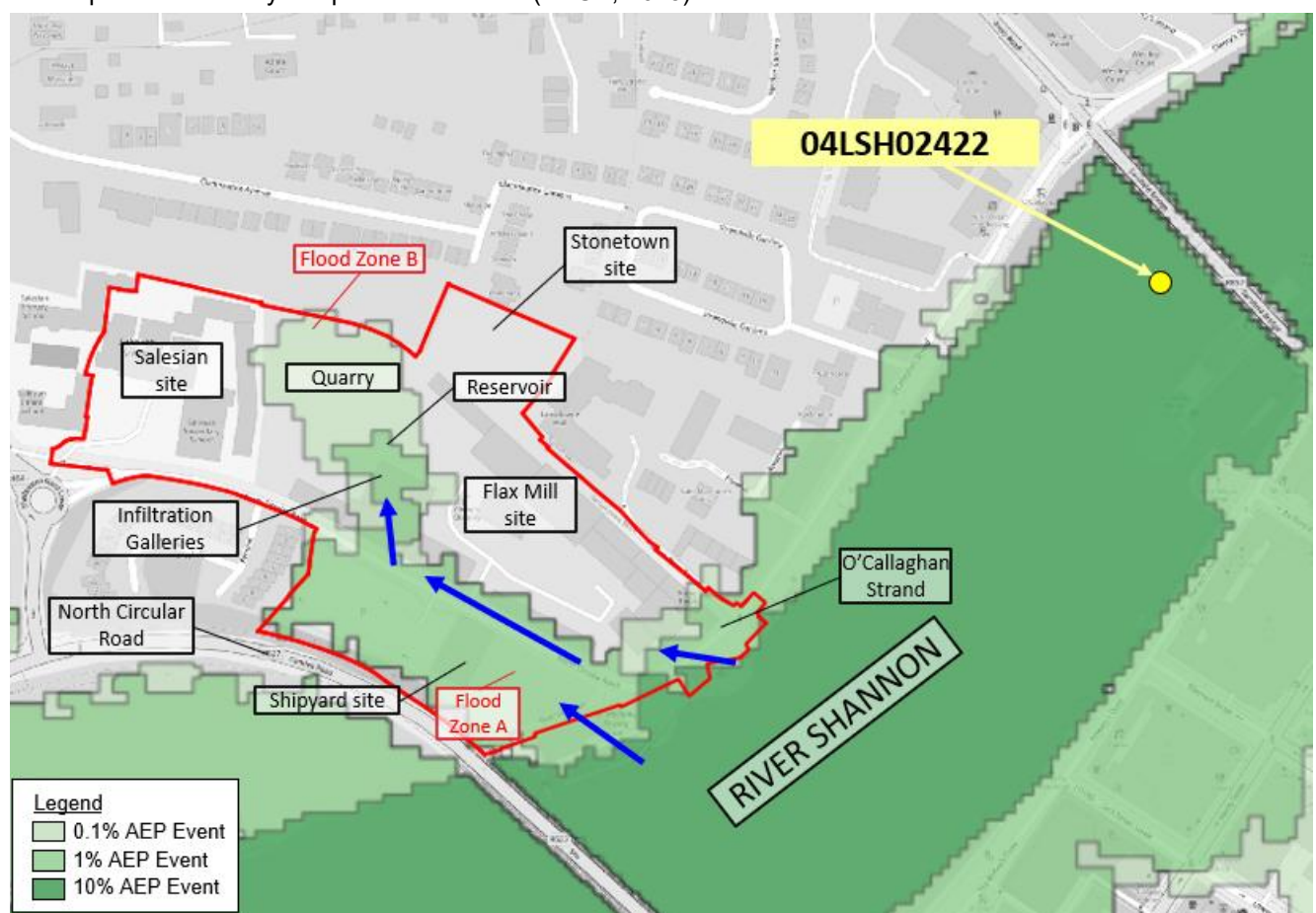


Figure 11-1 - Tidal flooding (CFRAM study) and flow paths (shown in blue). Site boundary shown in thin red line (ARUP, 2025)

11.3.2 Site development

A review of historic maps (including available 6-inch historic maps, 25-inch historic maps, and aerial photographs (1995 to 2018) from the Ordnance Survey of Ireland (OSI, 2023) and current aerial photography (Bing Maps, 2025)) shows that the shipyard site has been in use since the First Edition 6 Inch map was published in 1849, while the remainder of the site was developed for industrial use around

the turn of the 20th century. Activity on the site dates back to the 1800s when the Lansdowne Quarry opened and the site was identified for development as a Flax Factor. Thomas Cleeves established the condensed milk factory on the site in 1884 and despite changes of ownership through the century, the site retained milk processing facilities until 2011. The site now includes the Salesian Secondary School, industrial buildings, workshops and offices and, on the Shipyard site, a warehouse and car park.

11.3.3 Current Site Setting and Topography

The site lies on the west of Limerick City on the bank of the River Shannon and comprises the former Cleeves factory, flaxmill, Limerick Dock shipyard and St Michael's rowing club. The site is enclosed by O'Callaghan Strand road along the river Shannon to the East, the R527 road to the South, the R464 road to the West, and residential areas: Clanmaurice Avenue and Strandville Gardens to the North and Northeast. The surrounding areas are largely residential to the West, North, and Northeast, with Ardscoil Rís across the R464 to the West. The Westfields wetlands lie to the South and Southwest on the other side of the R527.

The existing topographic levels vary greatly across the site, ranging from +13.00m AOD at the top of the Salesians and Stonetown Terrace Sites, down to +3.80m AOD at the Riverside. North Circular Road (NCR) is the primary route into and through the site. The approach to NCR is key to the success of the development. Currently, the NCR slopes down from 6.4 m AOD northwest to 3.97m AOD at the interface with O'Callaghan Strand. The lowest recommended flood protection allowance is 5.7m AOD and requires the re-grading of the NCR to provide safe access and egress to the Flaxmill, Stonetown Terrace and Quarry site. Therefore, the NCR should be re-graded and raised to the 5.7m AOD.

The Shipyard Site is located in Flood Zone A. However, Condell Road runs south of the Shipyard site between 6.5m OD to 8.0m OD northwest to southeast. The road is well above the flood protection level and can provide emergency access and egress for the Shipyard site.

There is a disused quarry excavation at the centre of the site, referred to as the Reservoir, which was historically used for water storage. The onsite reservoir currently discharges to the River Shannon via a historic outfall pipe. A report prepared by Irish Hydrodata Ltd. (2021) made the following findings following dye tracer testing of the outfall connection:

'The main objective of the test has been confirmed, namely that waters exiting the lagoon through the flap valve enter the river Shannon at the outfall adjacent to St. Michael's rowing club on O'Callaghan's Strand. This flap valve appears to be designed to operate solely as an inlet and it is only because it is not functioning properly that waters can exit through it on the falling tide. It is likely therefore, that there is (or was) another means by which waters can exit the lagoon to the river.' Based on the findings of this report a direct connection between onsite Reservoir and River Shannon has been established, with potential for a further (as yet unidentified) connection.



Figure 11-2 Discharge pipe at the River Shannon, during dye tracer testing (Source: Dye Tracer Survey Report (Irish Hydrodata Ltd., 2021))

Refer also to Figure 11-6 which shows the location of the discharge pipe at the River Shannon (identified as 'Outflow'), in the context of the proposed development site.

11.3.4 Protected Areas

The nearest designated European and Natural Heritage Sites are identified as follows (NPWS, EPA, 2025):

- Lower River Shannon SAC (site code 002165) – 0 km (i.e. adjacent to the site boundary). Note the Westfields Wetlands are located 35 m from the site and are included within the above designation.
- River Shannon & River Fergus Estuaries SPA (site code 004077 – ca. 20m from site.

In addition to their designation status, both of the above sites are protected under the EPAs WFD Register of Protected Areas within Ireland.

There are also Proposed Natural Heritage Sites within the vicinity of the proposed development, identified as follows:

- Fergus Estuary And Inner Shannon, North Shore (site code 002048) – 0 km (i.e. adjacent to the site boundary)
- Inner Shannon Estuary - South Shore (site code 000435) – ca. 0.6 km from site.
- Knockalisheen Marsh (site code 002001) – ca. 1.5 km from site.

11.3.5 Hydrology

Surface Water

In addition to the above identified designated sites (i.e. Lower River Shannon SAC (which includes the Westfields Wetlands) River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, Inner Shannon Estuary - South Shore pNHA, and Knockalisheen Marsh pNHA) key surface water bodies in the vicinity of the proposed development have been identified as follows:

- Immediately adjacent to the site is the Limerick Dock Transitional Waterbody (EPA Ref: IE_SH_060_0900) which flows from Shannon Lower (EPA Ref: IE_SH_25S012600) to Upper Shannon Estuary (EPA Ref: IE_SH_060_0800).
- The North Ballycannon River (EPA Ref: IE_SH_25N170970) which flows north to south into Limerick Dock transitional waterbody, approximately 2.5 km west of the site.
- The Crompaun East River (EPA Ref: IE_SH_27C090600) is approximately 3.4 km northwest of the site and flows south west to the Upper Shannon Estuary.

The scheme site lies on the Limerick City Northwest Groundwater body (EPA Ref: IE_SH_G_140), as discussed in further detail in Section 11.3.6. It is noted that both the North Ballcannon River and Crompaun East River are receiving waterbodies for the Limerick City Northwest ground waterbody.

Westfield Wetlands

As previously noted, the Westfield Wetlands are located ca. 35m to the South West of the site across the R527. The Westfield Wetlands cover ca.25 hectares and are part of the Lower River Shannon Special Area of Conservation (SAC 002165). The wetlands are also bounded by the River Shannon and River Fergus Estuaries Special Protection Area (SPA Site Code 4077). The Westfield Wetlands serves as a popular local amenity, attracting a diverse range of wildlife, including migrating wildfowl. This area is an essential resource for city residents and a refuge for wildlife.

Based on existing topography and inferred regional groundwater flow direction (discussed in detail in Section 11.3.6) it is likely that there is indirect connectivity between the site and the Westfield Wetlands via. groundwater flow (from the proposed development site towards the groundwater discharge zone along the River Shannon SAC). Furthermore, based on available information, there is a reported direct connection between the proposed development site and the Westfield Wetlands, via. historic abstraction from a Spring source within the Wetlands, as detailed further below.

According to the JBA Consulting report “Westfields Wetlands Management Plan” (JBA Consulting, 2023¹) there are 2no. identified potential sources of water to the Wetlands:

- the main flow into the wetland area appears to be flow via. a pipe from the River Shannon directly to the Wetlands during high tide, which splits beneath the pedestrian causeway to enter both the Central Wetland and Eastern Wetland waterbodies; and,
- via. a spring located in the eastern portion of the Wetlands, approximately 550m from the proposed development. Review of aerial photography suggests that the spring continues to flow.

¹Limerick City and County Council commissioned a management plan for the Westfields Wetlands to assess the ecological health of the area and to provide a long term management of the wetland habitats. Document available here: [westfields-management-plan-july-2023.pdf](#)

Furthermore, this spring source '*supplied the Cleeve's Factory nearby... The spring is reported to have been abandoned in the fifties and covered with a steel plate*' (JBA Consulting, 2023). Historic 6 inch mapping available for the region (dating from 19th / early 20th Century) shows the presence of a pumphouse (OSI, 2025).

There are no currently available records which show a connection between the spring source at the Westfield Wetlands and the proposed development site. However given the reported historic presence of the pumphouse, spring supply and locally reported (albeit unconfirmed) connection to the proposed development, along with the fact that any historic decommissioning / capping is unlikely to have fully sealed off the pipework, for the purpose of this assessment it is conservatively assumed that the historic connection remains in place. Therefore it is conservatively assumed that there is an existing viable direct connection between the Wetlands and the proposed development (via. historic abstraction pipework). Key hydrological features in the general vicinity of the site are presented in the Figures below.

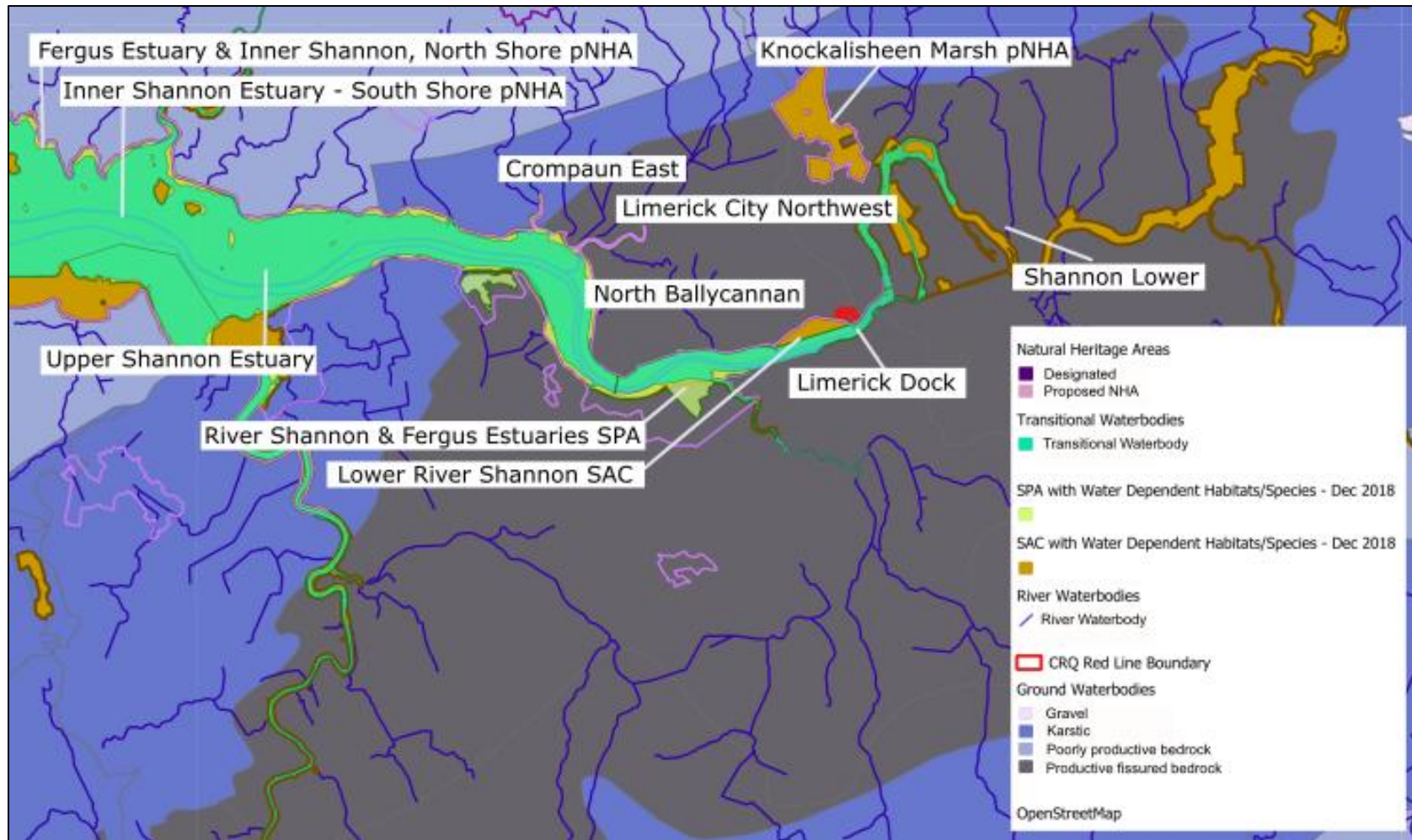


Figure 11-3 River waterbodies, transitional waterbodies, groundwater bodies, protected areas, and proposed Natural Heritage Areas, in the vicinity of the Cleeves Riverside Quarter development.

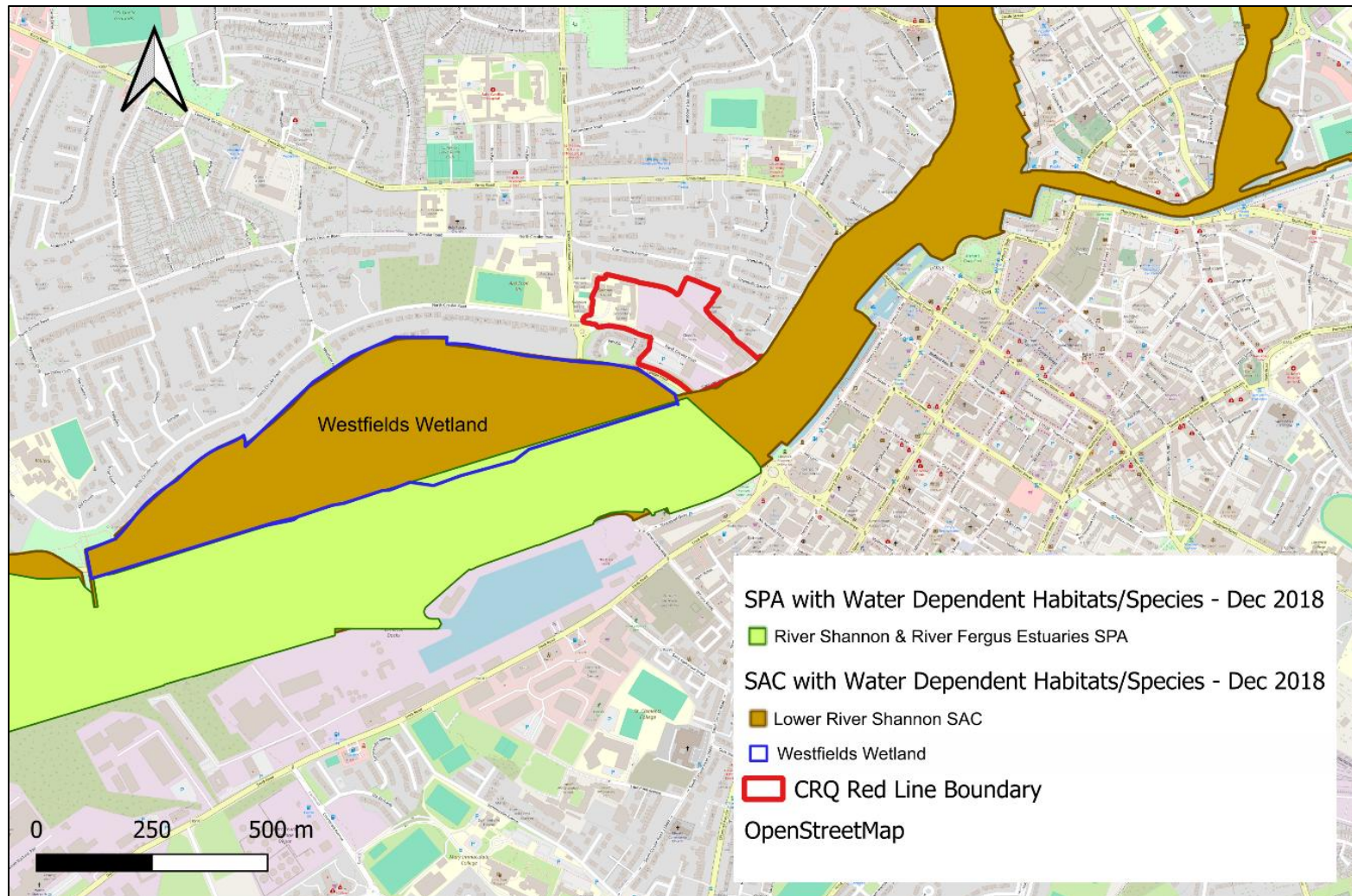


Figure 11-4 - River Shannon and River Fergus Estuaries SPA, and Lower River Shannon SAC locations in relation to the Cleaves Riverside Quarter development.

Water Quality

The EPA maintains a database of surface water features including rivers and lakes as well as water quality and risk status in accordance with the requirements of the EU Water Framework Directive (2000/60/EC) (WFD). The purpose of the WFD is to protect and improve water quality in all waters (including rivers, lakes, estuaries, coastal waters and groundwater). This involves improving or maintaining current water quality status with the aim of achieving ‘Good’ ecological status for all waters by 2027; and mitigating against the risk of a decline in the waterbody quality status. The hydrological connectivity of the site is described above and the WFD status of the relevant waterbodies are examined in detail in the WFD Assessment. A summary of the WFD waterbodies and their current status is given in Table 11.1

Table 11.1 – WFD waterbodies and their ecological status/potential in the latest WFD assessment period, as well as the risk determined in the 3rd Cycle of WFD assessment.

WFD Water body	ID Code	Category	Status (2016-2021)	Risk (3rd Cycle)
Limerick Dock	IE_SH_060_0900	Transitional	Poor (Ecological Potential)	At risk
Upper Shannon Estuary	IE_SH_060_0800	Transitional	Poor	At risk
Shannon (Lower)_060	IE_SH25S012600	River	Moderate	Review
North Ballycannon_010	IE_SH25N170970	River	Good	Not at risk
Crompaun (East)_010	IE_SH27C090600	River	Poor	At risk
Limerick City Northwest	IE_SH_G_140	Groundwater Body	Good	At risk

The proposed development site is located adjacent to the Limerick Dock transitional waterbody (refer to Figure 11.2) which has been designated a Heavily Modified Water Body (HMWB) due to the presence of extensive port facilities, and embankments that have severely altered the natural shape (straightening) of the channel, changed the river banks (armouring), altered and deepened the channel (dredging) and changed the hydromorphological functioning (change in sediment flow and deposition) of the river channel. The connection of this water body with its surrounds and floodplain has also been severely altered. Therefore, the water quality status is given in terms of ecological *potential*, rather than ecological status. The Limerick Dock waterbody was classified as being of “poor” ecological potential in the latest WFD cycle on the basis of monitoring, and with the designation arising from the “Fish Status or Potential”. The breakdown of the WFD elements and their Ecological Potential is given in Table 11.2.

Table 11.2. – Limerick Dock quality elements and values as assessed for WFD Status (2016-2021)

Status	Value
Ecological Status or Potential	Poor
Biological Status or Potential	Poor
Phytoplankton Status or Potential	High

Fish Status or Potential	Poor	
Hydromorphological Conditions	Moderate	
Supporting Chemistry Conditions	High	
General Conditions	High	
Oxygenation Conditions	High	
Dissolved Oxygen (% Sat)	High	
Other determinand for oxygenation conditions	High	
Nutrient Conditions	Good	
Phosphorous Conditions	High	
Specific Pollutant Conditions	Pass	

Approximately 2.7km downstream of the proposed development site, the Limerick Dock transitional waterbody enters the Upper Shannon Estuary transitional waterbody, which was classified as being of “poor” ecological status in the latest WFD cycle on the basis of monitoring, and with the designation arising from “Other Aquatic Flora Status or Potential”. The breakdown of the WFD elements and their Ecological Potential is given in Table 11.3.

Table 11.3 – Upper Shannon Estuary quality elements and values as assessed for WFD Status (2016-2021)

Value	Status
Ecological Status or Potential	Poor
Biological Status or Potential	Poor
Phytoplankton Status or Potential	High
Other Aquatic Flora Status or Potential	Poor
Invertebrate Status or Potential	Moderate
Hydromorphological Conditions	Good
Supporting Chemistry Conditions	High
General Conditions	High
Oxygenation Conditions	High
Dissolved Oxygen (% Sat)	High
Other determinand for oxygenation conditions	High
Nutrient Conditions	Good
Phosphorous Conditions	High
Specific Pollutant Conditions	Pass
Chemical Surface Water Status	Failing to achieve good

The Shannon Lower waterbody (located ca. 7km upstream of the proposed development site) was classified as being of “moderate” ecological status in the latest WFD cycle on the basis of modelling. Nearby, the North Ballycannon waterbody was classified as being of “good” ecological status in the latest WFD cycle on the basis of modelling, while the Crompaun East waterbody was classified as poor on the basis of monitoring, with the designation arising from “Invertebrate Status or Potential”. The WFD Water Quality Status Risk for each surface waterbody as determined in the 3rd Cycle is given in Table 11.2.

It is also noted that the Upper Shannon Estuary transitional waterbody, flows into the Lower Shannon Estuary waterbody (IE_SH_060_0300) approximately 25km downstream of the proposed development site, which was classified as being of “good” ecological status in the latest WFD cycle, and deemed ‘not at risk’ with respect to WFD Water Quality Status Risk. The Lower Shannon Estuary waterbody enters the Mouth of the Shannon (HAs 23;27) Coastal Waterbody (IE_SH_060_0000) downstream of Tarbert, with reported ‘Good’ WFD Status.

Water Quality at Westfields Wetlands

Westfields Wetland is part of Lower River Shannon SAC. As part of the Westfields Wetland Management Plan (2023), a water quality sampling campaign was undertaken by JBA Consulting on a 3-weekly basis from June to November 2020, inclusive. Samples were taken at eight locations for analysis of oxygen conditions, nutrients, physicochemical, and microbiological properties. In general, water quality was found to be relatively good in terms of Biochemical oxygen demand (BOD) and microbiology. However, elevated nutrients – ammonia and phosphorus – were found at some locations. The source of these elevated concentrations of nutrients was not clear and speculated to be due to: waterfowl numbers; mobilisation of nutrients from sediments or decay of plants disposed on the site; stormwater from Condell Road, Westfields Park or elsewhere in the vicinity; inflow from the Shannon on high tide; sewage or greywater pollution; ingress of contaminants from the spring; other local land use factors.



Figure 11-5 - Sample locations in Westfields Wetlands.²

Site Specific Water Quality Monitoring

A water quality monitoring programme has been carried out at the site by Priority Geotechnical Ltd (2025), comprising groundwater sampling from selected representative monitoring boreholes, the onsite reservoir (SW01), and nearby surface water in the River Shannon (at key locations upstream, and downstream of the site, as well as at the discharge outfall from site to the River Shannon).³

² Sample Locations are denoted as follows: 1 – Western end of central wetland, 2 – Inlet/outlet point from central wetland, 3 – Inlet/outlet point from eastern wetland/lake, 4 – Near viewing platform, 5 – Eastern end of the eastern wetland/lake, 6 – South Western side of the southern wetland, 7 – Northern side of the southern wetland, 8 – Open drainage channels to the east end of the southern wetland. S marks the location of the reported spring, per historic maps.

³ Note – preliminary samples were analysed at Eurofins UK, and had deviation codes (B - Sample age exceeds stability time (sampling to extraction); C - Sample not received in appropriate containers; H - Appropriate cooling measures were not taken for sample transportation; or a combination of these).

Tabulated and screened results are presented in Appendix 11-1. Sample locations are presented in Figure 11-6. Samples were taken on two dates (20th May 2025 and 8th July 2025) and, in the case of the surface water samples, at high tide and at low tide on 8th July.

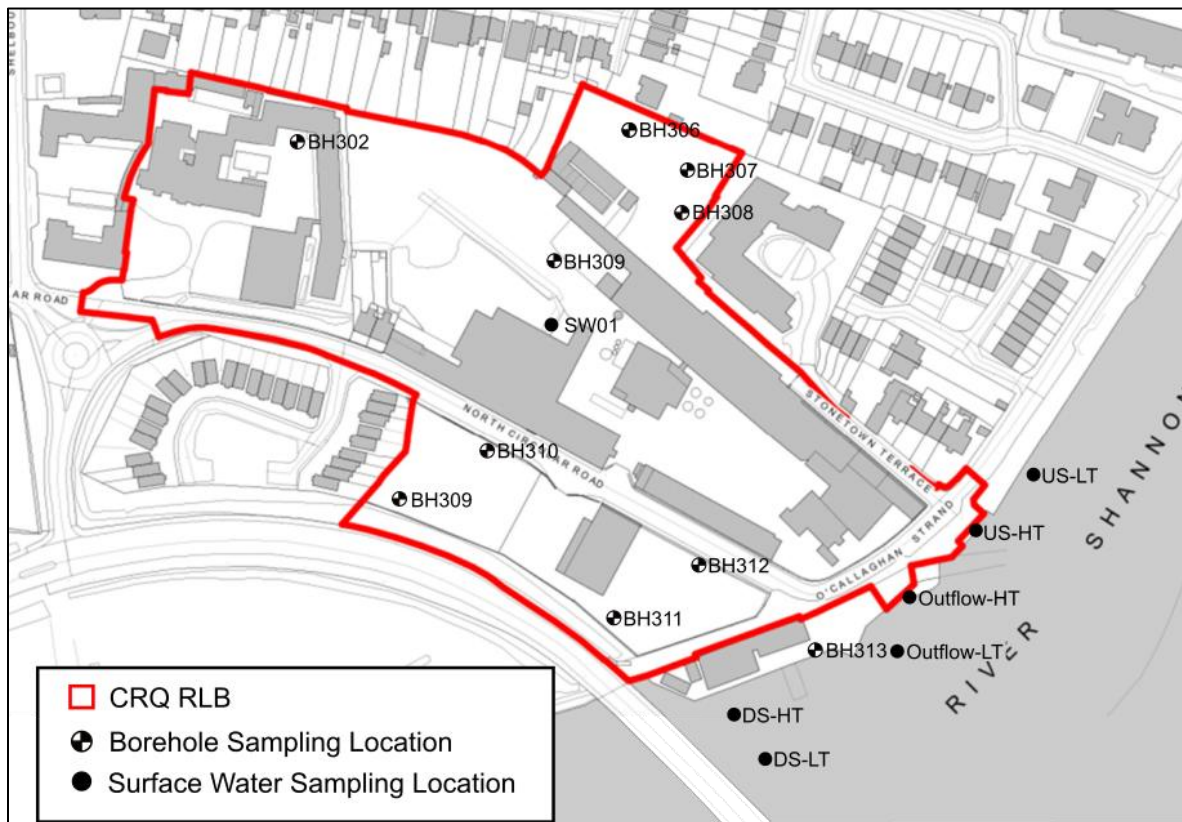


Figure 11-6 - Water quality sampling locations. (BH: Borehole, SW: Surface Water, US: Upstream, DS: Downstream, HT: High Tide, LT: Low Tide)

Analytical results were screened against relevant Generic Assessment Criteria (GAC) which are statutory surface water regulation (SI 272/2009; SI 327/2012; SI 386/2015; SI 77/2019).

Surface Water Results

For the majority of quantitative results, values for determinands were below the statutory thresholds where given. However, there were exceedances observed for BOD for five of the six surface water samples taken from the River Shannon on 08 July. The sixth sample – the outfall sample taken at high tide on that date is on the threshold for BOD (4.0 mg/L). The BOD value for the reservoir on site is 3.0 mg/L for that date. Typically, values for BOD in the River Shannon as monitored by the EPA and reported on catchments.ie are below the statutory threshold of ≤ 4.0 mg/L (95%ile). There have been three exceedances in the last 10 years. Since the upstream value also exceeds the threshold, it is unlikely that the BOD level in the surface water of the River Shannon is negatively impacted by baseline water quality at the proposed development site in this instance.

Potential exceedances are recorded for hexavalent chromium (Cr(VI)) at the outfall on 08 July at both high and low tide. The relevant GAC is 0.6 $\mu\text{g/L}$ AA-EQS, i.e. annual average value environmental quality standard. Therefore, 12 samples over the year would be needed to determine if there is a breach of the EQS value for Cr(VI). Based on the water sampling results, surface water in the reservoir (SW01,

denoted as 'Surface Water' sample location, Appendix 11-1), despite its connectivity to the River Shannon via the outfall pipe, does not appear to be the source of the Cr(VI) as the results for this location were below the limit of detection on both occasions. Cr(VI) was detected above the LOD, but below the GAC threshold (7.5 µg/L) in seven of the thirteen borehole water samples.

11.3.6 Hydrogeology

11.3.6.1 Aquifer Characteristics

The GSI provides a methodology for aquifer classification based on resource value (regionally important, locally important and poor) and vulnerability (extreme, high, moderate or low). Resource value refers to the scale and production potential of the aquifer whilst vulnerability refers to the ease with which groundwater may be contaminated by human activities (vulnerability classification is primarily based on the permeability and thickness of subsoils), as presented in Table 11.4.

Table 11.4 – Aquifer classification per GSI

Depth to rock	Hydrogeological Requirements for Vulnerability Categories				Unsaturated Zone (sand & gravel aquifers only)
	Diffuse recharge			Point Recharge (shallow holes, losing streams)	
	high permeability (sand/gravel)	Moderate permeability (sandy subsoil)	low permeability (clayey subsoil, clay, peat)		
0–3 m	Extreme	Extreme	Extreme	Extreme (30 m radius)	Extreme
3–5 m	High	High	High	N/A	High
5–10 m	High	High	Moderate	N/A	High
>10 m	High	Moderate	Low	N/A	High

i NA = not applicable.
 ii Release point of contaminant is assumed to be 1–2 m below ground surface.
 iii Permeability classifications relate to the engineering behaviour as described by BS 5930.
 iv Outcrop and shallow subsoil (i.e. generally <1.0 m) areas are shown as a sub-category of extreme vulnerability.
 (amended from Deakin and Daly (1999) and DELG/EPA/GSI (1999))

Groundwater vulnerability is an indication of how easily the aquifer can become contaminated by human activity. It is dependent on the thickness and permeability of the overlying soils and depth to the water table. For example, a bedrock aquifer with minimal thickness of overburden or with a thin layer of permeable overburden will be more vulnerable to contamination than a bedrock aquifer which has a thick layer of low permeability overburden. Extreme groundwater vulnerability is also associated with karst landforms as these are a direct pathway for water and contaminants to enter the aquifer from the surface.

The proposed site is underlain by a Locally Important Aquifer (Lm) - Bedrock which is Generally Moderately Productive. There are no reported gravel aquifers in the regional vicinity of the proposed development (GSI, 2025).

Groundwater vulnerability (in the bedrock aquifer) rating is predominantly 'High', with areas of 'Extreme' and 'Rock at or near surface' identified in the vicinity of the onsite former quarry (with exposed rock faces), referred to as 'the reservoir', as presented in Figure 11-7 (GSI, 2025).

There are no karst features located within the site of the proposed development (GSI, 2025). The closest reported karst feature is a Turlough (Karst ID: IE_GSI_Karst_40K_5954), located ca. 5.27 km Southwest of the site, as detailed in Chapter 10 – Land, Soils and Geology.

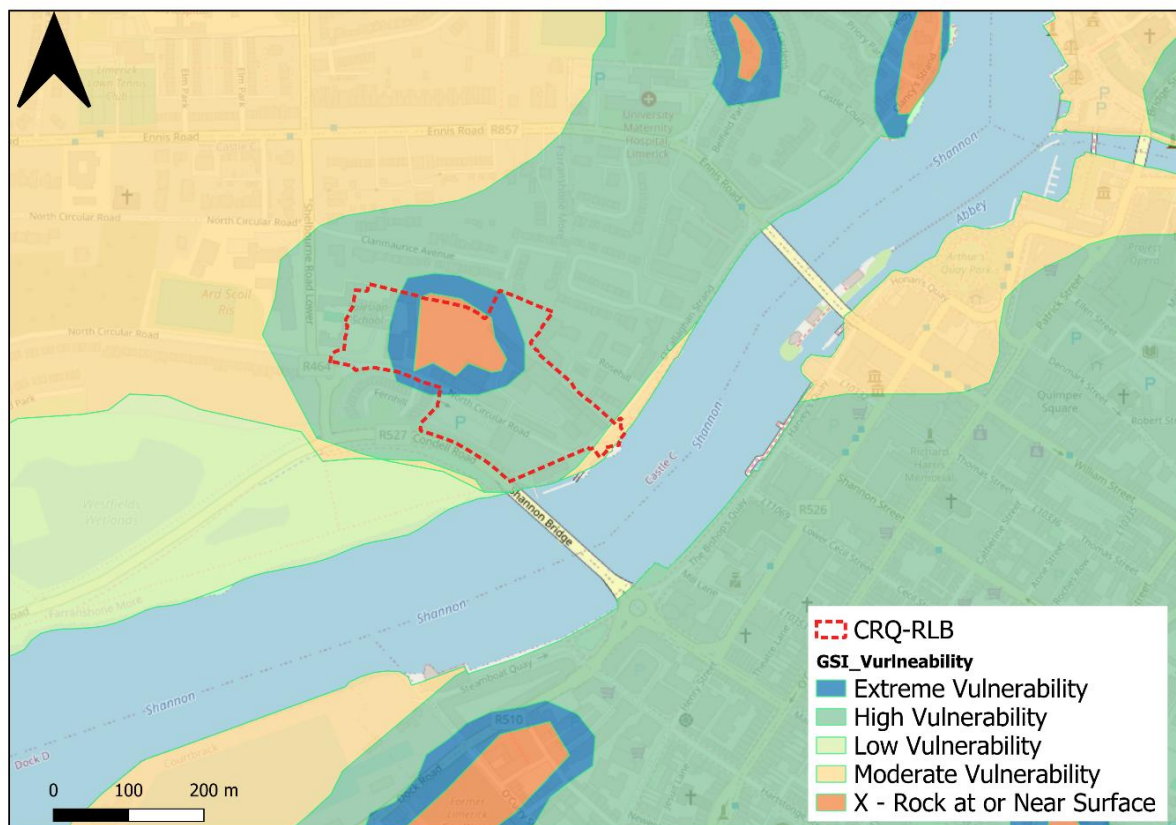


Figure 11-7 : Regional Groundwater Vulnerability Rating

11.3.6.2 Soils & Bedrock Geology

The primary superficial (Quaternary) sediments underlying the site and surrounding area comprise Urban sediments and Bedrock outcrop or subcrop (Rck). Estuarine silts and clays are present along the River Shannon, which borders the Proposed Development (GSI, 2025). This was verified during onsite GI works (PGL, 2025) which confirmed the site is underlain by made ground, glacial deposits (sandy gravelly clay) and strong to very strong limestone Bedrock, of the Visean Limestones (undifferentiated) and Carboniferous limestone Formations.

11.3.6.3 Groundwater Recharge

Recharge is the amount of rainfall which infiltrates to ground and replenishes groundwater levels in the bedrock and gravel aquifers. It is dependent on the following key factors: effective rainfall (i.e. total rainfall less evaporation and surface water run-off), transpiration (i.e. uptake by vegetation) and aquifer characteristics (i.e. how easily the aquifer can accept water and store it). Additionally, not all effective rainfall will contribute to recharge due to impermeable materials in urbanised areas and associated drainage and water management infrastructure.

The average recharge rate to the bedrock aquifer underlying the general vicinity of the site is 101 - 150mm/yr, while the average recharge rate at the exposed bedrock / reservoir area of the site reported to be 401 – 450 mm/yr with (GSI, 2025), as presented in Figure 11-8.

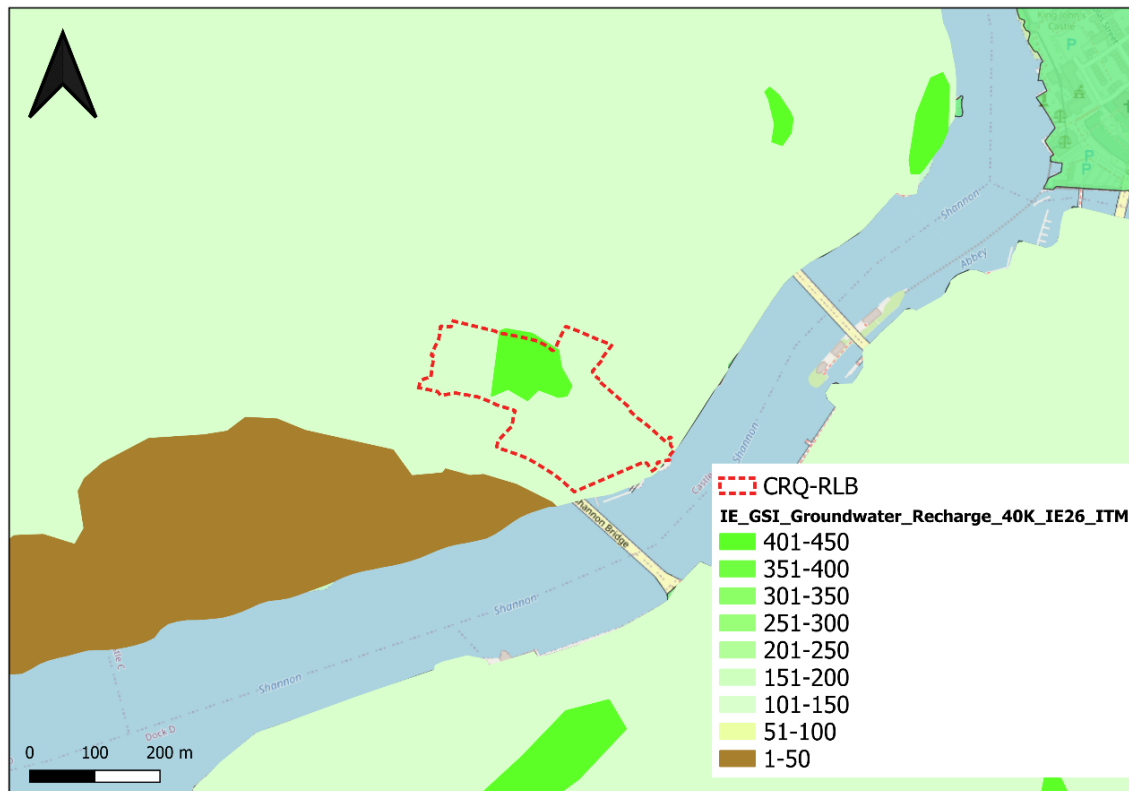


Figure 11-8 Groundwater Recharge

11.6.3.4 Groundwater Bodies

The proposed development site is located within the Limerick City Northwest Groundwater body (EPA Ref: IE_SH_G_140).

Limerick City Northwest Groundwater body (GWB)

The Limerick City Northwest GWB as delineated by the GSI as a groundwater body which is bounded to the west and south by the River Shannon, to the north by the contact with the karstified Pure Unbedded Limestones of Cratloe GWB, and to the east by a surface water catchment boundary which is an implied groundwater divide.

The conceptual model for the Limerick City Northwest GWB is described by GSI (2004⁴) as:

- Groundwater flow occurs along fractures, joints and faults in the limestones and volcanic rocks. There is likely to be an epikarstic layer at the top of the limestones, which acts to redistribute recharge in the subsurface and, in high water table conditions, is a very high transmissivity layer. The aquifers have low storativity.
- Recharge occurs diffusely through the subsoils and at outcrop. Potential recharge may be rejected in areas where the water table is very close to the surface. Recharge will be inhibited by urban made ground in the north of the GWB.
- Groundwater flux in the limestone aquifer will be concentrated in an approximately 30 m zone at the top of the bedrock. This zone comprises an epikarstic layer of a few metres, below which is a

⁴ [Microsoft Word - Limerick NW.doc](#)

network of joints, fractures and faults. Deeper groundwater flow can occur along permeable fault zones or deeper fractures. The flow regime in the volcanic aquifer is similar, excepting the epikarstic layer.

- These rocks are devoid of intergranular permeability; groundwater flow occurs in fractures and faults. It is noted by the GSI that there is no information available for this GWB on springs or borehole yields.
- The aquifers in the GWB are generally unconfined. Near rivers and streams, the water table is close to the surface. Beneath higher ground, significant unsaturated zones may exist. Depending upon topography, the water table can vary between 2 metres up to ~15 m below ground surface. Water table fluctuations in discharge areas will be relatively low (on the order of 1-2 m) whereas under local topographic highs in the limestones, the water table elevation may vary by up to 5 m.
- The land is generally poorly drained in the low-lying ground in the west of the GWB, next to the River Shannon.
- Flow path lengths are generally long (up to 1500 m). In discharge zones, flow paths will be much shorter, at around 100–300 m. On a local scale, groundwater discharges to the streams and smaller rivers crossing the aquifer. Local groundwater flow directions are determined by topography and local drainage patterns. Regional groundwater flow directions are roughly westwards and southwards, directed towards the Shannon.
- The main discharges are to the streams and rivers crossing the GWB, and to the River Shannon that forms the western and southern boundaries of the GWB. Groundwater sustains flows in the gaining rivers and streams crossing the GWB.

Westfield Wetlands

As noted previously the source of water to the wetlands is via a tidal connection to the River Shannon, downstream of the proposed development site, and a (groundwater fed) spring. Based on existing topography and inferred regional groundwater flow direction (as detailed further below) it is likely that there is indirect connectivity between the site and the Westfield Wetlands via groundwater flow (from the proposed development site towards the groundwater discharge zone along the River Shannon SAC).

11.6.3.5 Groundwater Levels and Flow Direction

Groundwater flow in the limestone and volcanic aquifers of the Limerick City Northwest groundwater body occurs primarily through fractures, faults, and weathered zones, with the epikarst layer in limestone playing a key role in near-surface flow. These fractured zones are hydraulically connected, and the degree of connectivity is influenced by structural features such as faults and joints. Regionally, surface water and groundwater are generally in hydraulic continuity, as evidenced by sinking and re-emerging streams and seasonal variations in groundwater levels near rivers and streams, and the spring source located west of the proposed development site. Groundwater is discharged to the surface as baseflow to streams and rivers crossing the groundwater body (GSI, 2004). The volume of water flowing from rivers to aquifers or vice versa is dependent on the water table elevation.

Based on the conceptual hydrogeological setting, and regional groundwater contour mapping (GSI, 2025) presented in Figure 11-9, groundwater flow follows topography in the vicinity of the proposed development site. Accordingly, assumed groundwater flow beneath the proposed development flows in a general southerly direction, with some groundwater flow to the south-east, and to the south-west,

before discharging directly to the River Shannon SAC, with groundwater discharging to the Westfield Wetlands, along the western portion of the site.

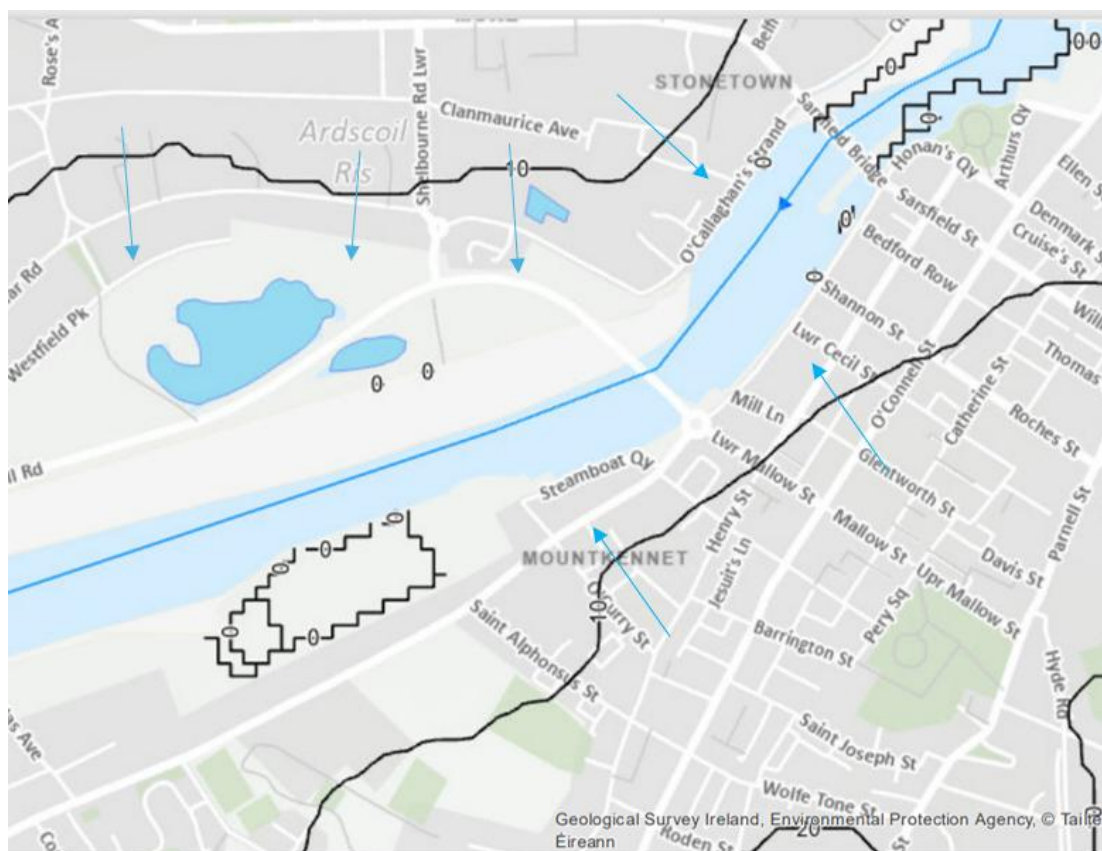


Figure 11-9 Inferred Regional Groundwater flow direction (GSI, 2025)

At the time of reporting, site specific groundwater monitoring data from 4no. water monitoring events carried out between 2nd May 2025 to 8th July 2025 at 12no. groundwater monitoring wells was available, as presented in Table 11-5. Groundwater levels during this period were variable across the site, ranging from 2.18 to 7.39 m BGL. Groundwater levels vary seasonally and are likely to be 0.5 to 1.0 metres higher during winter months (Arup, 2025).

Table 11-5 -Site-specific Groundwater monitoring data (Source: Priority Geotechnical Ltd., 2025)

Location	Response Zone	Groundwater Depth (mbgl)			
		02/05/2025	08/05/2025	20/05/2025	08/07/2025
BH301	Glacial subsoil	Dry	-	Dry	Dry
BH302	Bedrock	5.08	-	5.10	4.97
BH305	Made Ground / Glacial subsoil	Dry	-	Dry	Dry
BH306	Bedrock	Dry	-	4.65	4.72
BH307	Bedrock	3.2	3.22	5.27	5.3
BH308	Bedrock	-	7.29	7.39	7.38
BH309	Made Ground	2.75	-	2.90	2.88
BH310	Made Ground	3.05	-	3.27	3.26

BH311	Bedrock	2.18	-	3.28	3.15
BH312	Glacial subsoil	2.85	-	3.05	2.97
BH314	Bedrock	3.66	-	3.99	3.98

Continuous groundwater level monitoring was carried out for a period of 3no. months (between May 2025 and August 2025) at 4no. key locations (BH308 – located within the Stonetown Terrace zone, BH311 – located within the Shipyard zone, BH314 – located within the proposed PBSA zone, and at the onsite Reservoir, SW01). All groundwater monitoring wells monitored were installed with response zones in limestone bedrock. The results are presented in Figure 11-10 to Figure 11-13.

The results show a maximum tidal groundwater range of 1.7m at BH311, located closest to the River Shannon, as expected. The onsite Reservoir, which is connected directly to the River Shannon via a discharge pipe, showed a maximum tidal water level range of 0.7m.

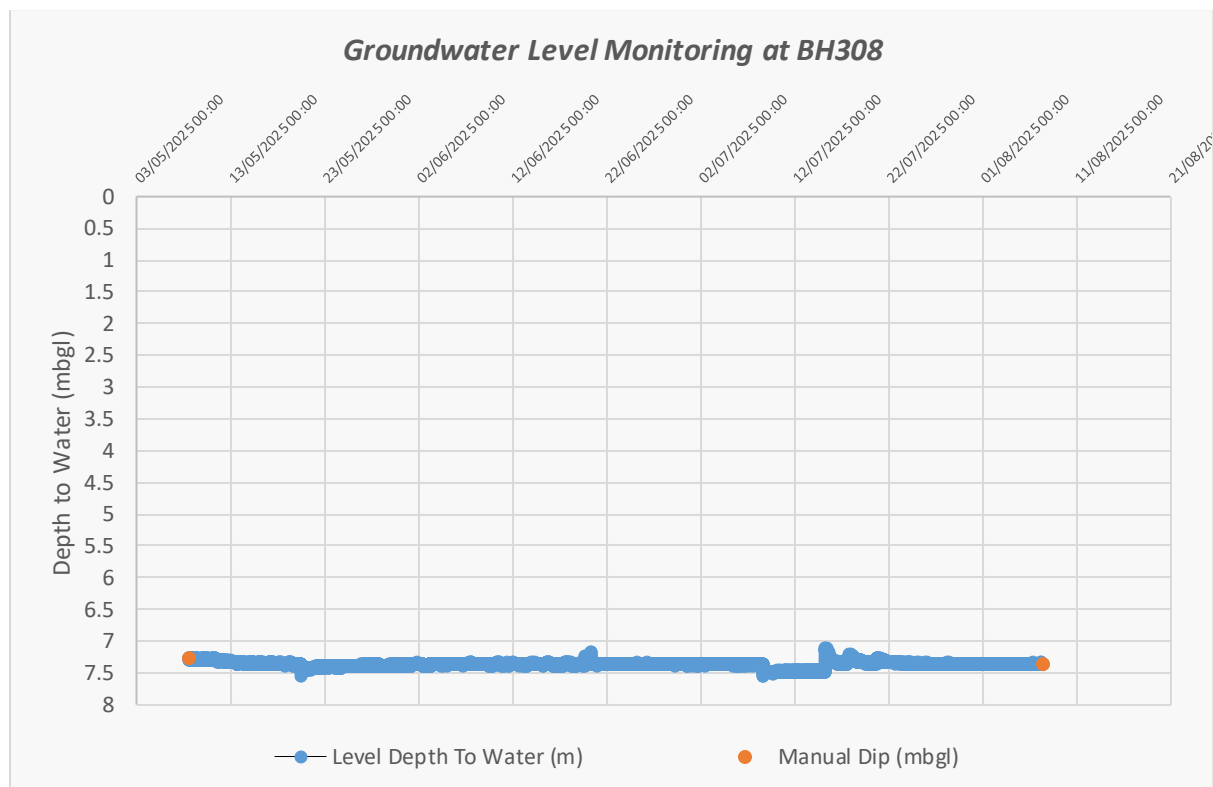
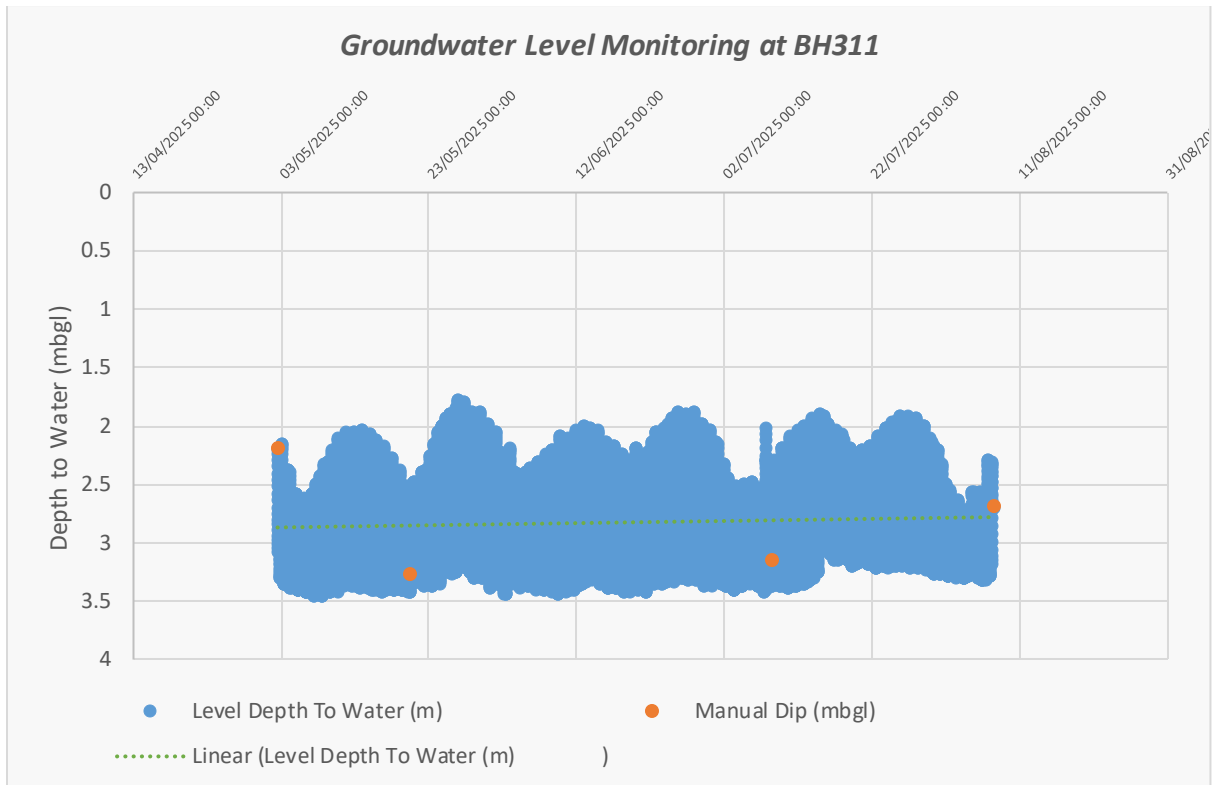
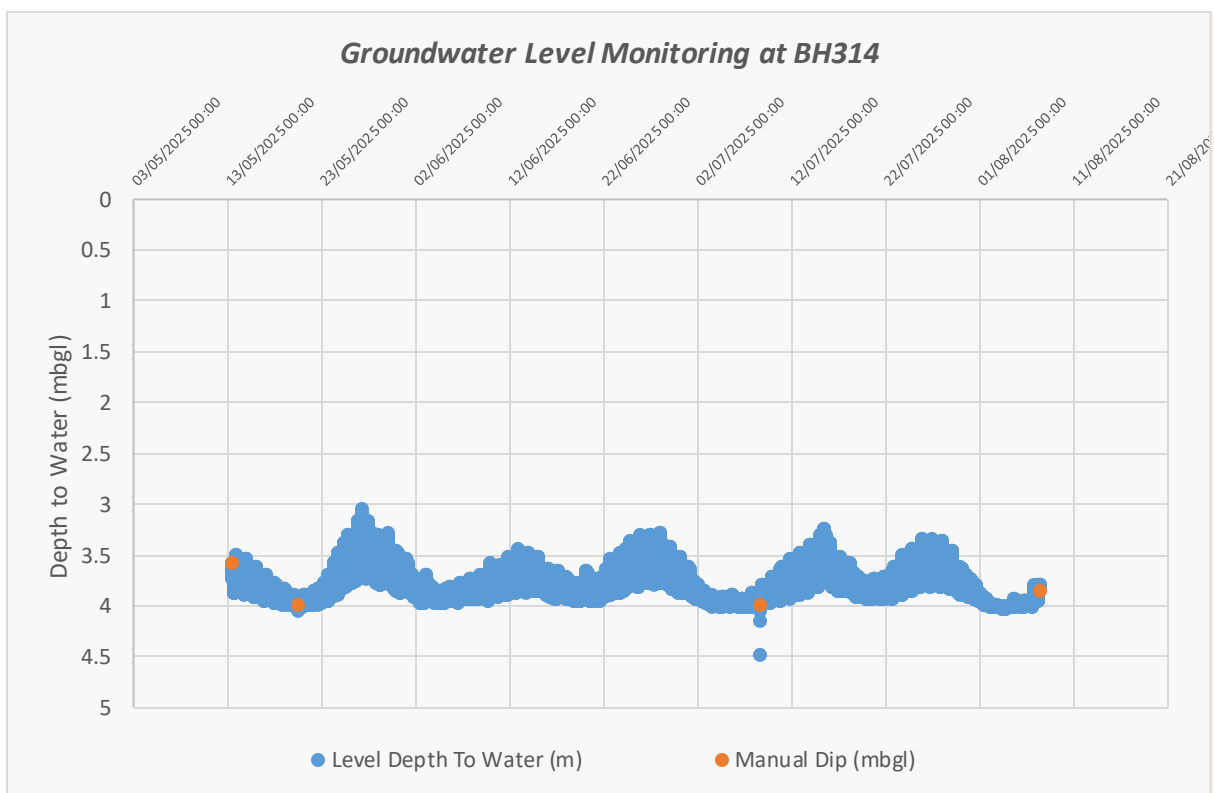


Figure 11-10 Hydrograph for BH308 (Source: PGL, 2025)

**Figure 11-11:** Hydrograph for BH311**Figure 11-12** Hydrograph for BH314

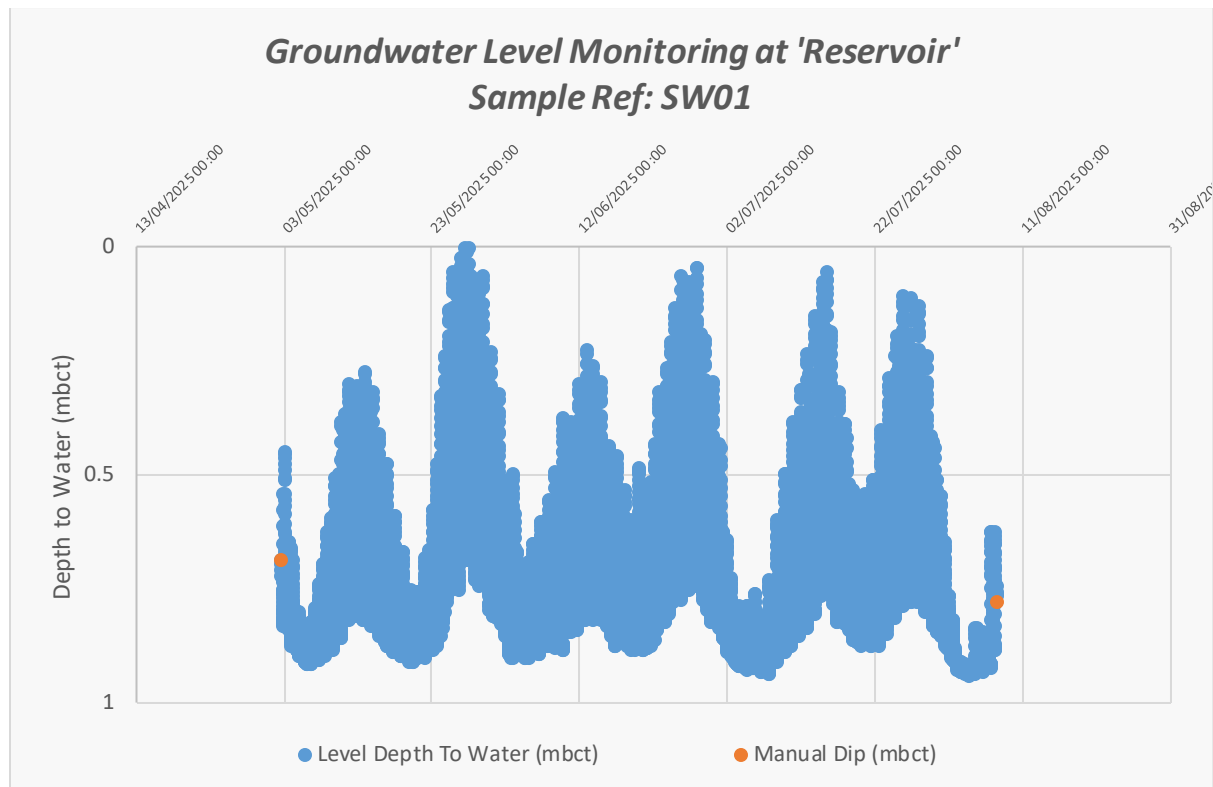


Figure 11-13 Hydrography for Reservoir / SW01

11.3.6.6 Groundwater Use and Available Resource

The GSI maintains a record of groundwater abstractions consisting of wells and springs, in addition to designated drinking water protection zones (referred to as Source Protection Areas). According to the GSI database, there are no group water scheme or public water supply abstraction points, or designated group water scheme or public water supply Source Protection Areas within the vicinity of the Site (GSI, 2025). The closest Groundwater Scheme is the Murroe PWS (Code: IE_GSI_SPA_216) located ca. 15km east of the proposed development.

Based on the GSI database, there are 8no. wells located within 3km of the site, as summarised in the following table and presented in Figure 11.14 below. However, none of the listed wells are located within 500m of the proposed development (notwithstanding the location accuracy noted below). Therefore there is no potential for impact to any of the identified wells.

Table 11.6 – Boreholes in the vicinity of the site

GSI Well Name	Source Type	Location Accuracy	Depth of hole (m)	Yield (m ³ /d)	Use
1415SEW002	Borehole	to within 1km	16.8	Unknown	Unknown
1415SEW003	Borehole	to within 1km	25.0	Unknown	Unknown
1415SEW014	Borehole	to within 1km	50.3	Unknown	Unknown
1415SEW060	Borehole	to within 100m	6.0	Unknown	Unknown
1415SWW012	Borehole	to within 50m	31.7	5.50	Unknown
1415SWW013	Borehole	to within 1km	46.3	98.0	Unknown
1415SWW015	Borehole	to within 1km	12.8	1090	Unknown

1415SWW019	Borehole	to within 1km	49.0	21.80	Domestic use only
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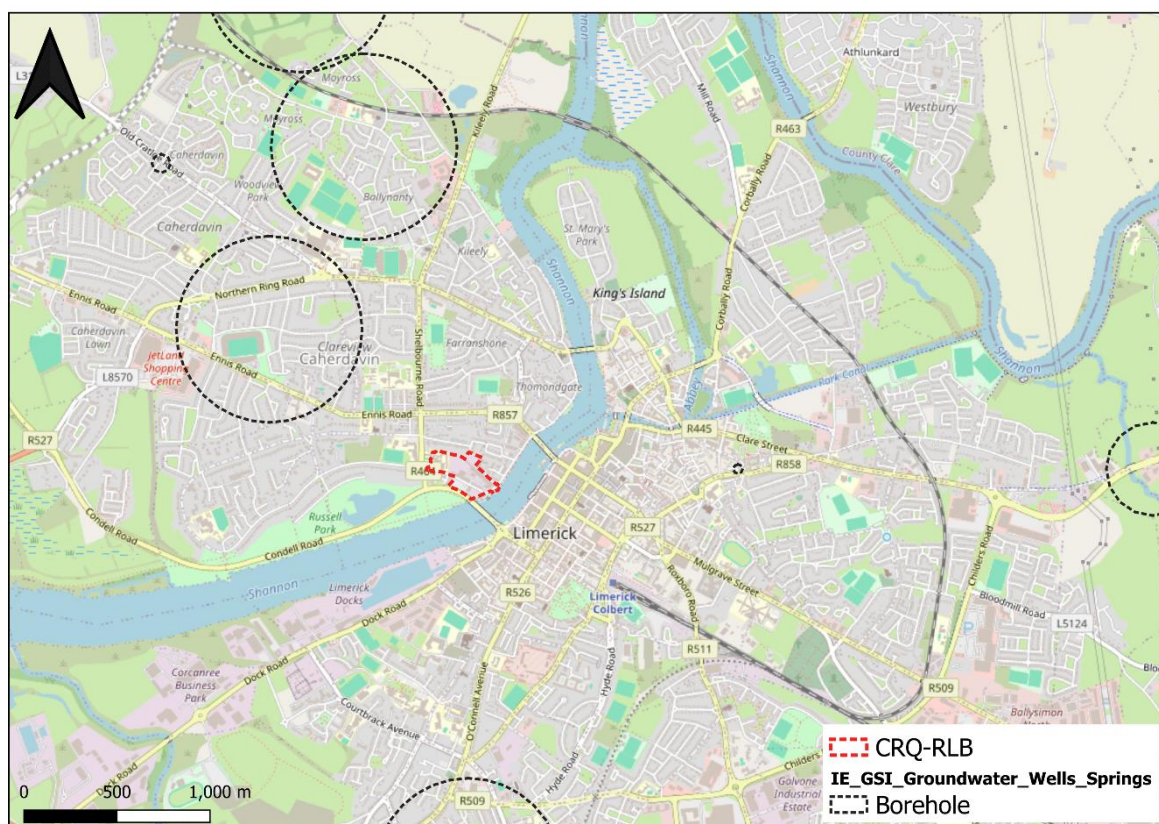


Figure 11-14: GSI boreholes in the vicinity of Cleeves Riverside Quarter

11.3.6.7 Groundwater Quality

The European Communities Environmental Objectives (Groundwater) Regulations, as amended (S.I. 9 of 2010) came into effect on 27th January 2010. The aim of the Regulations is to achieve the environmental objectives established for groundwater by Article 4 (1) (b) of the Water Framework Directive (2000/60/EC), as amended. The 2010 Regulations, as amended, set down groundwater quality standards for nitrate (50mg/L) and active substances in pesticides in Schedule 4 and also established threshold values for pollutants or indicators of pollutants in Schedule 5. Under these regulations the EPA must assign a status of 'Good' or 'Poor' to those bodies of groundwater where available data and knowledge allows.

The Proposed Development is within one groundwater body namely: Limerick City Northwest Groundwater Body European Code: IE_SH_G_140). The Limerick City Northwest ground waterbody was classified as being of "good" groundwater status in the latest WFD cycle (2016-2021). The breakdown of the WFD groundwater elements and their Status is given in Table 11.7.

Table 11.7 - Limerick City Northwest quality elements and values as assessed for WFD Status (2016-2021)

Value	Status
Overall Groundwater Status	Good
Quantitative Groundwater Status	Good
Saline (or Other) Intrusions Test	Good
Impact of Groundwater on Surface Water Ecological/Quantitative Status Test	Good
Groundwater Dependent Ecosystems (GWDTE) - Quantitative Assessment Test	Good
Water Balance Test	Good
Chemical Groundwater Status	Good
Saline (or Other) Intrusions Test	Good
Impact of Groundwater on Surface Water Ecological/Chemical Status Test	Good
Groundwater Dependent Ecosystems (GWDTE) - Chemical Assessment Test	Good
Drinking Water Protected Area Test	Good
General Chemical Assessment Test	Good

However, the Limerick City Northwest groundwater body was determined to be “at risk” in the 3rd WFD Groundwater Quality Status Risk Cycle.

Site Specific Groundwater Quality

A water quality monitoring programme has been carried out at the site by Priority Geotechnical Ltd (2025) as previously outlined, which included 2no. rounds of groundwater sampling. Tabulated and screened analytical results are presented in Appendix 11-2, with PFAS analysis results in Appendix 11-3. Analytical results were screened against relevant Generic Assessment Criteria (GAC) which are statutory groundwater regulation (SI 9/2010; SI 366/2016) as well as the Interim Guideline Values (EPA 2003), applied in the absence of statutory groundwater regulation values.

Most of the determinands analysed in the groundwater were below the relevant GAC threshold values. However, there were a number of exceedances. The most frequent exceedance was in ammoniacal nitrogen, with results above the IGV (EPA 2003) threshold value of 0.15 mg/L found in all but two samples – BH306, and BH308 which had insufficient sample on 20 May 2025. There is no statutory threshold for ammoniacal nitrogen for transitional waterbodies, therefore there were no exceedances observed for the surface water samples. However, the values of ammoniacal nitrogen determined for the surface water were in the same range (average 0.44 mg/L) as those determined for the groundwater samples, including those taken from the River Shannon. This is in contradiction to the ammonia-N recorded at the EPA monitoring stations for Limerick Dock, which consistently average at 0.06 mg/L.

Other exceedances identified in the results are summarised as follows: pH (BH309, 20 May 2025); chloride (BH302, BH309, BH310, BH312, BH314, 20 May 2025; BH313, BH314, 08 July 2025); phosphate (BH310, 20 May 2025); sulphate (BH309, 20 May 2025); manganese (BH312, 20 May 2025 and 08 July 2025, BH313, 08 July 2025), fluoranthene (BH312, 20 May 2025)..

11.3.6.8 Geological Heritage Sites

There are 2no. Geological Heritage Areas (GHA) in close proximity to the site. Mungaret Quarry (LK026) is located ca. 3.50km southwest of the site. The GSI (2025) states *‘This site is a complex of extensive branching network of pit offshoots, in a large, active quarry, which produces limestone for cement*

manufacture. Mungret Quarry is one of the largest quarries in the country, and given its long history and importance to the region economically, it is recommended for designation as a County Geological Site. The bedrock at the site is of Mississippian (Lower Carboniferous) limestone.'

The N18 Roadcut Ballykeefee (LK027) is located ca. 2.90 km southwest of the site. The GSI (2025) states '*Road cut excavated through limestone bedrock on the N18 route east of the Limerick Tunnel. The limestone visible in the road cut exposures along this stretch of the N18 Limerick Southern Ring Road near Junction 2 provides an insight into the strata and structure of the Carboniferous bedrock in this region of Limerick City. The road cut is around 200m long, with horizontal beds exposed along both the north and south sides of the road.'*

Taking account of the location, nature and scale of the proposed development, and the reasons that each of the above GHAs have been designated, the proposed development will not result in any likely environmental effects to designated GHAs.

11.4. CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The proposed development is described in detail in Chapter 2.0 Activities during demolition and construction will primarily comprise of:

- The demolition of a number of structures to facilitate development including (i) Salesians Secondary School and Fernbank House; (ii) 2 no. houses on North Circular Road; (iii) Residual piers from the basin of the reservoir; (iv) Upper Reservoir on Stonetown Terrace comprising 2 no. concrete water tanks, pump house and liquid storage tank; (v) 1960's lean-to building structures adjoining the Cold Store (former Weaving Mill); (vi) remaining fabric of c20th rear lean-to of the Flaxmill Building; (vii) c.1960s office building adjoining the Packing Store and Cheese Plant on North Circular Road; (viii) Cluster of buildings including altered part of the Linen Store, the former Linen Store, Storage Building, and Office/Lab building at O'Callaghan Strand / Stonetown Terrace with partial retention of existing stone wall; (ix) warehouse on the Shipyard site; and (x) partial removal of stone boundary wall defining the Cleeves site adjoining O'Callaghan Strand / Stonetown Terrace and around the Shipyard site. Based on preliminary engineering calculations, it is estimated that ca. 9,605 tonnes of demolition material will be generated during the proposed demolitions works with the largest material streams being steel, brickwork and concrete, consistent with the composition of the existing building fabric.
- The construction of 234 no. residential units; (b) 270 no. student bedspaces with ancillary resident services at ground floor level; (c) 299sqm of commercial floorspace; and (d) a creche (height ranging across the site from 3 – 7 storeys).
- 3 no. dedicated bat houses;
- Telecommunication antennae on roof of Block 2A of the PBSA, including (a) 9 no. Support poles to support 2 no. antennae each; (b) 6 no. microwave dishes affixed to the plant screen; and (c) associated telecommunications equipment and cabinets (effectively screened). To facilitate technologically acceptable locations at the time of delivery, a micro-siting allowance of 3m is proposed on the roof top of Block 2A of the PBSA for the infrastructure.
- Provision of vehicular access/egress points including (a) utilisation of existing access points to the Salesians Zone, to the Flaxmill and Quarry Zones and to the Mobility Hub on the Shipyard Site Zone; (ii) reopening an existing (currently blocked) access point off O'Callaghan Strand; (iii) new access

- points to the proposed undercroft carparking at Salesians from the North Circular Road and at the end of Stonetown Terrace road which provides access to the Stonetown Terrace Zone; and (iv) emergency access only from Stonetown Terrace to the Flaxmill Zone;
- Provision of 30 no. dedicated car parking spaces to serve the Salesians Primary School; and
 - All ancillary site development works including (a) water services, foul and surface water drainage and associated connections across the site and serving each development zone; (b) attenuation proposals; (c) raising the level of North Circular Road between Fernhill and O'Callaghan Strand; (d) refuse collection store (e) car and bicycle parking to serve the development; (f) public lighting; (g) all landscaping works.; and (h) temporary construction measures including (i) construction access to the Quarry site including provision of a temporary access across the reservoir; and (ii) temporary use of onsite mobile crusher.

During the construction phase, excavated materials will arise from site preparation works, including formation level adjustments, building foundations, substructures, internal roads, parking areas, and utility installations/diversions. Based on preliminary engineering calculations, an estimated 98,120 tonnes of excavated material will be generated, comprising made ground (fill), glacio-fluvial subsoils, and bedrock. Made ground is considered unsuitable for reuse, with approximately 50,920 tonnes expected to require off-site disposal. All such material will be removed and disposed of offsite to a suitably permitted / licenced waste recovery / disposal facility in accordance with relevant waste management legislation (including but not limited to the Waste Management Act of 1996, as amended and all subsequent waste management regulations as amended).

During the construction stage, tracked excavators will likely be sufficient to excavate made ground (fill), glacio-fluvial subsoils, and bedrock across the Site in order to achieve proposed formation levels. The extent of excavation for service / utility trenches will vary. All excavations are anticipated to encounter made ground / sandy silt / clay and/or gravel. Rock breaking will be required in areas where shallow bedrock is encountered.

Given the existing ground conditions, ground improvement works are required to facilitate the construction stage of the proposed development. The preliminary foundation strategy for the proposed development has been described previously in Chapter 10 – Land, Soils and Geology. In summary, pad foundations and strip footings will be used to support columns, superstructure walls and or core walls. Based on available information, the only building that will require a piled solution is Stonetown Terrace Apartments. Ground beams, pile caps and cores supported by bored piles are proposed for the Stonetown Terrace Apartment Block. Bedrock is noted at a range of 11mOD to -1mOD. Piles are to be end bearing on rock, with a 0.5m embedment. For the apartment block, a stepped raft slab to suit site levels on lean-mix blinded Clause 808 broken stone on stripped site is suitable (Arup, 2025). Groundwater recorded at the Stonetown Terrace site is approximately 6.6m below the FFL (Arup, 2025). Groundwater control may be required for the proposed bored piles at Stonetown Terrace Apartments. , All made ground beneath proposed structure floor plans shall be excavated. Based on the results of the environmental soil sampling, excavated material from the following locations is unsuitable for reuse onsite: beneath the proposed PBSA / Quarry Building, Stonetown Terrace Building, and O'Callaghan Strand Building. This material shall be disposed of to an appropriately licenced permitted facility in accordance with current waste regulations. As per the preliminary design, excavated material from beneath the Salesians site could be retained on site for suitable reuse, subject to compliance with

structural engineering requirements. As detailed previously within Chapter 10 – Land, Soils and Water, all identified contaminated soils / made ground where required shall be removed for appropriate offsite disposal during the enabling works phase, and in advance of foundation excavation. Given shallow groundwater levels across the site (as well as tidal flux), this will remove a potential source of contamination to groundwater during excavation works required as part of the construction phase.

11.4.1 Surface Water Drainage

The surface water drainage system is designed to drain each Phase II development zone as an independent network. This design will serve to facilitate the phasing of development. The surface water will discharge to the River Shannon via the pipe which is currently connected to the reservoir. The one exception is runoff from the O'Callaghan Strand site will connect directly to the outlet pipe.

Surface water infrastructure includes SuDS measures designed to intercept and to improve runoff quality through treatment measures. Green infrastructure measures include green roofs and raised planters at roof level, and at ground level: porous paving, swales and bioretention areas such as rain gardens, tree pits, planters boxes. Petrol interceptors will be installed on all surface water drains with potential exposure to hydrocarbons, for example car parks. The reservoir will also act as an attenuation facility. It has been calculated that the reservoir has capacity to attenuate excess runoff for a 1 in 100 year storm (plus 30% climate change and 10% urban creep). Hydraulically tailored water features will control surface water volume from the upper Stonetown Terrace level.. Ultimately, the volumetric surface water runoff post-development will be reduced by 2%, while the peak discharge from the site will be reduced by 73% versus pre-development.

11.4.1.1 Fire Water

The design includes a valve at the exit of the reservoir which can be closed in the event of a fire to prevent runoff of fire water to the River Shannon.

11.4.2 Foul water Drainage

Each site will have its own foul drainage networks and will discharge through individual gravity fed connections to adjacent Uisce Eireann foul sewers on NCR, O'Callaghan Strand and Stonetown Terrace. The anticipated average foul discharge for the development is 3.05 l/s with a peak discharge of 16.47 l/s. A Confirmation of Feasibility has been received from Uisce Eireann to confirm that the existing network has capacity to accept the foul water without requiring upgrade works.

11.4.3 Conceptual Site Model

In addition to flood risk, the following criteria are typically applied when evaluating potential impacts to the water environment: -

- Impacts to surface water / groundwater quality; and,
- Impacts to surface water flows / groundwater resources.

In terms of surface water flows / groundwater resources, no significant impact is anticipated arising from the proposed development based on the following considerations: -

- There are no reported public supply wells within the vicinity of the Site. There are no known onsite abstraction wells. According to the GSI (2025) database, there are 8no. groundwater wells located within 3km of the Site. However, due to the nature, scale and location of the proposed development, any offsite groundwater abstraction wells will not be impacted by the proposed development.
- There will be no significant change to rainfall recharge rates at the proposed development. The majority of the current site surface comprises hardstanding. The onsite reservoir / exposed water body will be maintained and enhanced via the proposed landscape design plan. Storm water generated from the proposed development will be conveyed through new storm water drainage networks which have been designed in accordance with SuDS design principles.
- Storm water generated from the proposed residential development will be conveyed through a proposed storm water network including SuDS and attenuated / managed on site prior to final discharge at greenfield run-off rates. The restricted discharge from the proposed site will be conveyed via a storm water sewer within the site before discharge to either the River Shannon. The proposed storm water discharge system has been designed to broadly follow the existing topographic levels and characteristics of the current natural drainage catchment regime. This will minimise any impacts to existing rainfall recharge rates at the Site (and accordingly groundwater levels beneath the Site, and surface water flows in the River Shannon) as a result of the proposed development.
- Based on encountered site-specific geological records, measured groundwater levels, and continuous groundwater level monitoring data, some dewatering will likely be required during the construction phase. However, given the fact that the Site is underlain by a locally important aquifer (Lm) – bedrock which is moderately productive, and taking account of the localised nature of potential dewatering, no groundwater level impacts to regional groundwater resources are anticipated. Similarly surface water level/ flow impacts are not anticipated.
- Pilling will be required at the Site, specifically for the Stonetown Terrace Apartment Block. Ground beams, pile caps and cores supported by bored piles are proposed for the Stonetown Terrace Apartment Block, as discussed in detail in Chapter 10 – Land, Soils and Geology. However given the temporary and localised nature of the piling works, no groundwater level impacts are anticipated to regional groundwater resources. Similarly surface water level/ flow impacts are not anticipated.
- No onsite groundwater abstraction is proposed during the operational phase. Based on the proposed design and encountered ground conditions beneath the Site, permanent dewatering will not be required during the operational phase.

Therefore, given the nature of the proposed development there will be no impact to regional or local groundwater resources or surface water levels / flows in the receiving River Shannon. Accordingly, potential impacts on groundwater resources, groundwater levels or surface water levels/ flows do not warrant further consideration.

In assessing potential water quality impacts, the EPA advocates a 'risk-based approach', and states that *'the principal aim in dealing with contaminated land and groundwater related issues is to secure the protection of human health, water bodies (including groundwater) and the wider environment'* (EPA, 2013). In accordance with this risk- based approach a preliminary Source-Pathway-Receptor (SPR) model has been derived for the Site.

Six key receptors (in terms of surface water /groundwater quality) have therefore been identified as follows;

- Bedrock aquifer beneath the Site (a locally important aquifer (Lm) – Bedrock which is Generally Moderately Productive (including onsite Reservoir);
- Lower River Shannon SAC (site code 002165) located adjacent to the Site (which is also a classified Transitional Waterbody (Limerick Dock)) (via. direct connection (existing discharge outfall from onsite reservoir), and indirect groundwater pathway);
- Transitional Waterbody (Limerick Dock) (EPA Ref: IE_SH_25S012600) (via. direct connection (existing discharge outfall from onsite reservoir), and indirect groundwater pathway);
- Westfield Wetlands (which are part of the Lower River Shannon SAC (site code 002165), located 35m from site (via. potential direct connection (reported historic abstraction from spring to site) and indirect groundwater pathway).
- Fergus Estuary And Inner Shannon, North Shore pNHA (site code 002048) located adjacent to the Site, (via. direct connection (existing discharge outfall from onsite reservoir), and indirect groundwater pathway); and,
- River Shannon & River Fergus Estuaries SPA (site code 004077), located ca. 20m from Site (via. direct connection (existing discharge outfall from onsite reservoir), and indirect groundwater pathway).

In accordance with relevant IGI Guidelines (2013), the Site Importance of the above identified hydrological / hydrogeological features is considered to be Extremely High⁵ to Very High⁶.

11.5. LIKELIHOOD OF SIGNIFICANT EFFECTS

11.5.1 Demolition and Construction Effects

This section considers the potential significant effects in relation to hydrology and hydrogeology, specifically water quality, during the Demolition and Construction phase of the proposed development and their likelihood in the absence of mitigation measures. Risks of effects from construction activities arise at all stages of the Demolition and Construction phase. Adopting a suitably conservative approach, this assessment has been prepared on the basis that all relevant construction stages of the proposed development at Salesians, PBSA, Stonetown Terrace, OCS and the Shipyard site could potentially occur concurrently (notwithstanding the specific sequencing requirements of the demolition and construction works as detailed in Chapter 2 of this EIAR and the CEMP which has been submitted as part of this planning application).

⁵ Defined as 'Attribute has a high quality or value on an international scale' (IGI, 2013)

⁶ Defined as 'Attribute has a high quality or value on a regional or national scale' (IGI, 2013)

11.5.1.1 Demolition Works

Asbestos has been identified in the roofs of the majority of buildings; however all asbestos present onsite will be removed for appropriate offsite disposal prior to demolition works. However the proposed demolition works have the potential to export sediment, rubble and contaminated materials to water courses via existing surface water runoff or excess rainfall runoff to either drains, the bedrock aquifer beneath site, or the reservoir on site (which is connected directly to the River Shannon (via. discharge outfall), and the Westfield Wetlands (via. reported spring abstraction), and also indirectly via. groundwater flow).

Additional to the demolition of buildings, concrete piers in the reservoir will be removed (see Figure 11.15). The reservoir will be drained to enable removal works, and a portion of the reservoir will be temporarily infilled to allow for access of construction vehicles. These works also have the potential to export sediment, rubble and contaminated materials to the reservoir on site, as well as the River Shannon and Westfield Wetlands (via. the above identified pathways), and bedrock aquifer beneath the site.



Figure 11-15 Reservoir with concrete piers designated for removal.

11.5.1.2 Enabling Works

Following completion of the demolition works, removal of hardstanding, made ground, and soil in preparation of the ground, during the enabling works phase, has the potential to mobilise these materials to the surface water, via runoff, creation of new flow pathways across the site, or runoff to the on site reservoir, as well as the River Shannon and Westfield Wetlands (via. the above identified pathways).

As such, the mobilised materials could be transferred to the key identified receptors - Bedrock aquifer beneath the Site, and Limerick Dock Transitional Waterbody, and therefore the Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, including Westfield Wetlands.

11.5.1.3 Excavation

The GI investigation (PGL, 2025) describes the stratigraphy of the site as topsoil and made ground of surfacing material composed of bituminous surfacing; and concrete hardstanding underlain by made ground of fill material composed of historical fill, construction and demolition waste, and reworked subsoil material with anthropogenic material. *“Widespread made ground deposits are typically underlain by glacial subsoils composed of coarse-grained slightly clayey to very clayey, sandy to very sandy gravel and fine-grained slightly sandy slightly gravelly to gravelly clay. Bedrock level is variable across the site, being encountered from 0.7 to 14.5 m BGL..*

During the 2025 Ground investigation (PGL, 2025), C&D waste material (including red brick fragments, construction rubble, plastic, silicon, slate tile, and wiring) was identified in made ground beneath the proposed Stonetown Terrace development. In addition, physical / olfactory evidence of potential hydrocarbon contamination was identified within the exploratory hole records for the 2025 Ground investigation (PGL, 2025). 61no. representative environmental soil samples were collected during the 2025 Ground investigation (PGL, 2025). Based on these results (as detailed further in Chapter 10 – Land Soils and Geology), contaminated soils have been identified beneath the proposed Stonetown Terrace Building, O’Callaghan Strand Building, Flax Mill site (PBSA / Quarry Building) and the Shipyard site.

Excavation works have the potential to mobilise soil, sediment and contaminated material (as identified above) to the bedrock aquifer beneath the site, and to surface water, via runoff, or to the onsite reservoir, as well as to the River Shannon and Westfield Wetlands (via the above identified pathways). Taking account of baseline groundwater level monitoring, there is potential for groundwater ingress into excavations at the Stonetown Terrace, Flax Mill, and Shipyard sites.

Mobilisation and transfer of hazardous materials, pollutants, heavy metals and soil sediments to surface water or groundwater during excavation and rock crushing are likely to have significant negative effects on water quality and environmental health, including biodiversity, and therefore needs to be carefully mitigated against. The Limerick Dock waterbody is already in Poor Ecological Potential on the basis of its biological status, and contamination with hazardous material poses further risk to the ecological health of the SAC flora and fauna.

11.5.1.4 Construction

The potential impacts from construction on hydrology and hydrogeology, specifically water quality can arise from the following activities (particularly in combination with rainfall percolation and runoff to surface and groundwater):

- Wet concreting
- Pile foundations
- Soil disturbance and earthworks
- Raising of level of North Circular Road

- Draining of the reservoir
- Temporary infilling of part of the reservoir
- Construction traffic
- Construction machinery
- Fuel and chemical use on site
- Changes in surface water runoff pathways

The onsite reservoir is considered to be a key sensitive receptor, given that it is an open body of water with a discharge pipe which outfalls directly to the Limerick Dock waterbody, Lower River Shannon SAC, and River Shannon & River Fergus Estuaries SPA. There is also a potential direct connection from the onsite reservoir to the Westfields Wetlands (via. reported historic abstraction from Wetlands Spring). Furthermore, based on the results of the tracer testing, there is potential for a second connection pipe between the onsite reservoir and the Limerick Dock waterbody, Lower River Shannon SAC, and River Shannon & River Fergus Estuaries SPA.

Wet concreting and concrete washout has the potential to result in dust deposition and wet concrete material flow to the drains, reservoir, and surface water and to cause contamination of the bedrock aquifer beneath site, onsite reservoir, and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands).

Shallow pile foundations are an option under consideration in the construction of structures at the Stonetown Terrace site. The GI report notes that there is the potential – although at low probability – for groundwater ingress into the excavations. This will need to be managed to prevent mobilisation of contaminant materials to the connected waterbodies.

Soil disturbance from earthworks and movement of soil, particularly in the raising of the level of the NCR, can cause mobilisation of sediment, soil and contaminated materials to waterbodies. Compaction of soil from construction traffic and construction machinery can lead to rainwater runoff and creation of new and fast-flowing runoff pathways to drains and surface waters.

Spills from fuel and any chemicals used on site can lead to contamination of water, entering surface waters or groundwater through drains and runoff.

The connectivity of the site to the Limerick Dock waterbody, Lower River Shannon SAC, including Westfields Wetland, and River Shannon & River Fergus Estuaries SPA, and to groundwater (bedrock aquifer) means avoidance of loss of any material to surface water and the receiving waterbody must be avoided at all costs. Groundwater ingress needs to be avoided and mitigated against during demolition and construction.

Groundwater monitoring wells present onsite provide a direct conduit to the underlying bedrock aquifer and need to be suitably protected / decommissioned during the construction phase.

Firewater run-off, in the unlikely event of a fire, can cause mobilisation of sediment, soil and contaminated materials to waterbodies.

Fuel and any chemicals, oils and paints used / stored on site can lead to contamination of water, entering surface waters or groundwater through drains and runoff. This is a particular risk given that the site is located in an identified flood risk zone. The shipyard site, which is the proposed location for the Construction Compound, is located within the identified flood zone. Flood risk during construction, and potential mobilisation of sediment, soil and contaminated material, as well as fuel, chemicals, oils and paints to waterbodies will need to be mitigated against during construction.

The effect of the Demolition and Construction activities on surface water and groundwater, their impact and significance are summarised in Table 11.8.

Table 11.8 – Summary of Significant effects during the Demolition and Construction phase

Activity	Effect	Quality	Significance	Duration	Type
Demolition of buildings, including buildings with asbestos	Potential for export of sediment, rubble and contaminated materials to water courses via existing surface water runoff or excess rainfall runoff to either drains, groundwater or the reservoir on site. Potential impact to bedrock aquifer beneath site, onsite reservoir, and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands).	Negative	Significant	Short-Term	Irreversible
Removal of hardstanding, made ground, and soil, including identified onsite contamination	Potential to mobilise these materials to the surface water, via runoff, creation of new flow pathways across the site, or runoff to the reservoir. Potential impact to bedrock aquifer beneath site, onsite reservoir, and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands).	Negative	Significant	Medium-Term	Irreversible
Removal of concrete piers from reservoir and temporary infilling of reservoir	Disturbance and mobilisation of the sediment and infill material. Potential impact to bedrock aquifer beneath site, onsite reservoir, and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands).	Negative	Significant	Medium-Term	Irreversible
Excavation works	Mobilisation and transfer of hazardous materials, pollutants, heavy metals and soil sediments to surface water or groundwater during excavation. Potential impact to bedrock aquifer beneath site, onsite reservoir, and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands).	Negative	Significant	Medium-Term	Irreversible
Excavation works – groundwater ingress	Mobilisation and transfer of soil sediments and pollutants to surface water. Potential impact to bedrock aquifer beneath site, and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands).	Negative	Moderate	Short-term	Irreversible
Excess surface water run-off / Temporary Flooding Risk	Flooding risk, specifically within identified onsite flood zone. Mobilisation and transfer of soil sediments and pollutants to surface water. Potential impact to bedrock aquifer beneath site, and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands).	Negative	Significant	Temporary	Irreversible
Rock crushing	Mobilisation and transfer of sediment material to surface water or groundwater during excavation. Potential impact to bedrock aquifer beneath site, onsite reservoir and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands).	Negative	Moderate	Short-term	Irreversible

Wet concreting	Potential to result in dust deposition and wet concrete material flow to the drains, and site run-off. Potential impact to bedrock aquifer beneath site, onsite reservoir and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands).	Negative	Moderate	Short-term	Irreversible
Pile foundations/Existing onsite groundwater monitoring wells	Mobilisation and transfer of soil sediments and pollutants (i.e. drilling polymers, additives and grout) to groundwater. Potential impact to bedrock aquifer beneath site, and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands).	Negative	Moderate	Short - Term	Irreversible
Construction traffic and machinery	Compaction of soil from construction traffic and construction machinery can lead to rainwater runoff and creation of new and fast-flowing runoff pathways to drains and surface waters. Potential impact to onsite reservoir and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands).	Negative	Moderate	Short - Term	Irreversible
Fuel and chemical use on site	Spills from fuel and any chemicals used on site can lead to contamination of water, entering surface waters or groundwater through drains and runoff. This is a particular risk given that the site is located in an identified flood risk zone. The shipyard site, which is the proposed location for the Construction Compound, is located within the identified flood zone. Potential impact to bedrock aquifer beneath site, onsite reservoir and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands).	Negative	Significant	Medium - Term	Irreversible
Firewater Runoff (in the unlikely event of a Fire)	Firewater run-off, in the unlikely event of a fire, can cause mobilisation of sediment, soil and contaminated materials to waterbodies. Potential impact to bedrock aquifer beneath site, onsite reservoir and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands).	Negative	Significant	Short - Term	Irreversible

11.5.2 Operational Effects

This section considers the potential significant effects in relation to hydrology, hydrogeology and water quality of the operational phase of the proposed development and their likelihood in the absence of mitigation measures. In terms of water services on site once operational, the design is intended to maintain and/or upgrade existing services drainage. For example, a discharge pipe currently connects the reservoir to an outlet to the River Shannon at Limerick Dock adjacent to St Michael's Rowing Club. This will be replaced with an upgraded pipe and a non-return valve at the outlet. Each site (Salesian, PBSA, Stonetown Terrace, Flaxmill, O'Callaghan Strand, Shipyard) will be treated independently and have its own set of surface water, foul and watermain networks.

Surface water will be gathered via drains and channels to proposed surface water sewers containing petrol interceptors. SuDs systems (green roofs, rain gardens, porous paving) and attenuation tanks will gather surface water. Surface water will also discharge to the reservoir which will act as an attenuation for stormwater run-off. "Surface water calculations prove that there is sufficient capacity in the reservoir to attenuate excess runoff for a 1:100 year storm (plus 30% climate change and 10% urban creep) from adjacent sites." (Cleeves Riverside Quarter Stage 2A2 Civil & Structural Scheme Design Report). A water feature designed as a flow control structure will manage the flow of runoff from the upper level of the PBSA at Stonetown Terrace to the quarry level below.

Foul water will be managed by proposed foul sewer networks which will connect to existing sewer connections managed by Uisce Éireann.

The effect of the operational activities on water and hydrology, their impact and significance are summarised in Table 11.9.

Table 11.9. Summary of significant effects during operational phase

Activity	Effect	Quality	Significance	Duration	Type
Surface water drainage	Potential for contaminated run-off via. the operational site surface. Potential impact to bedrock aquifer beneath site, onsite reservoir and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands). The design includes for emergency back-up generators which will be housed in plant rooms with dedicated bunded diesel storage (minimal volumes).	Negative	Slight	Short-Term	Irreversible
Excess surface water run-off	Flooding and overloading of surface water drainage system. Potential impact to bedrock aquifer beneath site, onsite reservoir and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands). However based on the findings of a detailed FRA (Arup, 2025) the development has been designed to ensure protection from a 1 in 200 year flood event, Finished Floor Levels as follows: Lower allowance (commercial uses): 5.7m AOD; Higher allowance (residential/habitable spaces): 6.2m AOD.	Negative	Slight	Short-Term	Irreversible
Foul water drainage	Capacity required for foul water drainage from the high-rise development to prevent contamination of surface water. Potential impact to bedrock aquifer beneath site, onsite reservoir and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands). The anticipated average foul discharge for the development is 3.05 l/s with a peak discharge of 16.47 l/s. A Confirmation of Feasibility has been received from Uisce Eireann to confirm that the existing network has capacity to accept the foul water without requiring upgrade works.	Negative	Moderate	Medium-Term	Irreversible
Firewater Runoff (in the unlikely event of a Fire)	Firewater run-off, in the unlikely event of a fire, can cause mobilisation of contaminants to waterbodies. Potential impact to bedrock aquifer beneath	Negative	Significant	Short -Term	Irreversible

	site, onsite reservoir and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands).				
Fuel and chemical use on site (routine maintenance etc.)	Spills from fuel and any chemicals used during routine maintenance can lead to contamination of water, entering surface waters or groundwater through drains and runoff. Potential impact to bedrock aquifer beneath site, onsite reservoir and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands).	Negative	Significant	Medium-Term	Irreversible

11.5.3 Do Nothing Scenario

In the event of nothing occurring at the Cleeves Riverside Quarter site, the site will remain as is. However, the structures on site will continue to deteriorate. This could lead to collapse of structures, creating debris and potential for transfer of this material to watercourses via rainfall and surface water runoff.

Surface water runoff will continue as is, with connection to the Limerick Dock waterbody via the pipe from the reservoir. In the do-nothing scenario, this pipe will not be replaced or fitted with a non-return valve and there will be continuation of ingress from the River Shannon to the site. Furthermore the proposed site remediation of the existing brownfield site would not occur, resulting in potential future mobilisation of identified contamination into the underlying bedrock aquifer, and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands).

11.6. CUMULATIVE DEVELOPMENT & IMPACTS

The site is located on the south east side of Limerick city adjacent to residential zones and schools and nearby to the Westfields Wetlands, commercial and recreational areas, sports facilities, hospital and tourist accommodation. Across the river lie Bishops Quay, Harvey's Quay and Limerick Dock facilities which are in operation. As part of this assessment, a comprehensive review of other permitted developments within a 1 km radius of the proposed site was undertaken, focusing on those submitted and approved within the last five years. This review was conducted using the Limerick City and County Council's online planning application portal. The relevant projects are listed in Appendix 1.1 of the EIAR and have been considered in evaluating the cumulative environmental effects of the proposed development.

All relevant developments in the immediate environs of the proposed development, which have been approved but are not yet fully constructed or operational have been reviewed as part of this assessment. Based on the location, nature and scale of these developments, and taking account of the results of the impact assessment for the proposed development (i.e. subject of this application), no significant cumulative effects will arise.

The masterplan development for Phase I has been assessed with respect to potential cumulative effects, based on available information. The masterplan development for Phase III and IV has been assessed with respect to potential cumulative effects, based on available information. It is noted that the proposed development has been designed to ensure future proofing where required of the overall masterplan development strategy, including Phase II demolition, ground improvement works (via. removal of contaminated materials / made ground) and drainage design.

Cumulative effects to surface water and / or groundwater are considered likely to have a imperceptible impact and are therefore not significant.

11.7. REMEDIAL & MITIGATION MEASURES

11.7.1 Demolition & Construction Phase Mitigation

During demolition, excavation and construction works, the following mitigation measures will be implemented in full to prevent runoff of soil, sediment, pollutants and hazardous materials, as well as contamination of groundwater, to identified key water receptors.

Mitigation measures outlined in Chapter 10- Land Soils and Geology are also applicable to the protection of surface water and groundwater during the demolition & construction phase.

The CEMP (AtkinsRealis, 2025) submitted as part of this planning application will be fully complied with by the Contractor(s) for the full duration of the demolition and construction phase and will be added to as required by the Contractor(s) (to take account of relevant planning conditions, any specific stakeholder requirements etc). In advance of commencement of works, a detailed construction management plan will be set out by the Contractor(s) within their Construction and Environmental Management Plan (CEMP). This will include management of extracted material and monitoring of rainfall conditions when planning construction activities to minimise runoff.

11.7.1.1 Surface Water & Groundwater

A Stockpile Management Plan will be developed by the Contractor(s), and provided to the Client and Employers Representative, in advance of commencement of construction. Stockpiled materials will not be located immediately adjacent to the onsite Reservoir, onsite drains, or any temporarily exposed groundwater (in the event that groundwater is encountered). Aggregate materials such as sands and gravels will be stored in clearly marked receptacles within a secure compound area to prevent contamination. Movement of material will be minimised to reduce the degradation of soil structure and generation of dust.

The onsite reservoir is a key sensitive receptor, given that it is an open body of water (within excavated bedrock), with a proven discharge pipe which outfalls directly to the Limerick Dock waterbody, Lower River Shannon SAC, and River Shannon & River Fergus Estuaries SPA. There is also a potential direct connection from the onsite reservoir to the Westfields Wetlands (via. reported historic abstraction from Wetlands Spring). Furthermore, based on the results of the tracer testing, there is potential for a second connection pipe between the onsite reservoir and the Limerick Dock waterbody, Lower River Shannon SAC, and River Shannon & River Fergus Estuaries SPA.

In order address the potential risk of any potential water quality impacts to the onsite Reservoir, and connected surface waterbodies (Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands), the following mitigation measures will be implemented during the demolition and/ or construction works:

- Temporary silt fencing will be erected around the onsite Reservoir prior to the commencement of any onsite works.
- A buffer zone of 20m will be implemented around the onsite Reservoir, where no onsite storage or use of fuels / chemicals or stockpiled materials (including soils, C&D waste) will be permitted. This will be strictly monitored and enforced by the Contractor and Employers Representative.

- To facilitate the removal of the concrete piers from the reservoir, surface drainage will be temporarily redirected from the reservoir to allow it to be drained. During the draining of the reservoir, the existing water will be temporarily pumped and will discharge via the existing discharge outfall (as per the existing baseline scenario). All surface water outlets from Salesians, Stonetown Terrace and the Quarry will be connected directly to the discharge pipe from the reservoir to the River Shannon.
- When the reservoir is empty, a comprehensive survey will be conducted of any exposed pipework / infrastructure which may indicate the presence of the reported historic connection to the Westfield Wetlands Spring, or any additional discharge points to the River Shannon. If viable historic pipeline connections to the Westfield Wetlands / River Shannon are uncovered, these will be further evaluated to understand the extent of the historic pipework, and if deemed suitable following assessment, such pipework will be decommissioned and sealed.
- During the temporary infilling of the onsite Reservoir to facilitate the construction works, clean imported material will be used which have been double washed at source. This will be confirmed by the supplier and regular visual checks will be carried out during the works to verify this.
- Temporary flood protection measures will be implemented within the extent of the flood zone at the Shipyard site – these measures are detailed within the CEMP (AtkinsRealis, 2025) submitted as part of this planning application. The Contractor(s) will adhere to all temporary flood management measures as per the CEMP, for the full duration of the demolition and construction works.
- Storage areas (for diesel, oil, paint, thinners and other chemicals stored on site) will be located at all times away from the identified flood zone at the Shipyard site.

There will be no in-water works permitted at the River Shannon (Limerick Dock waterbody, Lower River Shannon SAC, and River Shannon & River Fergus Estuaries SPA).

During detailed design, a shut-off valve at the nearest manhole to the existing discharge outfall (from the reservoir to the River Shannon) will be incorporated into the drainage regime for the proposed development. This manual shut-off valve will be easily accessible if required, and will allow the existing discharge outfall pipe to be shut off, preventing direct discharge from the reservoir to the River Shannon in the (highly unlikely) event of an onsite emergency / fire, and risk of contaminated fuel / firewater entering the reservoir. These proposed drainage works will be completed as soon as feasible within the construction programme.

Excavations will remain open for as little time as possible before the placement of fill. This will help to minimise the potential for water ingress into excavations and mobilisation of contaminants. Excavated materials will be visually assessed for signs of possible contamination such as staining or strong odours and sampling. Should it be determined that any of the soil excavated is contaminated, this will be segregated and appropriately disposed of by a suitably permitted/licensed waste disposal contractor. With the exception of the existing discharge pipe to the River Shannon SAC (via the onsite Reservoir), there will be no discharge of water permitted directly to the River Shannon SAC, under any circumstances, during the demolition and/ or construction works.

11.7.1.2 Asbestos & Waste Management

As part of the asbestos management strategy, mitigation specific measures as proposed by Phoenix Environmental Safety Ltd in their 2024 Asbestos Survey Report will be implemented. Asbestos containing materials will be removed prior to the commencement of any works. A licensed asbestos removal contractor should be contracted for removal and disposal of asbestos waste and all asbestos removal works will be undertaken in full compliance with the Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations 2006–2010 (S.I. No. 386 of 2006). The appointed contractor will adhere to all regulatory requirements and follow the recommendations outlined in the survey report, including the implementation of robust control measures to prevent exposure to asbestos material.

Demolition material that is deemed hazardous will be treated at an authorised facility either in Ireland or abroad.

All waste and material management and disposal / reused will be carried out in strict accordance with the C&DRWMP (Arup, 2025), submitted as part of this application.

Contaminated soil at the following locations requires excavation, and will not be reused onsite. Based on the results of environmental testing, this material is unsuitable for the proposed site end use:

- Stonetown Terrace Building – all onsite C&D material; and made ground / subsoils to a depth of 1.5m BGL (existing ground level) or to the maximum excavation / piling depth of foundations (if greater).
- O’Callaghan Strand Building – all made ground / subsoils to a depth of 1.0m BGL (existing ground level) or to the maximum depth of excavation for foundations (if greater).
- Flax Mill site (PBSA / Quarry Building) - all made ground / subsoils to a depth of 3.0m BGL (existing ground level) or to the maximum depth of excavation for foundations (if greater).
- Main Shipyard site – all made ground / subsoils excavated to facilitate the installation of proposed utilities (including drainage), tanks and any proposed underground structures in this area.

This material will be classified, managed, transported and disposed of offsite in accordance with the requirements of the Waste Management Act 1996, as amended, the Waste Framework Directive 2008/98/EC of the European Parliament and Council on waste and any relevant subsequent waste management legislation.

The above identified contaminated soil will be excavated and removed for offsite disposal during the enabling works phase, and in advance of the excavation of foundations. This is to mitigate the potential risk of groundwater impacts via existing onsite contamination.

11.7.1.3 Groundwater & Gas Monitoring Wells

Temporary onsite groundwater and gas monitoring wells will be either suitably protected for the duration of the works and / or appropriately decommissioned in accordance with best practice guidance (SEPA guidance document “Good Practice for Decommissioning Redundant Boreholes and Wells”

11.7.1.4 Soil & Sediment Management

- For the prevention of contamination of receptors by mobilised soil and sediment, the following measures will be implemented:
 - The creation of steep slopes will be avoided to prevent runoff from precipitation.
 - Heavy discharges of water onto the soil will be avoided.
 - Prevention of over-watering of loose areas for dust suppression.
 - Site traffic will be restricted to designated routes.
 - Regular leak monitoring and maintenance of dewatering pipes will be undertaken
 - The recommended maximum vehicle weightings will be maintained to avoid destabilization and subsequent erosion of soil surface
 - Disturbed land or stockpiles will be progressively rehabilitated by establishing temporary or permanent vegetation supported by irrigation.
 - Excess work areas will be covered with geotextile type liners.
 - Collection systems will be provided under machinery or equipment during wash down to prevent erosion from runoff.
 - Flow attenuation - mechanisms to control run off of precipitation such as temporary structures to slow running water to facilitate pollutant removal and infiltration and reduce runoff will be installed.
 - Sediment traps will be placed on all drainage lines such as geotextile lining.
 - Collection channels capable of collecting all runoff water during storms if it contains fine clay particles will be constructed.
 - A contained control facility will be used for concrete washout.
 - Runoff water from reservoir will be treated and discharged at a controlled flow rate through storm water discharge network (subject to agreement with LCCC).
 - Collection channels and reservoir will be inspected and cleaned on a regular basis to prevent sediment build up.
 - The site will be stabilised as soon as possible after construction.

11.7.1.5 Fuel & Chemical Management

- For the prevention of contamination of receptors by fuel or chemicals used on site, the following measures will be implemented:
 - Regular inspections/audits of hazardous materials usage, handling and storage areas and regular/thorough maintenance of vehicles and hydraulic systems and inspections of sanitary facilities and disposal will be carried out by contractors.
 - All contractors handling hazardous materials will keep appropriate spill clean-up material adjacent to storage and maintenance areas.
 - The amount of diesel, oil, paint, thinners and other chemicals stored on site that pose potential spillage environmental hazards will be minimised. materials that minimise environmental impact such as lead-free paints, asbestos free materials etc. will be used.
 - Collection systems will be provided/bunded if necessary, under machinery or equipment that may leak hydrocarbons/hazardous substances.
 - The contractor will be responsible for training all staff in the procedures for handling spills and will provide all staff with appropriate personal protective equipment.
 - The contractor will provide all staff with appropriate personal protective equipment.

- Impacting adjacent sites will be avoided by ensuring all contractors activities, equipment and waste storage is confined to the allocated site boundary.
 - Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles will take place in a designated area or within the construction compound which will be away from the onsite Reservoir, surface water gulleys or drains with a minimum 20 m buffer zone. In the event of a machine requiring refuelling outside of this area, fuel will be transported in a mobile double skinned tank. An adequate supply of spill kits and hydrocarbon adsorbent packs will be stored in this area.
 - Secure storage of all containers that contain potential polluting substances in a dedicated internally bunded chemical storage cabinet unit or inside a concrete bunded area.
 - Oil and fuel storage tanks will be stored in designated areas, and these areas will be stored within temporary bunded areas, doubled skinned tanks or bunded containers to a volume of 110% of the capacity of the largest tank/container. Drainage from the bunded area(s) will be diverted for collection and safe disposal.
 - Clear labelling of containers so that appropriate remedial measures can be taken in the event of a spillage. All drums to be quality approved and manufactured to a recognised standard. If drums are to be moved around the Site, they will be secured and on spill pallets; and drums will be loaded and unloaded by competent and trained personnel using appropriate equipment.
- In the event of a spill, the following procedure will be followed:
 - Identify and stop the source of the spill and alert people working in the vicinity;
 - Notify the Environmental Manager immediately giving information on the location, type and extent of the spill so that they can take appropriate action;
 - If applicable, eliminate any sources of ignition in the immediate vicinity of the incident;
 - Contain the spill using spill control materials, track mats or other materials as required. Do not spread or flush away the spill;
 - If possible, cover or bund off any vulnerable areas where appropriate such as the onsite Reservoir, drains, watercourses and/or sensitive habitats;
 - If possible, clean up as much as possible using the spill control materials;
 - Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste contractor with appropriate permits so that further contamination is limited;
 - The Environmental Manager will inspect the site as soon as practicable and ensure the necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring; and
 - The Environmental Manager will notify the appropriate stakeholders such as Limerick City & County Council, National Parks and Wildlife Service and/or the EPA.

11.7.1.6 Flooding

From a flooding perspective, the proposed construction compound at the Shipyard site, lies within the 0.5% AEP area for tidal flooding. Based on the extent of predicted tidal flooding, the other construction compound at the Flaxmill site is located outside of the predicted flood zone. **All fuels, chemicals, oils, paints and any other hazardous materials will be stored within the construction compound at the Flaxmill site, which is located outside of the predicted flood zone.**

To mitigate flood risk during the construction period, the contractor will employ the following mitigation measures as part of the site preparation for the construction phase (ARUP, 2025):

- **Demolition & Construction Stage Flood Protection Measures:**
 - Elevating the site compound / site storage areas at the Shipyard site via fill placement to an appropriate level (i.e. 5.7m AOD based on the outcome of the FRA (ARUP, 2025).
 - Constructing and/or implementing temporary flood defences at the Shipyard site (i.e. civil works and/or proprietary flood defence products, or a combination of both) to an appropriate level (i.e. 5.7m AOD based on the outcome of the FRA (ARUP, 2025).
 - In the event of a tidal flood warning, materials stored in the Shipyard site compound will be removed immediately to avoid the risk of flooding to neighbouring properties.
- **Preparation of a Flood Emergency Response Plan for Construction Phase (FERP-CP) – A** FERP-CP will be developed by the Contractor(s) for the proposed development, which will contain a detailed response plan to a tidal flood event on the Shannon occurring while construction was active on the site, which will include the following mitigation measures (ARUP, 2025):
 - Development of a FERP-CP in the first instance;
 - Definition of designated roles within the construction team / firm, and associated responsibilities with regard to the implementation of the FERP-CP;
 - Having an appropriate nominated person (e.g. site manager) who will be responsible for monitoring weather warnings, flood warnings, and storm-tide warnings (i.e. the 'Construction Phase Flood Manager') – this role will only come into play on a periodic basis (over the course of the construction phase);
 - Communication protocols to the site team to alert them to the possibility of a flood and the need to move any machinery, plant, equipment, etc, to an appropriate location within the site/site compound if safe to do so, and to evacuate the site;
 - General protocols around where and how machinery, plant, other equipment and materials are stored / stockpiled / located within the site compound(s), noting that all fuels, chemicals, oils, paints and any other hazardous materials will be stored within the construction compound at the Flaxmill site, which is located outside of the predicted flood zone.
 - Signage and other information on site drawing awareness to FERP-CP protocols (e.g. materials / plant / equipment storage, evacuation routes, etc).
 - The level of the compound and the materials storage areas are to be determined by the contractor and to be confirmed in the Flood Emergency Response Plan for Construction Phase (FERP-CP), taking into account the above mitigation measures, as well as the findings of the FRA (ARUP, 2025).

The Contractor(s) will provide a copy of the FERP-CP (which will take into account any relevant planning conditions, and any relevant future additional requirements via. changes in legislation or best practice guidance) to LCCC for review and comment in advance of commencement of any demolition or construction works onsite.

11.7.2 Operation Phase Mitigation

11.7.2.1 Surface Water

SuDS methods have been designed for the development with the aim to minimise the final discharge rate, mitigate flood risk, and to ensure that the final discharge flow rate does not exceed the current

levels. Additionally, SuDS will help to maintain or improve runoff water quality and minimise the use of buried attenuation tanks.

SuDS measures included in the plans are green roofs, planters, swales, porous paving and rain gardens. The effect of the SuDS measures will be a form primary treatment, interception of rainwater, and attenuation of surface water. Piped networks collecting surface runoff will include petrol interceptors to protect the water quality of the receiving water body.

Excess runoff from sites and SuDS will be routed to the reservoir for attenuation. Surface water calculations prove that there is sufficient capacity in the reservoir to attenuate excess runoff for a 1:100 year storm (plus 30% climate change and 10% urban creep) from adjacent sites.

The design of the surface water drainage systems, including the use of SuDS, attenuation tanks, and the reservoir as an attenuation facility, is intended to achieve a rate of flow discharge from the site that does not exceed the current levels. The implementation of SuDS measures means that, once operational, and with the mitigation measures in place, the impact of the development should be low in terms of water quality and quantity.

In the (highly unlikely) event of an emergency / fire, discharge of the fire water runoff will be prevented from entering the Lower River Shannon SAC through the surface water drainage network by operation of a shut-off valve on the discharge pipe at the exit from the reservoir, as previously identified. An Emergency Water Management Plan will be prepared and implemented during the operational phase, with a named Facilities Manager who will be contactable 24/7 and a deputy contact. Both personnel will be fully briefed on emergency procedures to manually shut off the discharge valve to the River Shannon immediately in the event of an emergency / fire.

11.7.2.2 Groundwater

Once operational, the site drainage system will accommodate all surface water without impact to groundwater levels, or infiltration of contamination. The underground attenuation tanks will be sealed. There will be no material change to existing infiltration rates, groundwater flow patterns or the existing hydrogeological regime.

11.7.2.3 Foul water

Wastewater generated on site will be routed to existing public sewage water networks operated by Uisce Eireann. A Confirmation of Feasibility has been received from Uisce Eireann to confirm that the existing network has capacity to accept the foul water without requiring upgrade works. The wastewater network will be gravity operated. In order to reduce pressure on the public sewage network water saving technologies will be included in the design, for example, low flow fixtures and dual flush toilets. Combining these technologies with smart metering and continued education of the water users, it is possible to achieve up to a 30% reduction in potable water consumption and wastewater discharge.

11.8. MONITORING REQUIREMENTS

11.8.1 Demolition & Construction Phase

A comprehensive surface water and groundwater monitoring programme will be implemented before, during and after the proposed demolition and construction works. This is particularly important during the replacement works of the outfall pipe. Regular sampling⁷ at key groundwater monitoring wells onsite, as well as at the onsite reservoir, and at key locations on the River Shannon upstream and downstream of the site. Water monitoring will be scoped, carried out and assessed by an appropriately qualified Environmental Manager or Ecological Clerk of Works. Results will be held onsite and available as required.

Excavations, especially piling for foundations will be carefully monitored for groundwater ingress.

Any drainage discovered during excavation will require inspection as to integrity of the pipework and connection from source to receptors with water quality analysis as required.

11.8.2 Operational Phase

Annual water quality analysis will be carried out during the operational phase to confirm that the water quality of the reservoir and surface drainage network is maintained and that the SuDS measures and petrol interceptors are effective. Additional water quality monitoring will be performed in the event of a flooding event on site or in the case of fire or any other accidental spillage.

11.9. RESIDUAL IMPACTS

11.9.1 Demolition & Construction Phase

The residual impacts to surface water and ground water quality resulting from potential pollution caused by demolition, excavation and construction activities⁸ during the construction phase are slight, negative, and temporary.

The residual impacts to surface water and ground water quality resulting from potential pollution caused by firewater runoff (in the unlikely event of a fire) during the construction phase are moderate, negative, and temporary.

No significant effects to the receiving environment, specifically to the bedrock aquifer / onsite reservoir, Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, Fergus Estuary And Inner Shannon, North Shore pNHA, and Westfield Wetlands, are likely to occur as a result of the proposed development during the demolition and construction phase.

⁷ Minimum monthly frequency

⁸ Specifically demolition works, removal of hardstanding, made ground, and soil (including onsite contamination), removal of concrete piers from reservoir, temporary infilling of reservoir, excavation works, rock crushing, wet concreting, piling, existing onsite groundwater monitoring wells, construction traffic and machinery, and fuel, oil, chemical and paint use /storage on site.

11.9.2 Operational Phase

Taking account of the proposed mitigation measures, the residual impacts to surface water and ground water quality resulting from potential pollution during the operation of the development are slight, negative, and short-term.

As determined by the WFD Assessment, on a regional scale, and after mitigation, the risks to the WFD quality elements were determined to be low, and subsequently the risks to the protected areas – the River Shannon & River Fergus Estuaries SPA and Lower River Shannon SAC – are also considered to be low.

The WFD requires member states to ensure that all water bodies achieve Good Ecological Status or Potential by 2027. In reviewing this development, there was no opportunity identified for the improvement of the WFD Status of the waterbodies assessed due to project activities. As such, the development with mitigations will have no negative or positive impact on the WFD status of the waterbodies. Additionally, completion of the proposed development itself will not act as an impediment to the achievement of Good Ecological Status or Potential by any other means.

11.9.3 WFD Assessment

In addition to the above assessment, an independent WFD Assessment was undertaken to examine the current WFD status of the receiving waterbody and any relevant hydrologically connected WFD waterbodies. The impact of the proposed development on any waterbodies which were screened in was scoped, and the resulting expected change (if any) to the WFD status of the waterbodies was determined.

In summary, the assessment found that, with mitigations in place, the proposed development will have no negative impact on the WFD waterbodies included for assessment. Additionally, the proposed development will not contribute to the improvement of the WFD status or to the achievement of Good Ecological Status/Potential by 2027. The WFD Assessment (AtkinsRealis, 2025) is submitted under separate cover, as part of this planning application.

11.10. WORST CASE SCENARIO

In the worst case scenario, adopting a precautionary approach, the risks identified during the demolition, construction and operational phases are not mitigated against. This would lead to the likely mobilisation of contaminants such as sediments, nutrients and hazardous material to the receiving waterbody and Lower Shannon SAC, including the Westfields Wetland, with further potential for transport to the River Shannon & River Fergus Estuaries SPA. Contamination of the groundwater is very likely without mitigation and would threaten the Good Ecological Status of the Limerick City Northwest groundwater body, as well as potentially the groundwater body's receiving water bodies – Crompaun East and North Ballycanan.

11.11 REFERENCES

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