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APPENDICES

7 Water Environment

7.1 Introduction

This chapter describes the potential effects of the Ballyhale Flood Relief Scheme on the Water Environment during its construction, operation and maintenance. It outlines the Assessment Methodology, Baseline Environment, Predicted Impacts and Mitigation Measures.

The techniques used are aimed at identifying constraints on the layout, design and construction methods of the proposed development as a result of the water environment.

The Water Environment Assessment has been completed by John Carr, Chartered Civil Engineer [B.Eng MSc CEng], DBFL Consulting Engineers.

John is a Chartered Civil/Environmental Engineer with over 10 years' experience specialising in the detailed design and design co-ordination of Civil Works. He holds an Honours degree in Civil Engineering from University College Dublin and a Masters in Environmental Engineering from Queens University Belfast.

Key skills include the design of storm, foul & water systems, design of SuDS infrastructure, flood modelling, roadworks, earthworks and site development. John also holds substantial experience in environmental consultancy including the preparation of Flood Risk Assessments, Environmental Impact Assessment (EIA) & environmental monitoring.

7.2 Assessment Methodology

7.2.1 Guidelines

The assessment of the potential effect of the proposed development on the water environment was carried out according to best practice and the methodology specified in the available guidance documents. Key guidance documents considered as part of EIAR preparation are listed below.

Table 7-1: Guidance Documents

Body	Guidance
Transport Infrastructure Ireland (TII)	Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA, 2009)
	Environmental Impact Assessment of National Road Schemes – A Practical Guide (NRA, 2008)
	Guidelines for The Crossing of Watercourses During the Construction of National Road Schemes (NRA, 2008)
	Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan (NRA 2007)
	Road Drainage and the Water Environment (DN-DNG-03065)
	Design of Earthworks Drainage, Network Drainage, Attenuation & Pollution Control (DN-DNG-03066)
	Drainage Design For National Road Schemes - Sustainable Drainage Options (RE-CPI-07001)
	Drainage Systems For National Roads [DN-DNG--03022]
Office of Public Works (OPW)	The Planning System and Flood Risk Management (OPW, 2009)
	OPW Flood Maps (http://www.floodinfo.ie/)
Environmental Protection Agency (EPA)	Guidelines On The Information To Be Contained In Environmental Impact Assessment Reports (EPA, May 2022)
	EPA Advice Notes on Current Practice (in the preparation of Environmental Impact Statements) (EPA, Sept. 2003)
	Geo Portal (https://gis.epa.ie/EPAMaps/)
Department of Housing Planning and Local Government	Draft River Basin Management Plan for Ireland 2022 – 2027
Inland Fisheries Ireland (IFI)	Guidelines on protection of fisheries during construction works in and adjacent to waters (Inland Fisheries Ireland 2016)
	The SUDS Manual (CIRIA C753)
Construction Industry Research and Information Association (CIRIA)	Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors (CIRIA C532)
	Control of Water Pollution from Linear Construction Sites (CIRIA C648)
	Development and Flood Risk – Guidance for the Construction Industry (CIRIA 624)
	The Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors (C532) (2001)

	Environmental Good Practice on Site Guide (C741) (2015)
Kilkenny County Council (KCC)	Kilkenny County Council Planning: https://www.kilkennycoco.ie/eng/services/planning/
Institute of Geologists Ireland (IGI)	Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements (2013)
Environment Agency (UK) EA	PPG1: General Guide to the Prevention of Pollution (UK Guidance Note)
European Union	EU Water Framework Directive

Information on the surrounding surface water and hydrogeological environments was assembled from the following sources:

- Site Inspections / Walkovers
- Review of Topographical Survey Information
- Consultation with Kilkenny County Council
- Review of information available on the Environmental Protection Agency (EPA) online mapping service.
- Review of information available on the Geological Survey of Ireland (GSI) online mapping service.
- Review of Office of Public Works (OPW) National Flood Hazard Mapping and Catchment Flood Risk Assessment and Management Studies (CFRAM Studies).

Water Framework Directive (WFD)

The Water Framework Directive (WFD) was adopted by member states across Europe in 2000. It requires, in summary terms, that all waters (rivers, lakes, groundwater, estuaries, coastal water, canals and reservoirs) are protected and that measures are put in place to ensure quality of these waters is restored to at least 'good' status or good potential (with some narrow exceptions) by 2027 at the latest. The Directive governs all activities that may have an impact on this objective or on the quality or quantity of water.

Ireland prepares a River Basin Management Plan every six years which sets targets to address water quality issues including the protection, improvement and sustainable management of the water environment. Launched in 2009, Ireland's first plans covered the period from 2009-2014. Published in 2018, the second plan covers the period 2018-2021. The

Draft Plan undertook a public consultation for 6 months for between September 2021 and March 2022 with the responses received informing the finalisation of the plan. On contacting the Department of Housing and Local Government and Heritage, the responsible body for the preparation and publication of the plan, they have confirmed that the date for its publication is not yet available.

7.2.2 Site Walkover Assessment

Site walkover surveys were undertaken from June 2020 – October 2021 with the purpose of identifying / verifying existing site drainage characteristics and water features.

The site walkover surveys encompassed the whole site area, with emphasis placed upon areas likely to be affected by proposed route alignments in order to fully assess potential issues with regards to:

- Water crossings (culverts / bridges);
- Flooding;
- Existing runoff patterns;
- Existing groundwater levels and flow paths;
- New outfalls (discharges) required;
- Potential for impact on surface water quality due to construction and operation of the scheme.

7.2.3 Hydraulic Modelling

The hydraulic modelling for the proposed scheme is set out in the Hydrology Report and Hydraulics Report and is available on the Kilkenny County Council Website.

7.2.4 Application of Methodology

This chapter has prepared in accordance with the following best practice methodology; “Guidelines on The Information to Be Contained In Environmental Impact Assessment Reports (May 2022)”.

The significance of the identified potential impacts is acknowledged by the combination of the sensitivity of the receptor and the magnitude of the potential impact. The generalised significance terms used in this assessment is in line with the EPA guidance reproduced below.

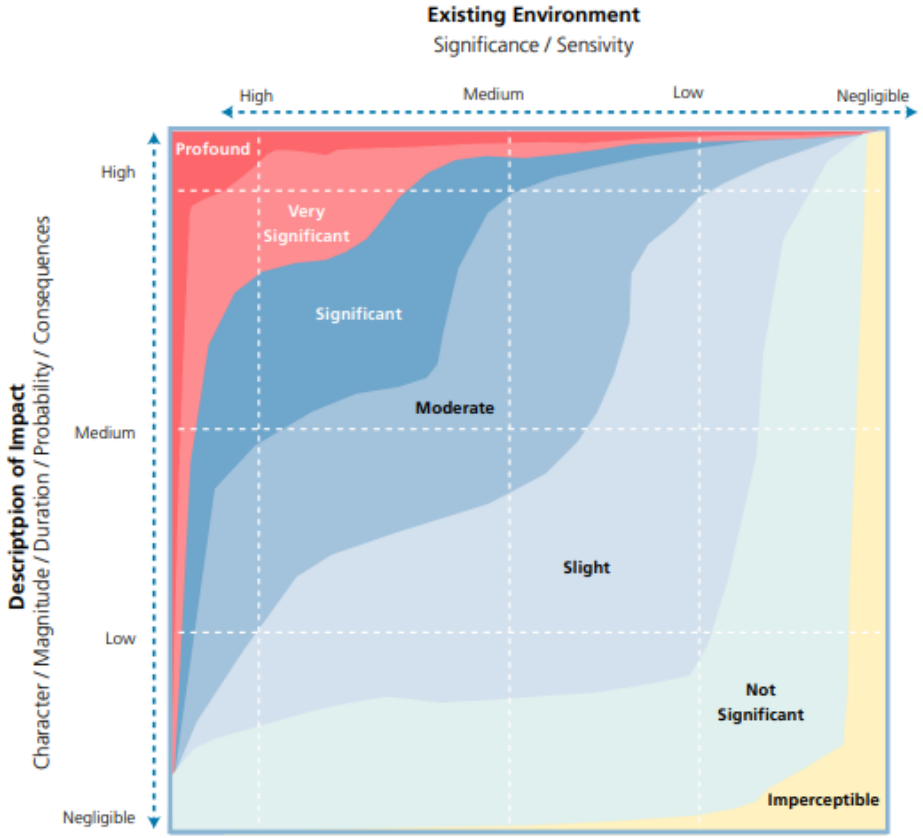

Figure 7-1: Sample Significance Effect Matrix (Source – EPA)

7.3 Baseline Environment

7.3.1 River Description

The Ballyhale River rises approximately 2.9km south of the town of Ballyhale. It begins in a forested region and flows north through largely agricultural land. The Ballyhale River enters the village near the church and splits into two channels either side of the church. The western branch flows in a generally open channel though agricultural land. The eastern channel flows through the rear of a number of domestic properties though a heavily modified channel with frequent structures of varying construction type. The branches merge upstream of Arrigle Business Park and flow through a long (circa 50m) culvert under buildings in the business park. Several additional culverts/bridges are present on the watercourse along its remaining route through the village. A number of weirs are also present on the channel within the village. The Ballyhale River leaves Ballyhale and merges with the Little Arrigle approximately 850 m north of Ballyhale.

Access to the stream from the banks within the village is often occluded by dense bankside growth fencing, culverts and bridges. In these areas the stream is between 1 and 2 metres below adjacent ground level. However, access was significantly better on the outside of the

village with the stream being adjacent to field level upstream of the village and slightly below field level after the village.

The stream varies in channel width from 1 to 2.5 and even 3m metres within this area. The flow is generally sluggish, although occasional short riffles are present. In the upstream section of the stream the stream is silted with some locally impacted areas with “sewage fungus” on the instream rocks. Organic-rich sediment line the banksides in the upstream areas. Particularly where the stream widens and splits in the village, these silt deposits are densely vegetated in places and cause the stream to constrict between the vegetation, resulting in an increased flow at these localised and constricted locations. In the long sections of glide or flat water, which ranged in depth on the occasion of this survey from 0.2 to 0.4 metres, the bed of the stream is silted with strong vegetative growth at the site. Beneath the silt, which was up to 10cm deep in places, gravels are present, with bedrock in some areas.

7.3.2 Hydrological Setting

Ballyhale is within the catchment of the Little Arrigle River which is a tributary of the River Nore. The main channel of the Little Arrigle runs to the west of the village and a tributary of the Little Arrigle runs though the village. This tributary is also known locally as the Little Arrigle however will be termed the Ballyhale River for the purposes of this assessment (this watercourse is also referred to in EPA mapping as Knockwilliam Stream). The Ballyhale River enters the village near the church and splits into two channels either side of the church. Several culverts/bridges are present on the watercourse along its route through the village.

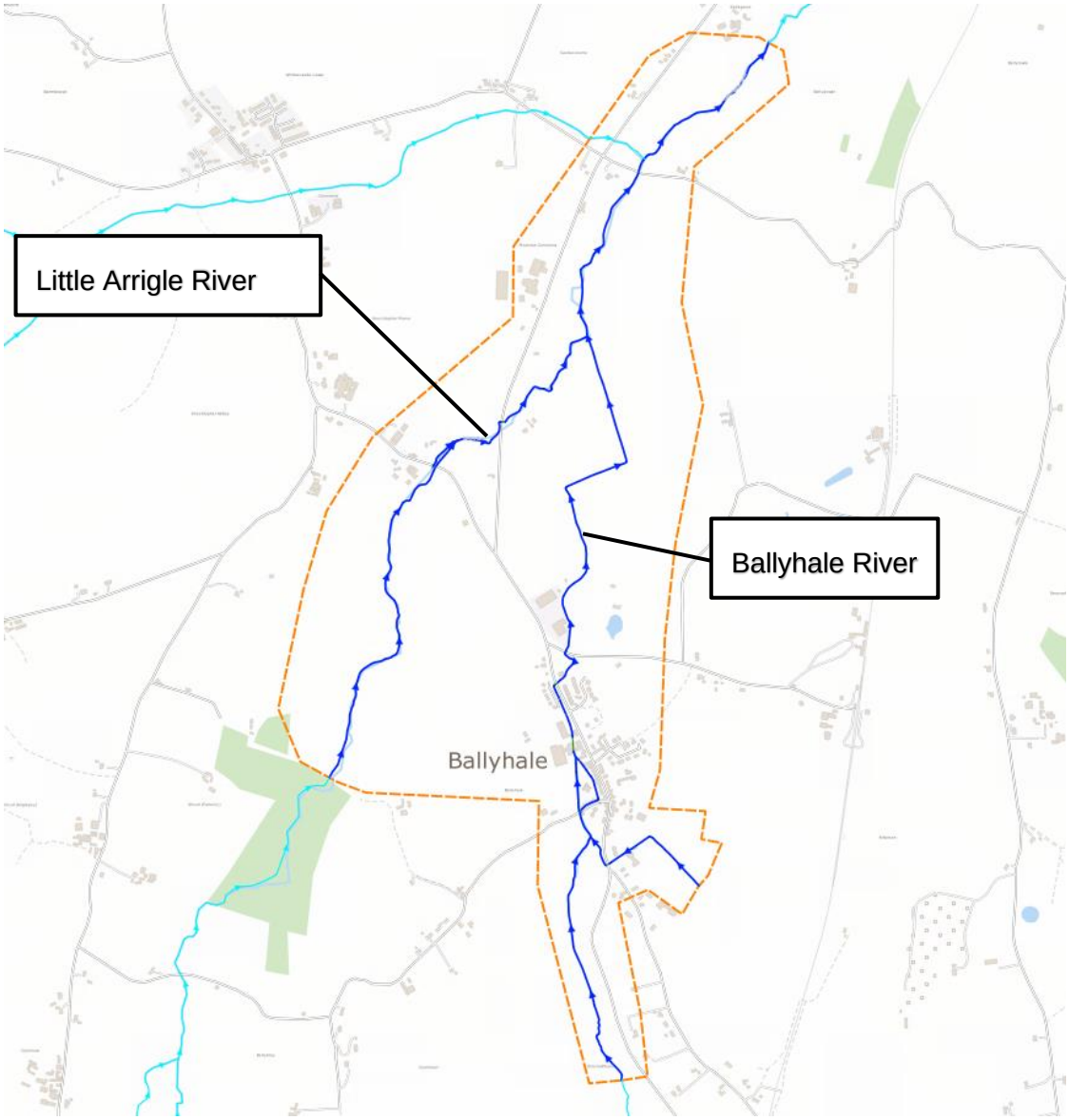

Figure 7-2 – Local Watercourses

EPA mapping indicates that the Little Arrigle/Ballyhale River are not designated Salmonid watercourses however the downstream River Nore is governed by salmonid regulations at the discharge of the Little Arrigle to the Nore (approx. 7km downstream of Ballyhale).

7.3.3 Regional Hydrogeology

Sandstone Bedrock underlies the entire scheme. The majority of the bedrock underlying the scheme is described as yellow and red sandstone and green mudstone, which are part of the Kiltorcan Formation, while at the northern end the bedrock is described as sandstone, shale and thick limestone which are part of the Porters Gate Formation. The County Kilkenny Groundwater Protection Scheme notes that the shales of the overlying Portersgate formation are less permeable and can act as a confining layer and artesian flows have been obtained

where wells have breached them to tap into the Kiltorcan sandstones below. The bedrock aquifer underlying the entire site is classified by Geological Survey Ireland as a “Regionally Important Aquifer-Fissured bedrock”.

No Drinking Water Protection Areas were identified in the vicinity of the site however protection zones are present on the aquifer near Thomastown where there are abstractions for drinking water supplies.

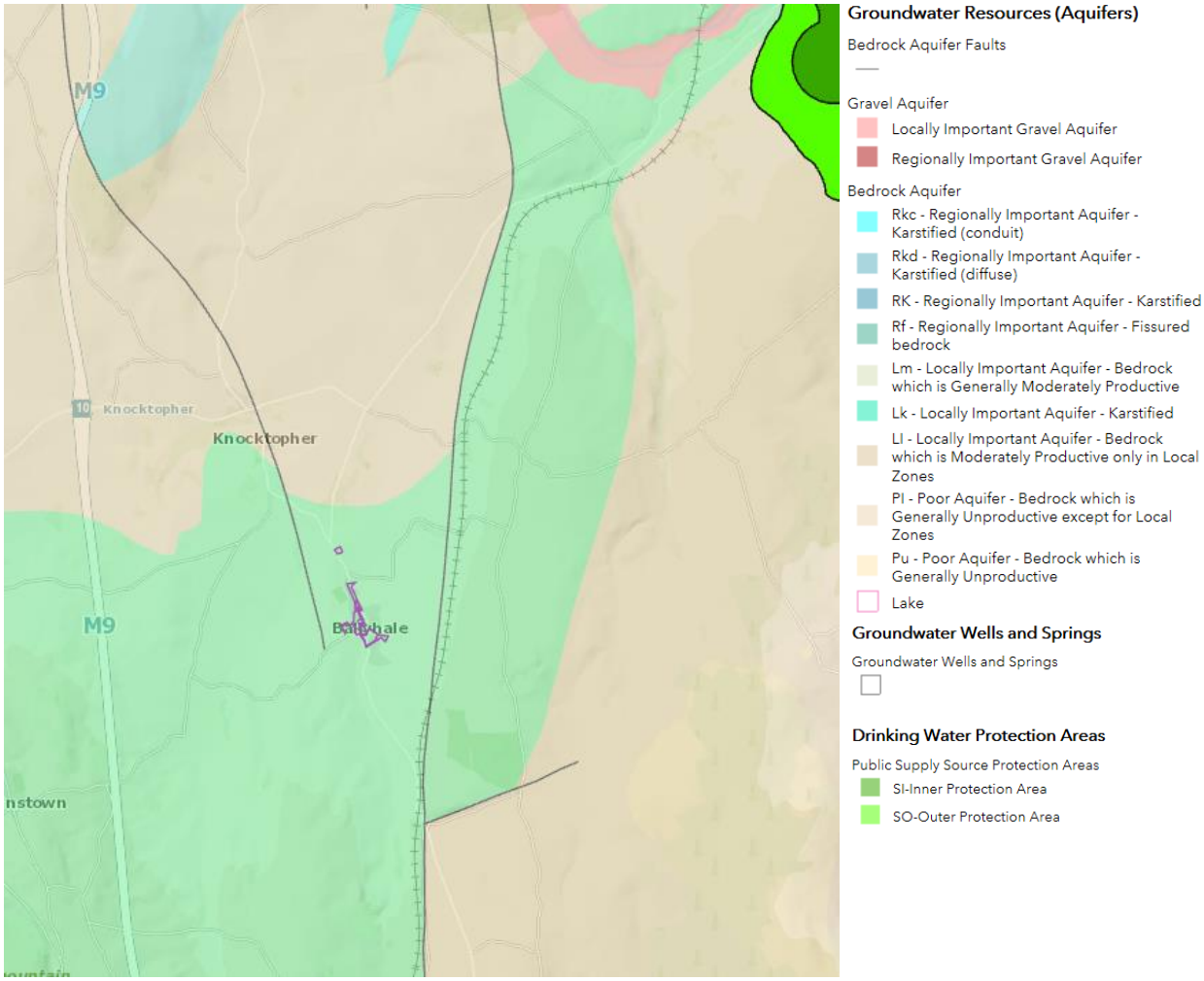

Figure 7-3 – Hydrogeological Setting

Groundwater Vulnerability is a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities. Groundwater vulnerability is classed from moderate to extreme across the southern half of the project extents due to the shallow depth to bedrock and relatively permeable soils. Areas of highest vulnerability correspond to areas of near surface bedrock and thin soil depths. It is noted that the aquifer vulnerability classification does not consider the nature of the underlying ‘receiving’ aquifer with respect to resource value or

significance of pollution occurring and is only a reflection on the protection afforded to the aquifer by overlying deposits.

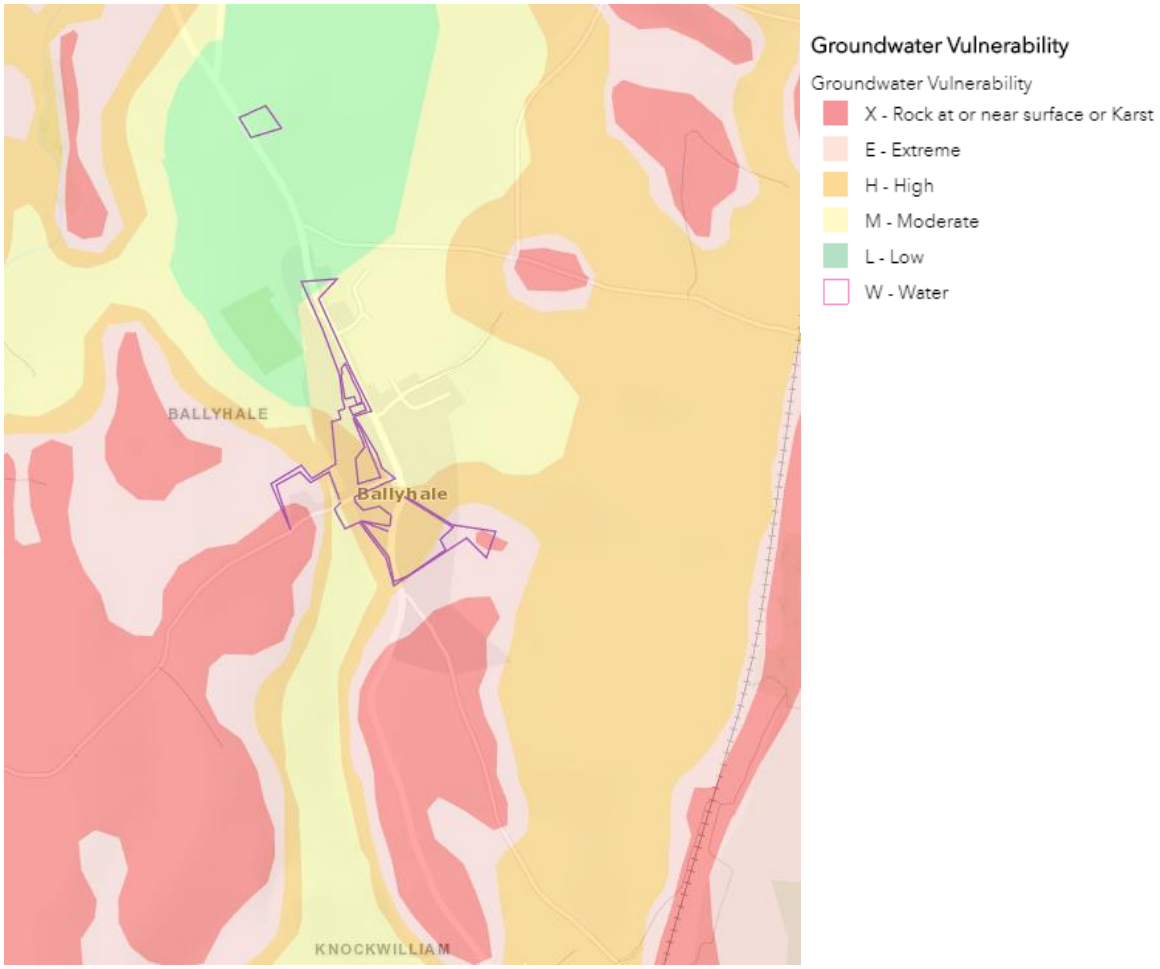

Figure 7-4 – Groundwater Vulnerability (Indicative Site Boundary)

7.3.4 Topography

The proposed scheme traverses an area of undulating lands generally falling from south to north. The Little Arrigle and Ballyhale Rivers flow in local topographic valleys. Higher elevation lands are present to the south east and west.

A detailed topographical survey of all lands, watercourses, and existing infrastructure affected by the proposed works has been carried out to inform the design for the scheme. In addition to this, LIDAR topographical data has been used to determine the topography beyond the proposed scheme extents.

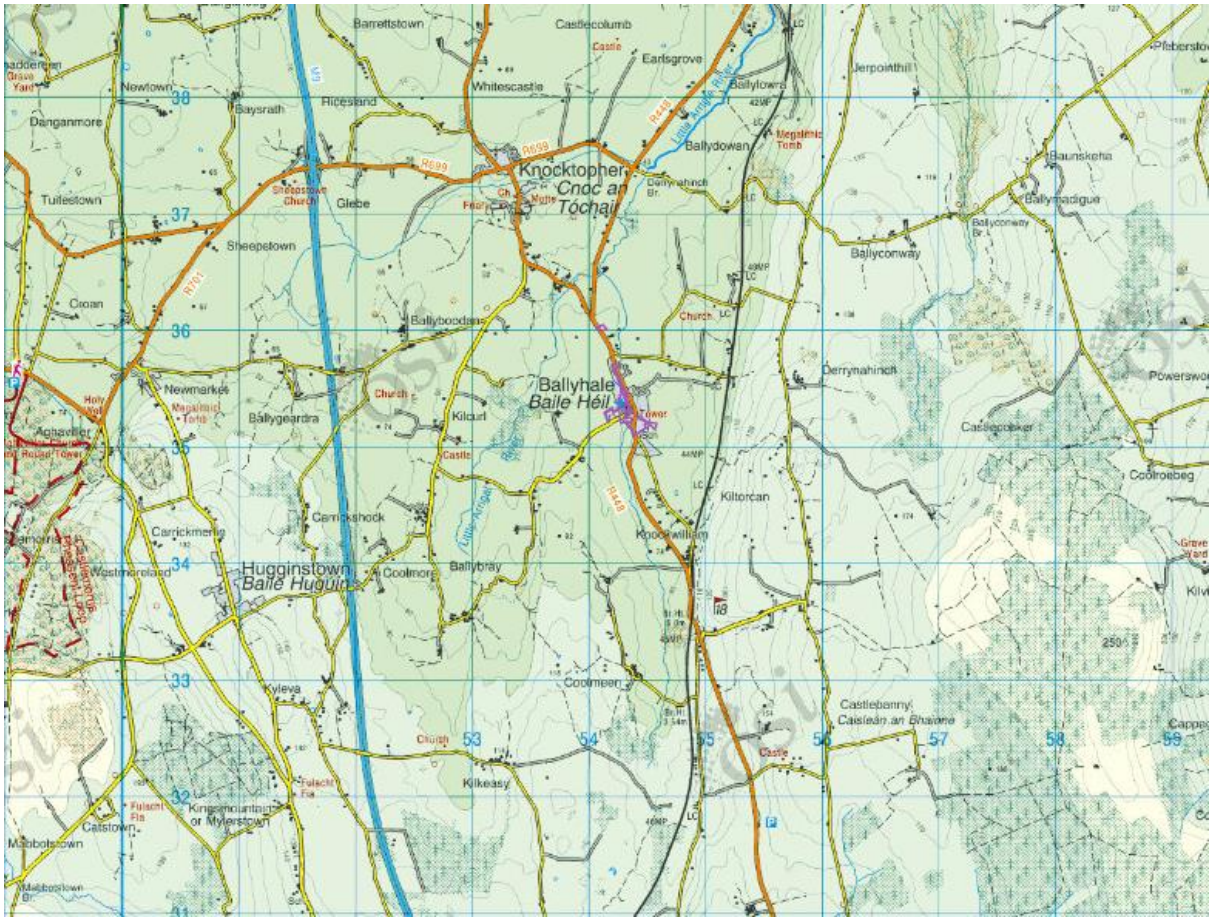

Figure 7-5 – Topography Overview (Indicative Site Boundary)

7.3.5 Water Quality

EPA Q Rating

The EPA operate a biological river quality (Q or biotic index) classification system based on biological sampling at water monitoring stations. These values are based primarily on the relative proportions of pollution sensitive to pollution tolerant macroinvertebrates resident at a river site.

Table 7-2: Biotic Indices – Interpretation

Q Value	WFD Status	Pollution Status
Q5, Q4-5	High	Unpolluted
Q4	Good	Unpolluted
Q3-4	Moderate	Slightly polluted
Q3, Q2-3	Poor	Moderately polluted

Q Value	WFD Status	Pollution Status
Q2, Q1-2, Q1	Bad	Seriously polluted

Q-rating data is unavailable for the Ballyhale River but there is data available for the Little Arrigle approximately 1.0km and 5.2km downstream. Refer to Table 7-3 for results.

Table 7-3: EPA Water Quality Monitoring Q-Rating Values

Waterbody	Station ID	Location E/N	Latest EPA Q-Rating
Little Arrigle	RS15L010040	253005.1 / 134746	3-4 (Moderate)
Little Arrigle	RS15L010100	254487 / 137328	4 (Good)

WFD Classification -Surface Water

The Little Arrigle River has been assigned as “At risk” status under WFD classifications. The watercourse (Knockwilliam_010) is classified as Moderate under the WFD in the direct vicinity (Ballyhale River) of the site and the Little Arrigle River is also classed as Moderate downstream of the site near its confluence with the Nore. The Nore is also classified as Moderate at this location.

WFD Classification -Groundwater

The groundwater body underlying the scheme extents is the Thomastown waterbody which is classed as “At risk” status under the Water Framework Directive (WFD). The groundwater body quality is classed as Good.

7.3.6 Meteorological Data Summary

Rainfall data for the area has been extracted from Met Eireann Data Charts, the annual rainfall data from 1981-2010 indicates the long-term average annual rainfall in the vicinity of the scheme is between 950-1050mm. Rainfall data values are higher in the higher elevation areas south and east of the village.

7.3.7 Abstractions

No Drinking Water Protection Areas were identified in the vicinity of the site however protection zones are present on the aquifer near Thomastown where there are abstractions for drinking water supplies. A number of smaller wells/springs are mapped by GSI in the vicinity of the site and may be used for drinking water.

There is a diversion/abstraction on the Little Arrigle at Goatsbridge which feeds a commercial fish farm (trout).

7.3.8 Discharges

A Wastewater treatment plant is present in Ballyhale at the northern edge of the village adjacent to the Ballyhale River. Historically this plant discharged to the Ballyhale River at this location however a pumped discharge route was installed to move the primary discharge point further downstream where greater assimilative capacity is available in the watercourse. The Ballyhale-Knocktopher Urban Wastewater Treatment plant carries out secondary treatment and discharges to the watercourse. Overall compliance in this WWTP is a “pass”.

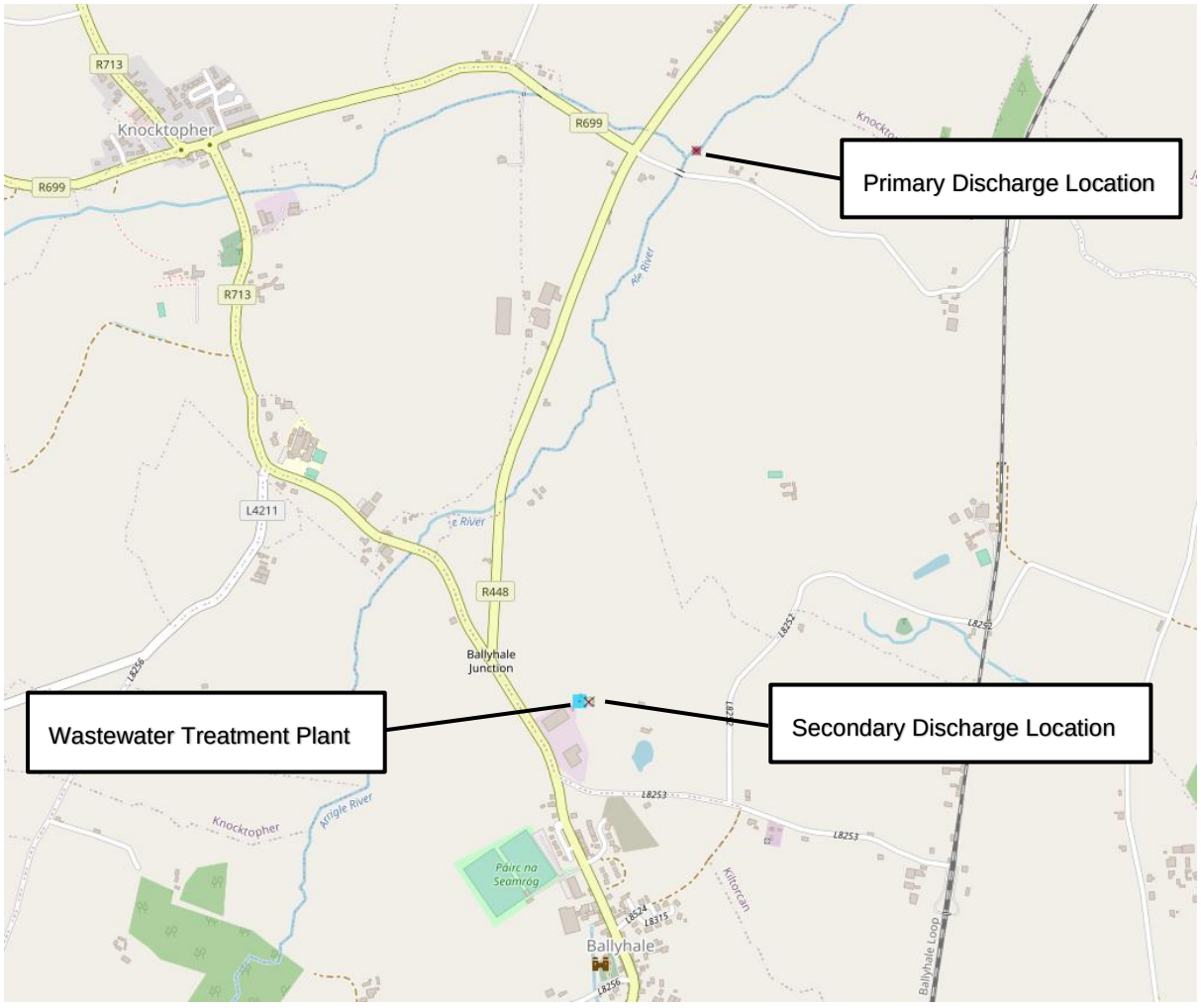

Figure 7-6 Ballyhale-Knocktopher Wastewater Treatment Plant and Discharge Location

7.3.9 Designated Sites

Designated sites (sites designated as conservation areas under Irish or EU legislation) within 5km of the proposed scheme or within the hydrological catchment of the scheme are indicated in Table 7-4 below.

Table 7-4 – Designated Sites

Station ID	Name	Designation	Distance	Receptor Pathway	Commentary
002162	River Barrow and River Nore	Special Area of Conservation (SAC)	<1 km	Direct Pathway	Freshwater stretches of the Barrow and Nore River catchments as far upstream as the Slieve Bloom Mountains and includes also the tidal elements and estuary as far downstream as Creadun Head in Waterford. Designation partially as a result of the presence of sensitive aquatic ecology including salmon, lamprey, Twaite Shad, Freshwater Pearl Mussel and extremely rare Nore Freshwater Pearl Mussel. The populations of Nore Freshwater Pearl Mussel are well upstream of the confluence of the Little Arrigle (population located between Abbeyleix and Ballyragget) Site is downstream of the works and certain proposed works may slightly overlap with SAC site extents. Site considered sensitive to potential hydrological impacts on water quality/quantity from the scheme.
004233	River Nore SPA	Special Protection Area (SPA)	6.5 km	Direct Pathway	The River Nore SPA is a long, linear site following the Nore and some tributary watercourses. Its designation is associated with ornithological interest. Although downstream of the subject site the designation is not considered particularly sensitive to water impacts at the subject site
000839	Kilkeasy Bog	Proposed Natural Heritage Area (PNHA)	4.5 km	No direct pathway	Kilkeasy Bog is a large wetland area comprising. small lakes, fen, wet grassland, cutover bog and heathland Site is not downstream of the proposed scheme and therefore is not sensitive to water impacts from the scheme
000404	Hugginstown Fen	SAC, PNHA	4.5 km	No direct pathway	Area of swamp and floating fen developed in a small valley in hilly country. It is underlain by limestone glacial till overlying and surrounded by acid Old Red Sandstone. Designated based on alkaline fens. There is no direct path from the Designated Site to the proposed scheme and therefore is not sensitive to water impacts from the scheme.

7.3.10 Flooding

The hydraulic modelling for the proposed scheme is set out in the Hydrology Report and Hydraulics Report and is available on the Kilkenny County Council Website.

Historical Flood Data

As part of the desktop study, historic and predicted flood risk mapping published by the OPW on the Flood Hazard Mapping Website http://www.floodinfo.ie/ was reviewed. Historical flood records notes KCC records of recurring flooding in Ballyhale and notes records of flooding affecting Ballyhale in November 2000 & November 2002

The South Eastern CFRAM carried out a study of flooding in Ballyhale which included hydraulic modelling. The study predicted that out of bank overland flooding occurs upstream of the village on the eastern bank of the Ballyhale River. These floodwaters flow overland across agricultural lands and into the village. Flooding was also shown to be affected by a number of undersized culvert/bridge structures on the watercourse through the village. The study estimated that 25 properties in Ballyhale are at risk of flooding for the current day 1% Annual Exceedance Probability (AEP) event. The existing flood mechanisms are to be verified as part of the updated hydraulic modelling exercise in the current scheme phase.

River Flows

River flows were derived as part of the Hydrological Assessment for the scheme and are detailed in the supporting Hydrology Report. Selected river flows are presented below to provide a guide on the flow conditions in the local watercourses.

Table 7-5: River Flows

Location	Hydrology Report Ref	Qmed (m^3/s)	Q100 Flow (m^3/s)	Q1000 Flow (m^3/s)
Ballyhale River – Upstream of Village	15_1358_3	1.67	4.70	7.74
Little Arrigle River – Upstream of confluence with Ballyhale River	15_1182_7	1.56	4.33	7.07

Existing Flooding

The existing flood risk and flood mechanisms are described in the Hydrology Report and Hydraulics Report. The predicted Q100 flood events are shown in Figure 7-7.

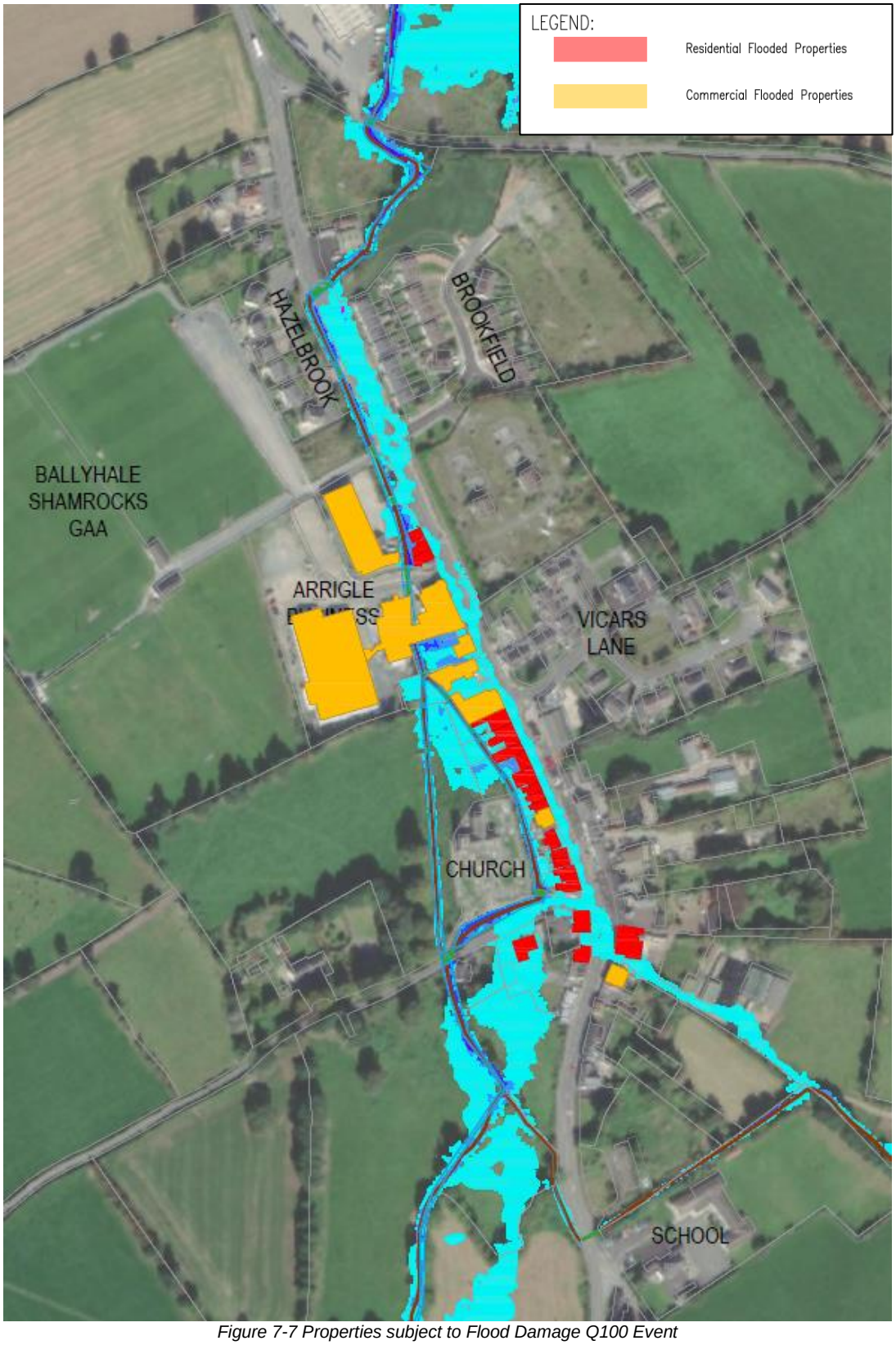

Figure 7-7 Properties subject to Flood Damage Q100 Event

The primary flood mechanism for the flooding within the village is caused by structure incapacity with resulting backwater effect causing out of bank flooding along the Ballyhale River resulting in flooding at the rear of the Main Street properties, coupled with two significant overland flow routes from the south of the village.

Channel incapacity upstream of the village from the Ballyhale River creates an overland flow path that flows northerly towards Chapel Lane, re-entering the western church reach of the Ballyhale River at the church access bridge.

A second overland flow route is evident from an unmapped tributary of the Ballyhale River that flows adjacent to the school boundary. A low point in the bank where the channel turns at an approximately 90-degree bend coupled with unmaintained vegetation restricting flows within the channel downstream causes flooding from the right-hand bank flowing down 'Sheff's Lane' that emerges onto the Main Street. The flow route diverges at the Chapel Lane junction, flows that tend down Chapel Lane enters the western church reach at the church access bridge. Flows that tend down Main Street enters the main Ballyhale River at the former Garda Station.

In higher flow events, the flow path on the Main Street continues and re-joins the Ballyhale River at either the downstream section of the 'Main Street Bridge' at the Hazelbrook development or downstream of the Station Road bridge.

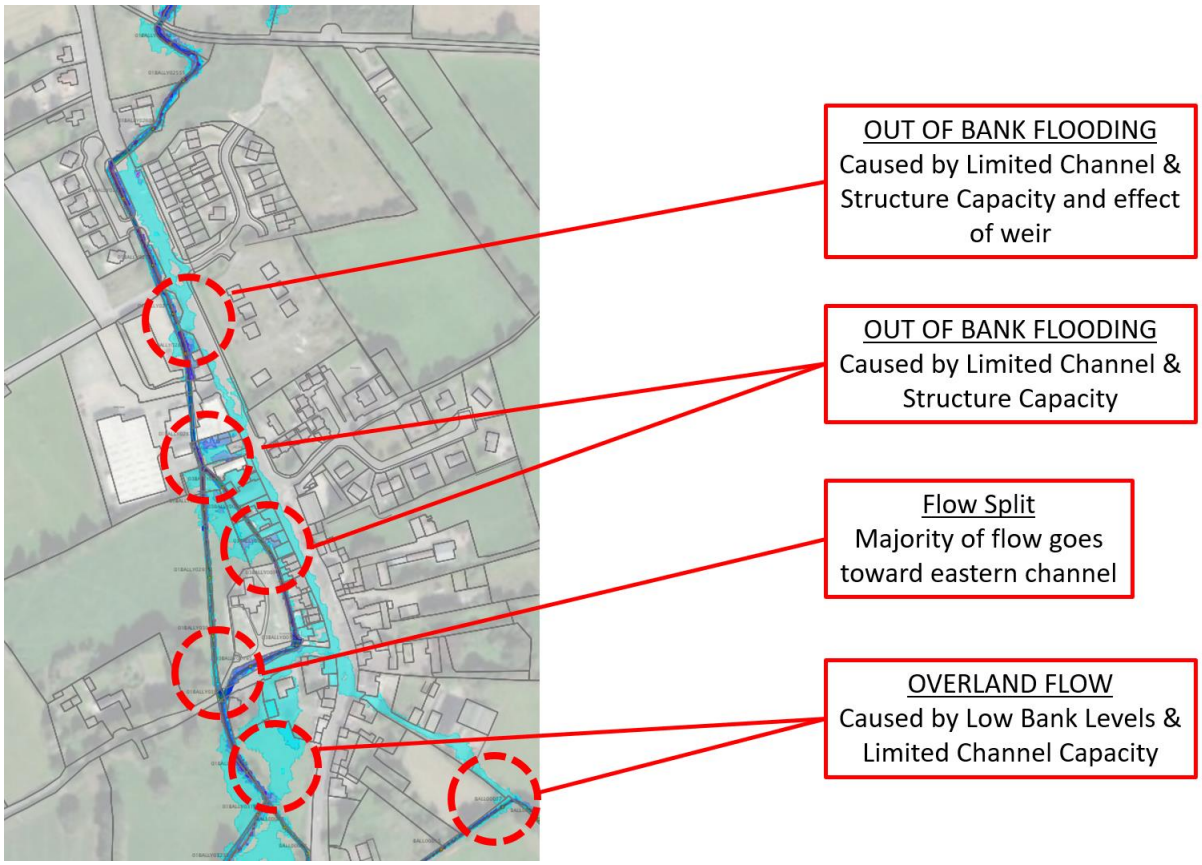

Figure 7-8 Flood Mechanisms – Overview

7.4 Predicted Impacts of the Proposed Development

7.4.1 Do Nothing Scenario

If the proposed Scheme were not to proceed,

- The opportunity to mitigate against flooding up the to 1% AEP flood event would be lost and, during flood conditions, the following risks to water quality are anticipated:

- The potential for contamination could arise from sewer surcharging and from sources such as chemicals or other potential pollutants stored in areas which become inundated during flood conditions.

The opportunity to provide positive impacts on stream morphology such as the proposed removal of weirs would also be lost.

If the “do nothing” option were chosen, the opportunity to protect Ballyhale Village from flooding up to the 1% AEP flood event would be lost along with the opportunity to protect water quality and human health and safety during flood events.

7.4.2 Construction Phase

This section identifies a list of potential and significant effects to the water environment within the subject site caused by the construction of the proposed development in the absence of mitigation measures.

During the construction of the scheme the various in-stream elements will impact the river conveyance through a reduced channel width or piped flow, which will increase flood risk upstream of the affected parts of the river. These works would be undertaken during the summer months when river flow is typically lower giving a potential temporary negative effect on the hydrology of the Ballyhale River. Additional potential effects that may arise during the construction phase include:

Table 7-6 Construction Phase Potential Impacts

Potential Impact	Probability	Duration
Contamination of surface water runoff to local watercourses due to weathering and erosion of the surface soils during construction activities	Low	Temporary
Improper discharge of foul drainage from contractor's compound to local watercourses	Negligible	Temporary
Surface water runoff to local watercourses during the construction phase may contain increased silt levels (e.g. runoff across areas stripped of topsoil) or become polluted by construction activities	Low	Temporary
Discharge of rainwater pumped from excavations	Low	Temporary
Accidental spills and leaks associated with storage of oils and fuels, leaks from construction machinery and spillage during refuelling and maintenance contaminating the surrounding surface water and local hydrogeological environments	Low	Temporary
Concrete runoff, particularly discharge of wash water from concrete trucks	Low	Temporary
Discharge of vehicle wheel wash water to local watercourses	Low	Temporary
Infiltration of groundwater into excavations	Low	Temporary
Construction of culverts can disturb stream sediments and increase turbidity locally within the watercourse	Low	Temporary
Concrete, bentonite and other cement-based products will be used during construction activities. These materials are highly alkaline and corrosive and can have significant negative effects on local watercourses surface water quality if improperly handled. Cement based products can also be detrimental to waterbody environs by altering the waters pH	Low	Temporary
Changes in surfacing caused by vegetation stripping or gravel placement may also affect runoff or rates in local watercourses	Low	Temporary
Changes in surfacing or drainage approach may affect groundwater recharge patterns.	Low	Temporary

7.4.3 Operational Impacts

The existing watercourse in Ballyhale is heavily modified and the scheme design has sought to return the stream to natural conditions wherever possible. Measures include the removal of weir structures and the removal of the artificial flow split. Fencing will be introduced in some areas where previously the stream banks were subject to poaching by cattle. Flood defences where proposed are beyond the stream banks and therefore only affect flood routing during extreme events and maintain normal flow conditions in the channel. These measures are considered to result in a slight positive effect on stream morphology.

The proposed Scheme will provide protection up to the 1% AEP flood event. This will result in a significant long-term positive impact due to the reduction in flood damages.

The proposed flood defences will prevent the flood waters from following through properties and roads, washing contaminants into the river. This will significantly improve the Ballyhale Rivers water quality.

An inspection and maintenance regime will be carried out throughout the lifetime of the proposed scheme to ensure the Flood Defence Scheme remains in an effective condition. Channel and embankment maintenance operations can encompass a variety of activities, including silt and vegetation management, aquatic vegetation cutting, bank protection, bush cutting/branch trimming, tree cutting, mulching, mowing and structure maintenance.

7.4.4 Worst Case Scenario

Under a ‘worst case’ scenario, the accidental release of significant quantities of fuel, oil, paints or other hazardous material occurs on site during the construction phase, through the failure of secondary containment or a materials handling accident on the site. If this were to occur over open ground, then these materials could infiltrate through the soil contaminating the groundwater or flow overland and contaminate surface water receptors.

In the absence of mitigation measures there would be a temporary negative impact on the water quality of the receiving environment.

7.5 Mitigation Measures

7.5.1 Mitigation Measures – Preamble

From the assessment of potential impacts during construction and operation and decommissioning, the following key issues have demonstrated potential impact significance and so require particular attention for mitigation and management:

- Chemical Pollution of Watercourses
- Pollution of watercourses by silt / suspended solids
- Changes to Stream Channels
- Changes to runoff and flow patterns

The greatest risk to the environment is during the construction period, coinciding with the greatest amount of activity on site. Furthermore, effects unmitigated during construction have the potential to extend into the operational phase.

Details of additional mitigation measures proposed are included in the following sections. It is noted that all identified potential effects have been mitigated via prevention and reduction, and that impact offsetting is not proposed.

7.5.2 Mitigation Through Design

The project layout has evolved in order that the design avoids unnecessary conflict with the water environment. Design evolution to minimise environmental impact has been prioritised throughout the various design stages.

- The scheme avoids excessive culverting or pumping which would have significant negative environmental impacts.
- The scheme avoids Upstream Storage which would change the hydrological regime and represent a negative impact on the watercourse.
- The scheme avoided the creation of flow diversion channels. which has negative effects to the existing hydrological and morphological regimes.

This is detailed in the Alternatives Considered Chapter and has been continued throughout the planning stage and design phases.

7.5.3 Mitigation through Procedure

In order to facilitate the integration of environmental issues into scheme planning, construction and operation, an Environmental Operating Plan (EOP) shall be produced, implemented and maintained by the contractor.

The EOP shall be designed to assist the main contractor in preventing, managing and/or minimising significant environmental impacts during the construction phase. To achieve this objective the EOP shall comprehensively incorporate all Environmental Commitments set out in the Contract documents, Planning Documents (including EIAR), any conditions and/or modifications imposed by An Bord Pleanála or the Local Authority. The EOP shall be co-ordinated with all other environmental procedural documents required.

7.5.4 Specific Mitigation Measures – Pollution Control

This section outlines the mitigation measures that will be required to minimise pollution impact to the water environment during both the construction and operational phase of the development.

Construction stage drainage shall be encompassed by a robust Sustainable Drainage System (SuDS) design which will be used to control drainage and silt management on the site. Drainage measures to include;

- During construction, contaminated surface water runoff in working areas will be collected by temporary drainage systems installed by the contractor and then treated or desilted on-site before discharge to the Ballyhale River. No outflows or dewatering flows from the works area will discharge directly into watercourses.
- Pumps will be used where it is required to dewater an isolated area. Where pumps are used, they will be placed in a sump that isolates them from the base of the excavation in a perforated container. The discharge will be routed through a suitability sized sediment removal system.

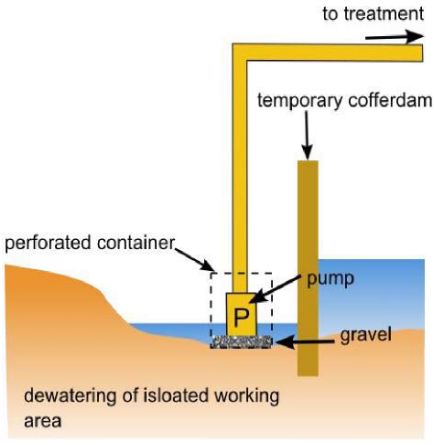

Figure 7-9 Submersible Pump on a gravel base and perforated container [Source SEPA Engineering in the Water Environment Good Practice Guide Temporary Construction Methods]

- Construction drainage ditches will take the form of wide, flat-bottomed swales designed to convey flows at a low velocity.

- Providing settlement tanks or temporary ponds where runoff from the works areas is treated prior to discharge to watercourses. Settlement features will be large enough to allow retention for sufficient time for the particles to settle. Settlement features will be regularly maintained to ensure that they are not full of sediment.

Figure 7-10 Settlement Ponds
[Source SEPA Engineering in the Water Environment Good Practice Guide Temporary Construction Methods]

Figure 7-11 Settlement Tanks
[Source SEPA Engineering in the Water Environment Good Practice Guide Temporary Construction Methods]

- Discharges will travel over vegetated buffer strip at low velocities prior to discharge to maximise filtration and settlement.

- Silt fencing or other appropriate measures shall be put in place downstream of exposed soils, soil stockpiles or unprotected new embankments.
- Silt fences will be installed downstream of areas of exposed soils adjacent to the streams riparian strip ensuring that the silt fence is at a right angle to the direction of the runoff. Silt fences will be used during the construction of the embankments.

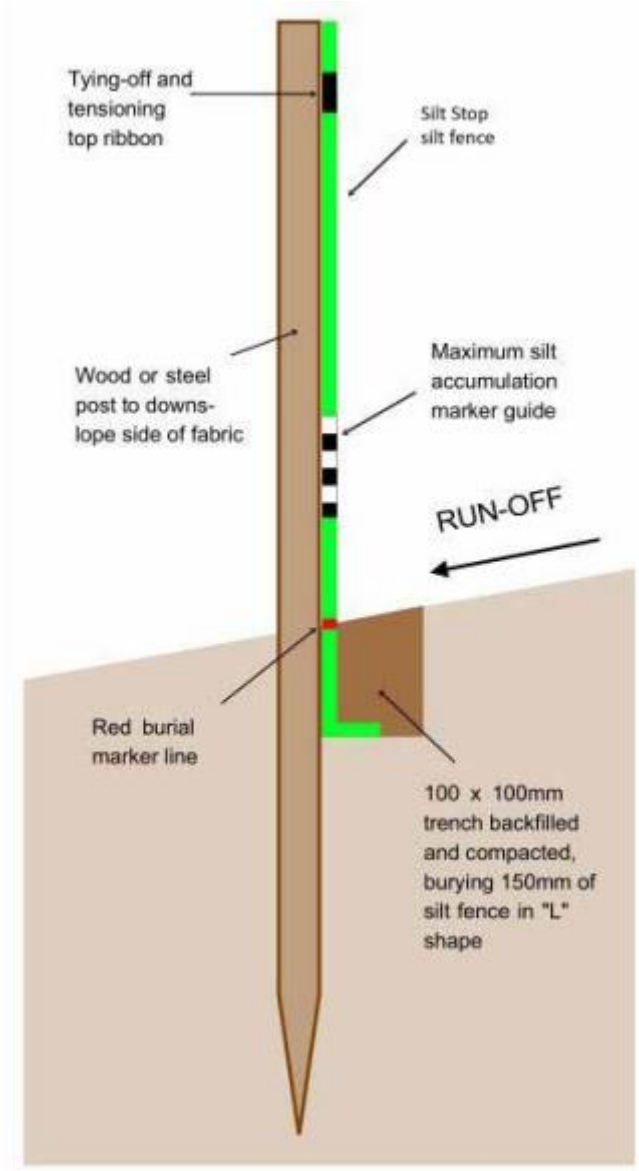

Figure 7-12 Silt Fence Cross Section [Source Hy-Tex Terrastop Silt Fence Construction Methods]

The installation of silt fencing will follow the following procedure:

1. Fence Line – Mark out the area required for the silt fence ensuring the fence is central and at right angles to flow of water.
2. Trenching – Dig a 100mm x 100mm trench to allow for the Silt Fence to be buried in an “L” shape as noted in Figure 7-12.

3. Fence Stakes – Position posts on the downslope side of the fence with a maximum of 1.5m post spacing and a minimum of 0.5m burial, securing the fence.
4. Attached the Silt Fence – Tension the top end by looping the ribbon bad over the post.
5. Backfill and Compaction – Backfill the trench line and firmly compact.
6. Inspection – Regularly inspect the Silt Fence and remove trapped silt when it reaches the top of the Silt Accumulation Line and repair any damage to the silt fence.

Figure 7-13 Silt Fence Installed alongside Riverbank [Source Thrace Synthetic]

- Vegetation will be established as soon as possible on all exposed soils.

Other measures to be employed throughout the construction and operational phases to minimise pollution risk include;

- Due consideration will be given to the prevailing ground and weather conditions when programming the execution of the works.
- Foul Drainage from all site offices and facilities will be contained and disposed of in an appropriate matter to prevent pollution of rivers and local watercourses in accordance with the relevant statutory bodies.
- Refuelling of construction machinery shall be undertaken in designated areas located away from surface water drainage in order to minimise potential contamination impacts on the water environment. Spill kits shall be kept in these areas in the event of spillages.
- Oil and fuel stored on site for construction will be stored in designated areas. These areas shall be bunded (to min 110% of chemical volume) and will be located away from surface water drainage.
- Pouring of concrete including wash down and washout of concrete from delivery vehicles to be controlled in an appropriate facility to prevent contaminating run-off and groundwater.

- All batching and mixing activities shall be located in areas well away from watercourses and drains.
- Any surface water abstracted from a river for use during construction will have an applicable licence agreement in place and will be fitted with a filter to prevent the intake of fish.

For any construction work within or directly adjacent to the water the following mitigation measures will apply

- Works to be carried out in the dry (offline of outside the water flow) in all cases.
- "Dry" works areas will be achieved either via full isolation of the channel section via Gravity Pipe/Flume or via partial isolation using cofferdams. See schematic diagrams below.

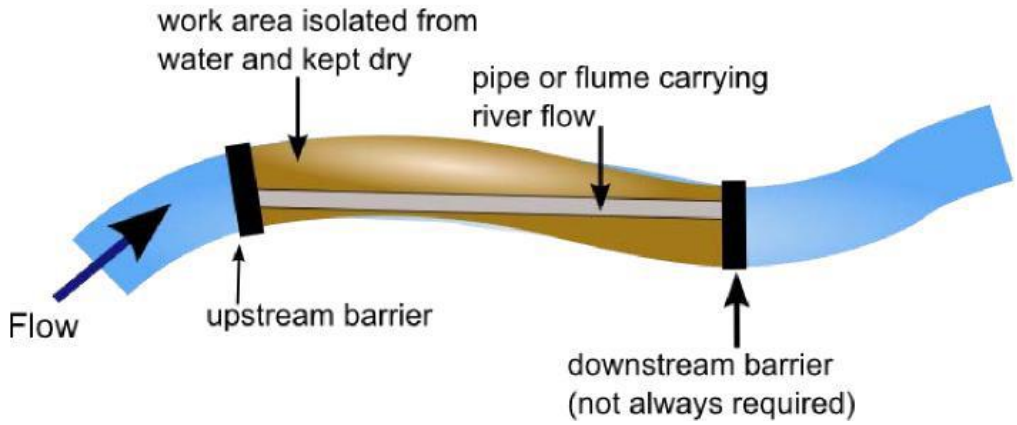

Figure 7-14: Full Isolation Gravity/Flume pipe
[Source SEPA Engineering in the Water Environment Good Practice Guide Temporary Construction Methods]

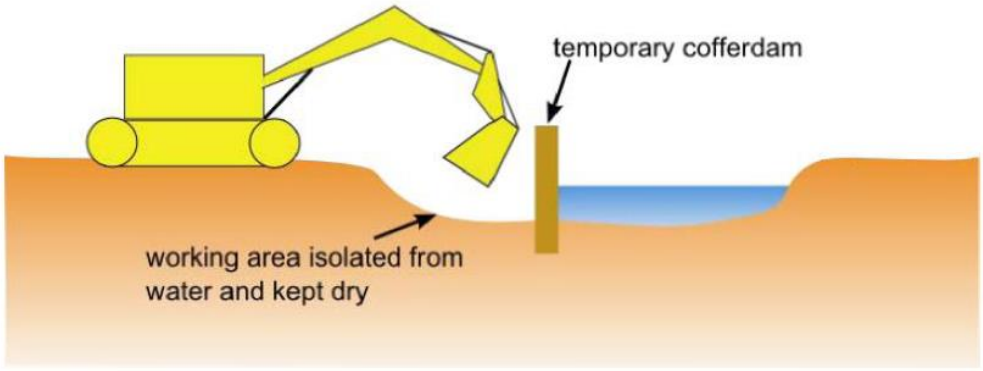

Figure 7-15: Partial Isolation Cofferdam
[Source SEPA Engineering in the Water Environment Good Practice Guide Temporary Construction Methods]

- Relevant fisheries authorities shall be informed of all in-stream construction work scheduled to take place. Any in-stream or culverting works shall be undertaken in consultation and with the agreement of the relevant statutory body and during the permitted times of the year.
- Hydrophilic grout / quick setting mixes / rapid hardener additives shall be used to promote the early set of any wet concrete required. Other materials such as biodegradable shutter oils will be considered.
- There shall be no use of persistent pesticides, herbicides or artificial fertilisers in any landscaping or subsequent maintenance within a 10m buffer of a watercourse.

Routine monitoring of water quality will be carried out at appropriate upstream and downstream locations prior, during and post construction. The water monitoring will be compared against the baseline results and current Environmental Quality Standards (EQS). Thresholds levels are noted below;

- The pH of any and all discharges made from and during construction woks shall be in the range of 6 – 9 and not alter the pH of any receiving fisheries waters by more than +/- 0.5 pH units.
- The level of suspended solids in any discharge as a result of construction work shall not exceed 25mg/l, nor result in the deposition of silts on gravels or any element of the aquatic flora or fauna.

7.6 Residual Impacts

It is considered that by implementing the proposed construction and operational phase mitigation measures above, that the significance of the identified impacts will be reduced to a “Not significant” residual impact on the identified hydrological/ hydrogeological receptors.

Based on the mitigation measures proposed, there will not be a negative impact on the WFD status of the Ballyhale Stream and the scheme will not cause any medium or long-term deterioration in the overall status.

The proposed Scheme will provide protection up to the 1% AEP flood event. This will result in a significant long-term positive impact due to the reduction in flood damages.

7.7 In-combination Impacts

Site activities during the construction phase have the potential to give rise to water pollution and impacts on flora and fauna that use water within the same catchment with removal of soils, overburden and rock during the construction phase has the potential to give rise to impact on water quality. Implementation of the proposed mitigation measures within this

chapter will ensure that there will be no cumulative significant adverse impacts on the water environment from the proposed scheme.

7.8 Cumulative Effects

The “Castlebanny Wind Farm” site extents falls within the same Water Framework directive Sub Catchment and within the Water Framework Directive River Sub Basin and would have a cumulative impact on the Ballyhale River and the downstream SPA if the projects proceeded in parallel or overlap construction periods. However, the implementation of mitigation measures described above will reduce these impacts to not significant residual impact.

7.9 Conclusions

It is considered that by implementing the proposed construction and operational phase mitigation measures above, that the significance of the identified impacts will be reduced to a “Not significant” residual impact on the identified hydrological/ hydrogeological receptors.

Based on the mitigation measures proposed, there will not be a negative impact on the WFD status of the Ballyhale Stream and the scheme will not cause any medium or long-term deterioration in the overall status.

The proposed Scheme will provide protection up to the 1% AEP flood event. This will result in a significant long-term positive impact due to the reduction in flood damages.

7.10 Difficulties Encountered in Assessment

No significant difficulties were encountered during the assessment.

7.11 References

- Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan (TII);
- The Management Of Waste From National Road Construction Projects (TII);
- Design of Earthworks Drainage, Network Drainage, Attenuation & Pollution Control (DN-DNG-03066) (TII);
- Guidelines On The Information To Be Contained In Environmental Impact Assessment Reports (May 2022) (EPA);
- EPA Advice Notes on Current Practice (in the preparation of Environmental Impact Statements) Sept. 2003;
- Geo Portal (https://gis.epa.ie/EPAMaps/) (EPA);
- The SUDS Manual (CIRIA C753) (CIRIA);
- Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors (CIRIA C532);
- Control of Water Pollution from Linear Construction Sites (CIRIA C648);
- Environmental Good Practice on Site (C692) (2010) (CIRIA);
- Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements. (2013) Institute of Geologists of Ireland (IGI);
- Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects, Dept of the Environment Heritage and Local Government;
- Construction Code of Practice for the Sustainable Use of Soils on Construction Sites, Department for Environment, Food and Rural Affairs (UK); and
- Geological Survey Ireland Spatial Resources https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228

APPENDIX 7-1

Hydraulics Report

APPENDIX 7-2

Hydrology Report

APPENDIX 7-3

Baseline Flood Maps

APPENDIX 7-4

Post Scheme Flood Maps