7 WATER

7.1 INTRODUCTION

The chapter assesses and evaluates the likely significant effects of the Proposed Scheme on water, in relation to hydrology, hydrogeology, water quality and quantity. The existing water baseline conditions and character of the Study Area are presented and the potential impacts anticipated from the development are identified and assessed. Mitigation measures and monitoring is proposed and residual effects are assessed.

The detailed description of the proposed Scheme and construction activities are provided in Chapter 3 (Description of the Proposed Development). The water distribution network elements associated with the construction of the Scheme are addressed in Chapter 11 (Material Assets). Impact on Aquatic Ecological Environment is discussed in Chapter 5 (Biodiversity).

The Study Area, for the purposes of this Chapter, extends along the channel, flood plains and surrounding lands of the River Deel (Figure 7.1). The Works Area, for the purposes of this Chapter is defined as the area within the temporary works boundaries for the Scheme as detailed in Chapter 3, Figure 3.1.

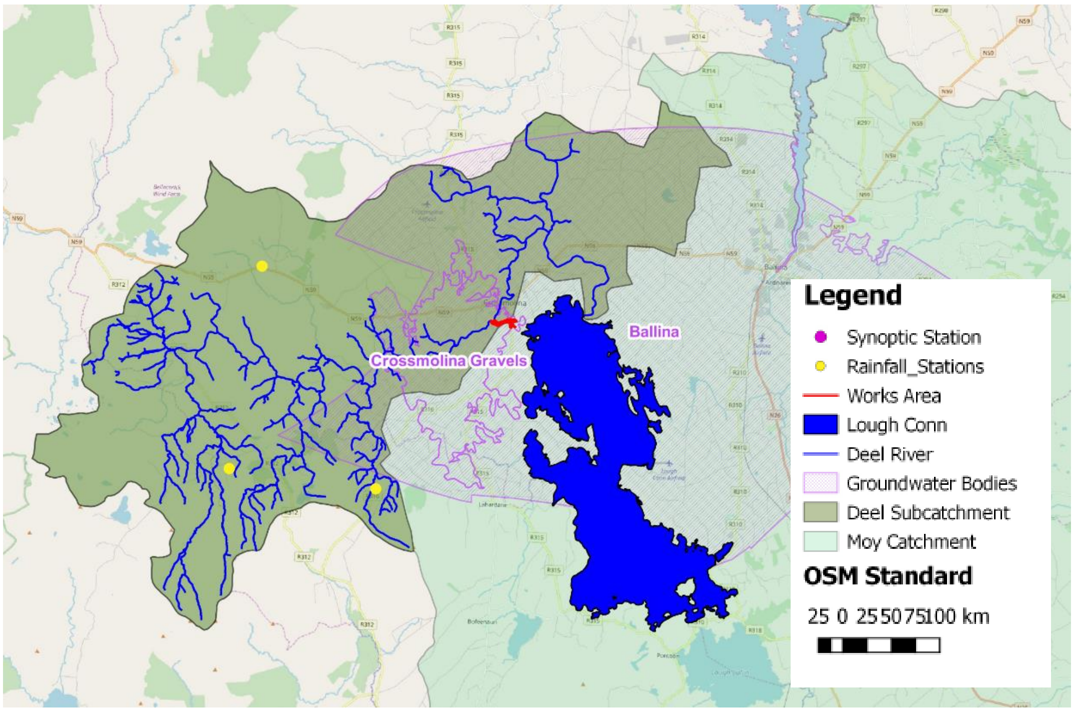

Figure 7.1 Deel sub-catchment and associated waterbodies in relation to the Works Area.

The construction phase of the Scheme will include construction of a channel from the River Deel to the existing Mullenmore Springs, creating washlands between the springs and Lough Conn by bypassing Crossmolina and reducing maximum flows in the River Deel to those which can safely pass under the soffit of Jack Garrett Bridge and described in detail in Chapter 3.

The operation phase of the River Deel (Crossmolina) Drainage Scheme will include the transfer of a portion of the flood waters in the River Deel to Lough Conn, via the diversion channel, approximately 6 hours in advance of the natural peak arriving from the River Deel. The anticipated rise in water levels in the channel during the 1% AEP flood event is approximately 0.5 m/hour. At the downstream end of the channel, flood waters will propagate across the existing springs, and the surrounding agricultural land towards Lough Conn creating wash lands. Lake water levels will rise more quickly following a flood event in the river as result of the operation of the channel. This will not have a significant effect on the overall flood levels in the lake as the same volume of water will be diverted to the lake via the diversion channel as would have reached the lake via the River Deel with no Drainage Scheme in place.

The scope of this Chapter entails the following:

- Description of the baseline hydrological, hydrogeological and water quality of the existing environment in the Study Area;
- An assessment of the 'do nothing' scenario
- Description and evaluation of the likely impacts of the development in terms of construction and operational phases including the character, magnitude and duration of such impacts;
- Description and development of proposed mitigation measures to minimise any potential impacts;
- Description of the residual impacts after mitigation; and a
- Description of impact interactions and cumulative impacts
- Description of post consent monitoring measures

7.2 METHODOLOGY

7.2.1 Literature Review

A desk study of relevant data was conducted. The following documentation and sources were reviewed:

- Ordnance Survey
- Geological Survey of Ireland (GSI)
- EPA:
    - water quality database (https://gis.epa.ie/EPAMaps/); and
    - www.epa.ie for Annual Environmental Report for Crossmolina WWTP
- Mayo County Council:
    - Mayo County Development Plan (2014-2020)
    - Planning Register
    - Water Services – Abstractions, Discharges & Supply Schemes
- National Parks and Wildlife Services (NPWS):
    - Designated Areas Mapping
    - Site Synopsis Reports
- Surface Water Results for the River Deel
- Met Éireann meteorological data
- OPW hydrological data:
    - Real time data - www.waterlevel.ie
    - Archived data www.opw.ie/hydro-data
- National River Basin Management Plan (2018 - 2021)
- Well card data compiled by the Geological Survey of Ireland (GSI)
- DoELG, National Water Study, County Mayo (2000)
- The Water Framework Directive website www.catchments.ie
- The Floods Directive (2007/60/EC)

- Flood Risk Management Plan for the Moy and Killala Bay River Basin (2018)

7.2.2 Relevant Legislation

The European Union (EU) WFD 2000/60/EC is a significant piece of environmental legislation which aims to improve the quality of river, lake, groundwater, estuarine and coastal waterbodies. WFD characterisation, monitoring and status assessment programmes are governed by three Regulations:

- Water Policy Regulations 2003 - 2014;
- European Communities Environmental Objectives (Surface Waters) Regulations 2009 - 2019 which provide an extensive suite of environmental standards for Irish surface waters; and
- European Communities Environmental Objectives (Groundwater) Regulations 2010 – 2016 which provide groundwater quality standards and threshold values for groundwater characterisation and protection against deterioration.

Currently in the second 6-year cycle (the first cycle ran from 2009 – 2015), the WFD's main objectives are:

- To protect, enhance and restore the 'status' of all bodies of water and to prevent their further deterioration;
- To achieve at least 'good status' by 2015 (or 2021 or 2027 under certain conditions)
- To promote sustainable use of water;
- To reduce the pollution of water by particularly hazardous 'priority' substances; and
- To lessen the effects of flooding and drought.

This Project will contribute to the achievement of these objectives by significantly reducing the risk of flooding in the Moy and Killala Bay Catchment.

7.2.3 Status of Water Bodies

'Status' is a descriptor term that incorporates ecological and hydro-chemical data and facilitates catchment comparisons on an EU scale and is assessed by the EPA. Biological information is provided in the form of Q values. Q Values are biotic indices used to express ecological water quality and are based on changes in the macro invertebrate communities of riffle areas brought about by organic pollution. Q1 indicates a seriously polluted water body and Q5 indicates unpolluted water of high quality. A value of Q3 indicates moderately polluted water. These Q value ratings are shown in Table 7.1.

Quality Ratings	Quality Class	Pollution Status	Condition
Q5, Q4-5, Q4	Class A	Unpolluted	Satisfactory
Q3-4	Class B	Slightly Polluted	Unsatisfactory
Q3, Q2-3	Class C	Moderately Polluted	Unsatisfactory
Q2, Q1-2, Q1	Class D	Seriously Polluted	Unsatisfactory

Table 7.1 Q value classification

Other relevant pieces of legislation include:

- Quality of Salmonid Waters Regulations (S.I. No. 293 of 1988)

This assessment of impacts was carried out in accordance with the following guidelines:

- The European Commission 'Guidance on the Preparation of the Environmental Impact Assessment Report (2017)
- DoEHLG,. Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (2010)
- The Department of Housing's 'Guidelines for Planning Authorities and An Bord Pleanála on Carrying out Environmental Impact Assessment' (August 2018)
- EPA, Guidelines on the Information to be contained in Environmental Impact Assessment Reports, Draft August, 2017
- EPA, Advice Notes for Preparing Environmental Impact Statements, Draft September 2015.
- Institute of Geologists of Ireland, 2013. Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements
- Environmental Impact Assessment of National Road Schemes – A Practical Guide (Rev 1, NRA, 2008)

7.2.4 Consultations

A scoping document was prepared and issued to relevant stakeholders (incl. Mayo CoCo, EPA, NPWS, IFI, TII) and any responses received are included in Chapter 2 of the EIAR. A summary of the responses relevant to this Chapter are provided below. Regard has been had to the responses in the preparation of this Chapter of the EIAR.

<u>Mayo County Council</u>

- EIAR to address the impact of the proposed Scheme on the overall environment of Lough Conn;
- EIAR to address the impact of the operation of the wash lands on the environment;
- Flood design should be for 1:70 years given the prevailing climatic conditions.

<u>Inland Fisheries Ireland</u>

- EIAR to contain adequate baseline information on the existing aquatic habitat in the River Deel and at the proposed wash lands.
- EIAR to contain surface water controls for the construction phase to ensure no silt/ sediment/ pollutant discharges to the River Deel or Lough Conn.
- EIAR to contain surface water controls considered for the excavated material to prevent runoff.
- EIAR to consider impacts of road and bridge construction and associated drainage.

7.2.5 Hydraulic Modelling

The hydraulic modelling is for the proposed Scheme is set out in the River Deel (Crossmolina) Drainage Scheme Hydrology and Hydraulics Report Update (2020) and is available on the OPW website.

7.3 EXISTING ENVIRONMENT

7.3.1 Physical Environment

7.3.1.1 Catchment Description

The Study Area is located in the Deel sub-catchment in the north-west of the Moy catchment (Figure 7.1). The River Moy drains a catchment of approximately 1,966 km^2 before entering the sea at Killala Bay. The Study Area is situated where the River Deel (Deel (Crossmolina) _040 river waterbody - IE_WE_34D010120) flows south-westwards to Crossmolina Town. In Crossmolina Town the Deel veers to the north and then loops southwards to where it enters to Lough Conn (IE_WE_34_406b lake waterbody) in the townland of Wherrew. The Deel sub-catchment is predominantly rural, with the exception of urbanisation in Crossmolina Town and environs, and has an area of approximately 155 km^2. The channel bed comprises limestone and shale and the general slope of the river is 5.54 m/km. Associated groundwater bodies are Crossmolina Gravels (IE_WE_G_0107) and Ballina (IE_WE_G_0035). The Study Area lies within the Conn Water Management Unit (WMU) as set out in the Conn WMU Action Plan.

The Study Area lies in an area to the south of Crossmolina, Co. Mayo (Figure 7.1). Geology and subsoils are discussed in detail in Chapter 6, and in summary the Study Area consists of Glaciofluvial sands and gravels, and is characterised by hummocky terrain with numerous hollows which occasionally contain water. The bedrock geology is limestone.

7.3.1.2 Hydrological cycle

The River Deel, originating in the Nephin mountain range, is susceptible to intense rainfall and as a result is prone to flooding. There are three Met Éireann Rainfall stations in close proximity to the Study Area and in the Deel sub-catchment (Eskeragh, Keenagh Beg and Derryhillagh) (Figure 7.1). Long-term annual rainfall averages (1945 - 2019) for these stations were 1420 mm, 1910 mm and 1613 mm respectively (Figure 7.2).

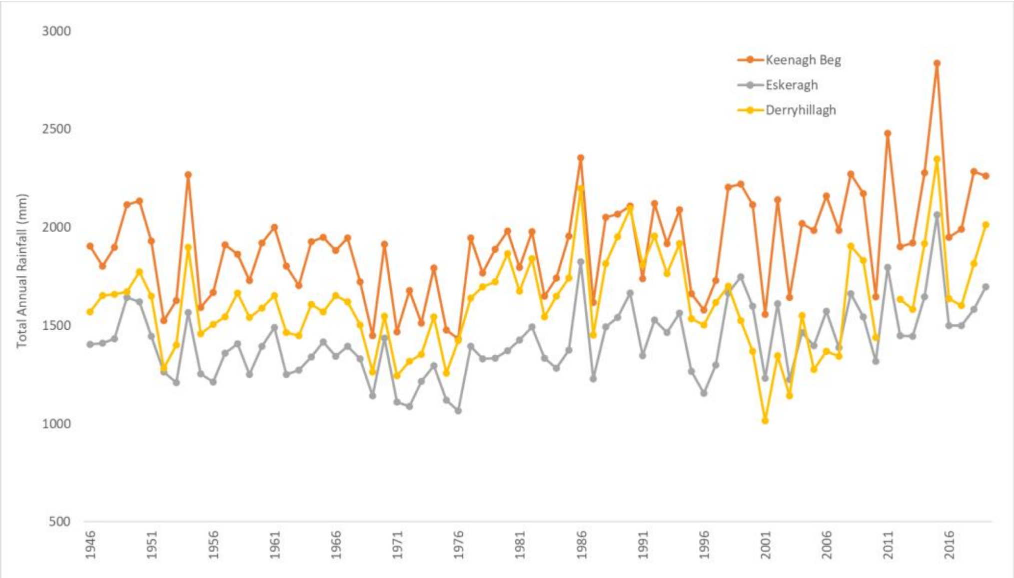

Figure 7.2 Eskeragh, Keenagh Beg and Derryhillagh rainfall (mm)

The closest synoptic station where air temperature and average potential evapotranspiration (PE) are recorded is at Newport, Co. Mayo (Figure 7.1) located approximately 15 km south-west of the Deel sub-catchment. The long term average annual PE for this station is 524 mm/year. The effective annual average rainfall (ER) represents the water available for runoff or groundwater recharge and is the rainfall less the actual evapotranspiration. The ER for the Study Area is ~950 as reported by GSI (www.gsi.ie).

The OPW have a water level gauge at Ballycarroon (Station 34007), 2.5 km upstream of Crossmolina Town (Figure 7.3) on the River Deel. Water level measurements have been recorded for the past 60 years at this location (Figure 7.3).

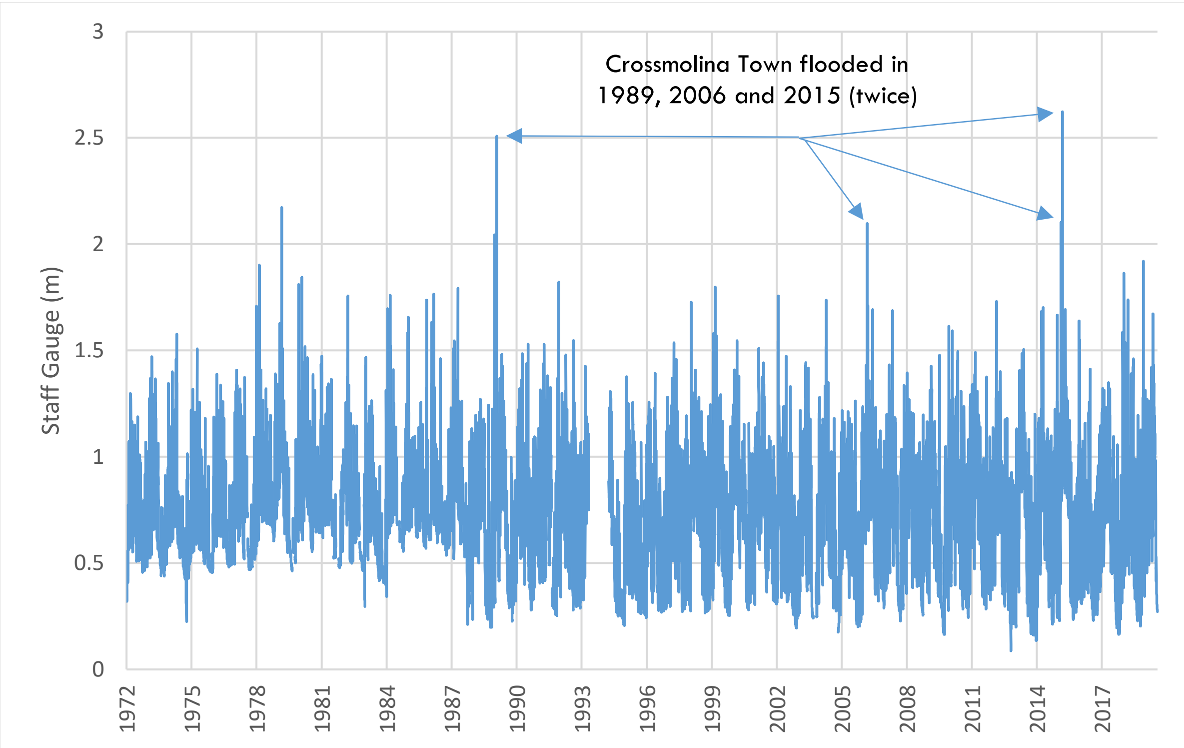

Figure 7.3 Daily average Ballycarroon water level (m)

The OPW also maintain a groundwater level gauge at the stream flowing from the Mullenmore Springs (Station 34117). Water level measurements have been recorded for the past 2 years at this location.

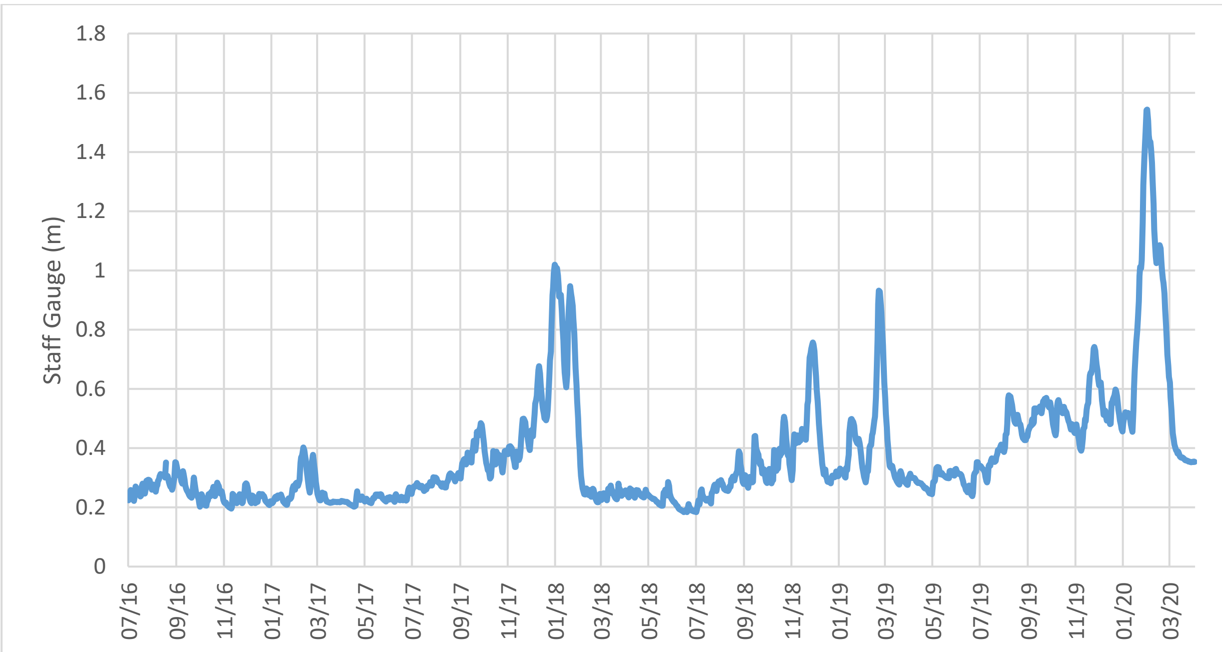

Figure 7.4 Mullenmore Stream water level

Furthermore, the OPW maintain a water level gauge in Lough Conn at Gortnaraby (34082) (Figure 7.5).

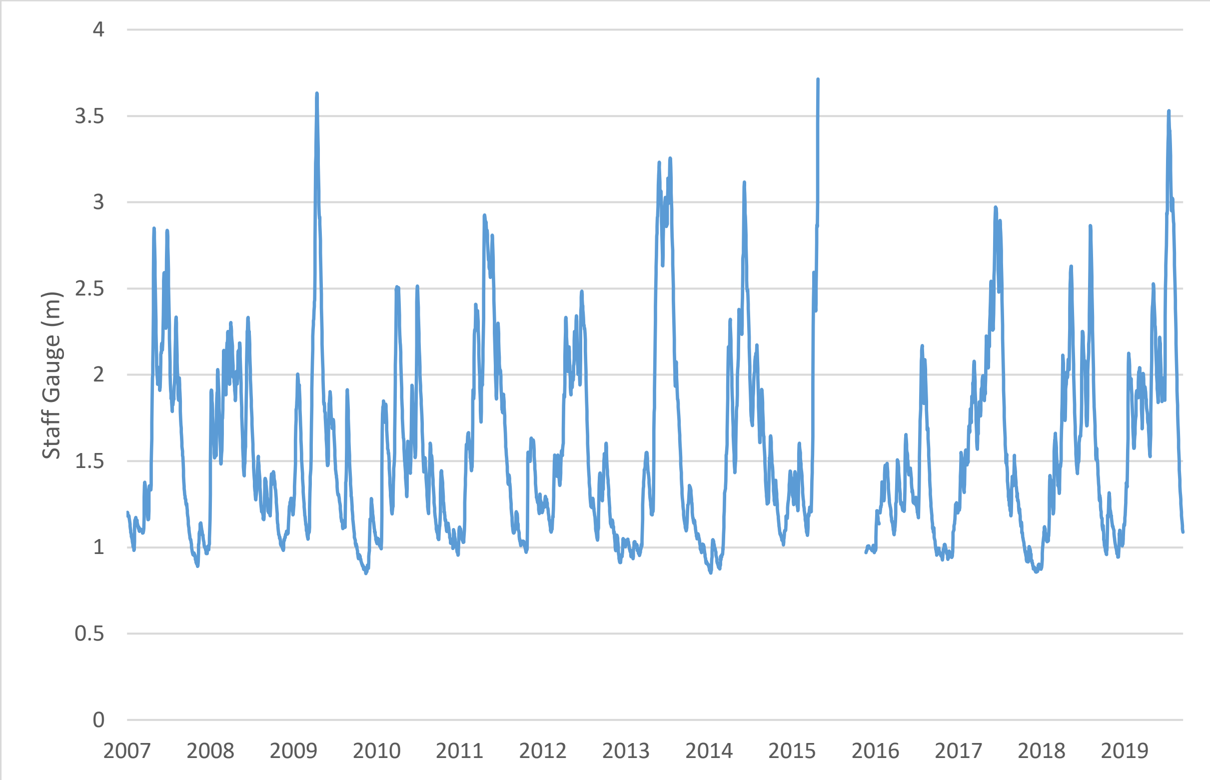

Figure 7.5 Lough Conn (Gortnoraby) water level

7.3.1.3 Drainage and flooding

Flood plains along the River Deel are generally not wide and end in steep sided slopes and low-lying hills. This features of the River Deel, combined with the lack of any attenuation upstream of Lough Conn has created a flashy river, prone to rapid increases in flow, and consequential flood risk. A number of tributaries feed into the River Deel. The River Deel flows across the sand and gravel deposits flowing west-east, initially the river bed is within the gravels but over a 4.5 km reach it is incised a few metres into the limestone bedrock. Drainage density is low on the gravels suggesting a high recharge to groundwater and it is possible that the River Deel would act as the discharge zone for this groundwater and possibly also recharge the gravels on occasions.

Where the Deel flows over bedrock, water sinks into the limestone at multiple points/ zones. At low flows all the flow is engulfed and the river bed is dry at Crossmolina. It is assumed that most/ all of the water drains to the springs at Mullenmore which has have a combined discharge typically varying from 0.7 – 1.1 cumec and which overflow to Lough Conn (refer to Appendix 7A).

The aquifers underlying the Study Area are classified as 'Lg' Locally Important Sand/Gravel Aquifer (Recharge coefficient: 85%; and recharge: 804 mm/yr) and 'Rk' Regionally Important Aquifer – Karsified (Recharge coefficient: 60%; and recharge: 572 mm/yr). Groundwater vulnerability, a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities, is 'High' (sand and gravels) and 'Moderate' (limestone till).

7.3.1.4 Erosion, transportation and deposition of material

The relatively steep gradients highlight the energetic nature of the River Deel. This has been confirmed by way of velocities predicted by the hydraulic model and observations of large gravels in the river bed made during site visits. River velocities vary along the length of a river and at any given cross section, velocities will vary with depth and position along any given cross section. Velocities vary with river flows and may increase locally due to turbulence associated with localised geometric factors and temporal changes. High velocities promote erosion while low velocities often result in deposition. One example is the horseshoe bend approximately 800 m downstream of Jack Garrett Bridge. River geometry therefore also affects the grading of material lining the river bed and bank. The fact that the River Deel dries out along a stretch from Ballycarroon ford to a point downstream of Crossmolina during low flows, as a result of karst activity, further influences the erosion, transportation and deposition characteristics of this river.

Sediment delivery regimes in rivers are highly sensitive to and controlled by hydrological patterns. Measurements taken from upstream (ST_4) and downstream (ST_5) of the Crossmolina WWTP (AER, 2015; 2016; 2017) show that suspended sediment (mg/l) in the River Deel ranges from 1 to 17 mg/l at ST_4 and 1 to 12 mg/l at ST_5 (Figure 7.6).

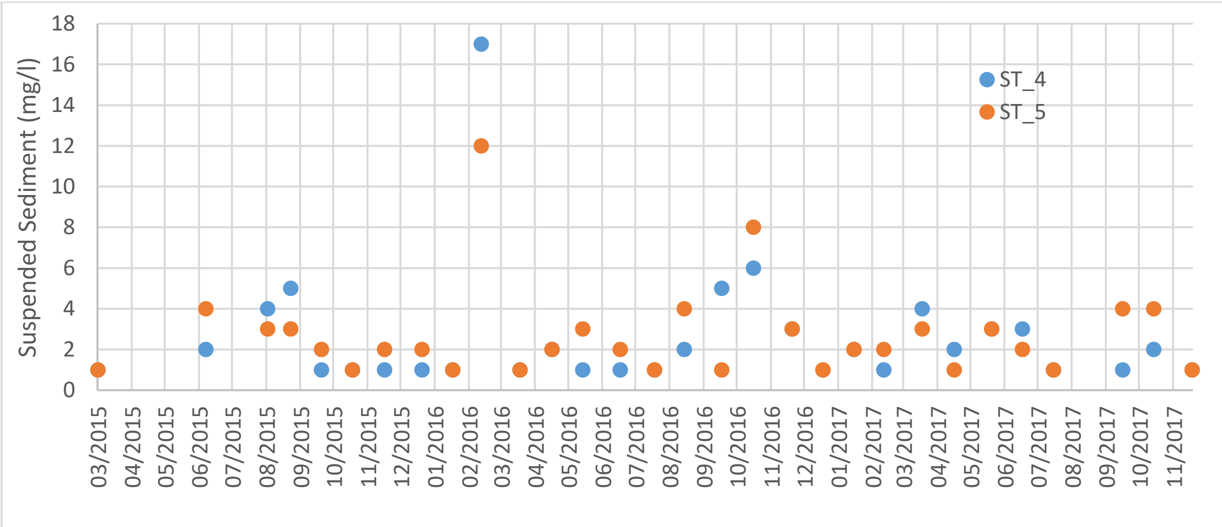

Figure 7.6 Suspended Sediment Concentrations upstream and downstream of Crossmolina WWTP

Turbidity (NTU) is widely used as an indicator of suspended sediment, however the relationship between these two variables can differ between catchments. Determining baseline levels of turbidity is challenging owing to numerous influencing factors: including 1) differing physical processes (geological and hydrological conditions); 2) historical land management regimes in the catchment; and 3) issues with instrumentation and repeatability of turbidity measurements.

The upper reaches of the Deel catchment have had historic peat extraction and forestry activities which are associated with suspended sediment runoff. Peat extraction in the Shanvolahan sub-catchment ceased in 2003 and a bog rehabilitation plan has been implemented to reduce suspended sediment loss.

7.3.2 Ecological Environment (See also Chapter 5)

7.3.2.1 Biological status

Receiving waterbodies associated with the Study Area, which could potentially be impacted upon were identified:

- the Deel (Crossmolina)_040, which receives water from the Deel (Crossmolina)_030 and Shanvolahan_010 river waterbodies; and
- the Moy_100 (Mullenmore Stream) which will receive water from the diversion channel.

Downstream waterbodies include the Deel (Crossmolina)_050 and the Deel (Crossmolina)_060 and Lough Conn. Groundwater bodies potentially impacted include Crossmolina Gravels and Ballina. Directly receiving waterbodies are all categorised as having ‘good’ status and ‘not at risk’ (Table 7.2).

Station ID	Waterbody ID	Waterbody Type	Station Type	Q-Values	Waterbody Risk	WFD Status	Year Sampled	Distance to Threshold
RS34D010050	DEEL (CROSSMOLINA)_040	River	PreWFD	5	Not at risk	High	1984	Far
RS34D010100	DEEL (CROSSMOLINA)_040	River	Operational	4-5	Not at risk	High	2016	Far
RS34D010120	DEEL (CROSSMOLINA)_040	River	Operational	4	Not at risk	Good	2016	Far
RS34D010150	DEEL (CROSSMOLINA)_050	River	PreWFD	4	Not at risk	Good	1993	Far
RS34D010200	DEEL (CROSSMOLINA)_050	River	PreWFD	4-5	Not at risk	High	2005	Far
RS34D010250	DEEL (CROSSMOLINA)_050	River	PreWFD	4	Not at risk	Good	2005	Far
RS34D010300	DEEL (CROSSMOLINA)_050	River	Surv. & Op.	4-5	Not at risk	High	2016	Far
RS34D010300	DEEL (CROSSMOLINA)_050	River	Surv. & Op.	4-5	Not as risk	High	2019	Far
RS34D010400	DEEL (CROSSMOLINA)_060	River	PreWFD	4-5	At risk	Moderate	2016	Far
RS34D010400	DEEL (CROSSMOLINA)_060	River	Operational	4-5	At risk	Moderate	2019	Far
/	Moy_100	River	/	/	Not at risk	Good	/	Far
LS340011004300010	IE_WE_34_406b Lough Conn	Lake	Operational	/	Not at risk	Good	/	Far
/	IE_WE_G_0107 Crossmolina Gravels	Groundwater	/	/	Not at risk	Good	/	/
/	IE_WE_G_0035 Ballina	Groundwater	/	/	Not at risk	Good	/	/

Table 7.2 Waterbody classifications and trends

7.3.2.2 Supporting Chemistry Trends

The overall trend from 2007 – 2015 is downwards for all parameters measured (Ortho-p, total ammonia (ammonia) and total oxidised nitrogen (TON). However, from 2014 – 2015 TON and ammonia increased in both the Deel (Crossmolina)_040 (Figure 7.7) and the Moy_100 (Figure 7.8) river waterbodies.

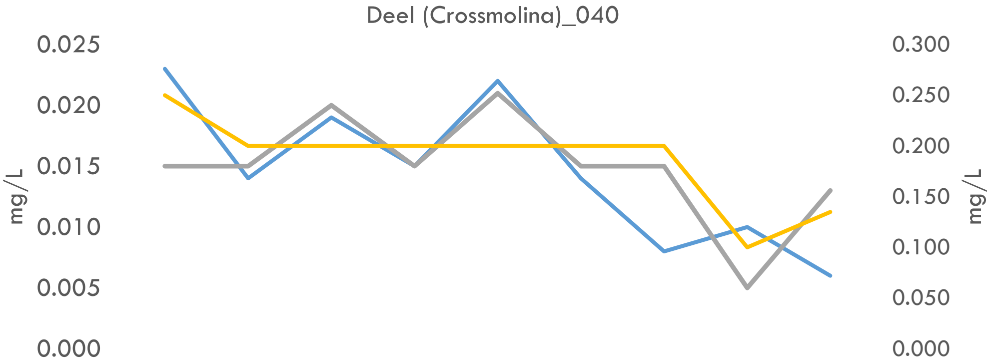

Figure 7.7 Ortho-p, total ammonia and total oxidised nitrogen trends (2007-2015) for the Deel (Crossmolina)_040 river waterbody

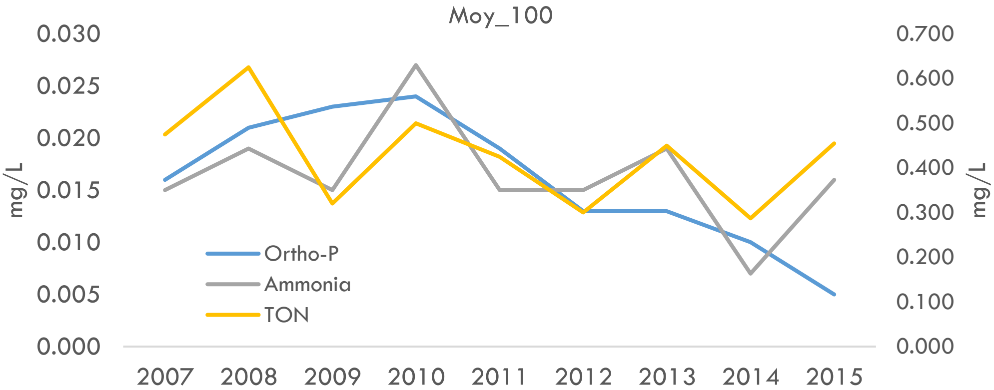

Figure 7.8 Ortho-p, total ammonia and total oxidised nitrogen trends (2007-2015) for the Moy_100 river waterbody

7.3.3 Chemical Environment

The EPA have been monitoring water quality and chemistry in the Deel River for a number of years. EPA monitoring stations incorporated in this report are: Lough Conn (ST_6); Deel Bridge (ST_1) in the upper reaches of the Deel catchment; Ballycarroon Ford (ST_2) immediately upstream of the proposed drainage channel; Crossmolina Bridge (ST_3) downstream of the proposed Scheme in Crossmolina town; and Knockadangan Bridge (ST_5) downstream of the Crossmolina WWTP.

	ST_6 L. Conn (2010-2017)		ST_2 Ballycarroon Ford (2015-2017)		ST_1 Deel Bridge (2015-2017)		ST_3 Crossmolina Bridge (2015)	
Parameter	Average	N	Average	N	Average	N	Average	N
Alkalinity-total (mg/l CaCO3)	98.1 ± 10.6	39	53.1 ± 25.9	14	21.2 ± 12.3	14		
Ammonia-Total (mg/l N)	0.018 ± 0.0	39	0.013 ± 0.0	14	0.019 ± 0.0	14	0.027 ± 0.0	7
BOD - 5 days (Total) (mg/l)			0.7 ± 0.3	14	0.9 ± 0.5	14	0.5 ± 0.0	7
Chloride (mg/l)			23.0 ± 8.0	14	19.6 ± 6.7	14		
Chlorophyll (µg/l)	2.1 ± 1.1	39						
COD-Cr (mg/l)							17.1 ± 8.1	7
Conductivity @25°C (µS/cm)	278 ± 19.1	39	194 ± 45.9	14	119 ± 30.3	14		
Dissolved Organic Carbon (mg/l)	7.4 ± 0.0	1						
Dissolved Oxygen (% Saturation)	97.4 ± 3.0	39	98.3 ± 10.4	14	89.6 ± 3.4	14	94.1 ± 2.0	7
Dissolved Oxygen (mg/l)	10.0 ± 0.9	39	11.4 ± 0.8	10	9.22 ± 3.4	10	9.6 ± 1.0	7
Nitrate (mg/l N)	0.190 ± 0.5	51	0.12 ± 0.3	19	0.061 ± 0.1	19		
Ortho-P (mg/l)	0.006 ± 0.0	27	0.005 ± 0.0	14	0.008 ± 0.0	14	0.009 ± 0.0	7
pH (pH units)	8.2 ± 0.1	39	7.7 ± 0.4	14	7.0 ± 0.4	14	7.7 ± 0.2	7
Silica (mg/l)	1.54 ± 0.6	22						
Suspended Solids (mg/l)							2.14 ± 1.7	7
Temperature (°C)	13.7 ± 3.9	39	9.78 ± 4.4	13	10.6 ± 4.7	13	14.2 ± 2.9	7
Total Hardness (mg/l CaCO3)			70.2 ± 27.5	14	30.2 ± 11.4	14		
Total Nitrogen (mg/l)							1.11 ± 0.2	7
Total Oxidised Nitrogen (mg/l N)	0.17 ± 0.1	39	0.21 ± 0.4	14	0.11 ± 0	14	0.542 ± 0.2	7
Total Phosphorus (mg/l)	0.01 ± 0.0	39					0.042 ± 0.0	7
True Colour (mg/l Pt Co)	53.4 ± 13.7	12	116 ± 52.8	14	115 ± 59.3	14		

Table 7.3 EPA water chemistry monitoring data (ST_2, ST_3, ST_5 and ST_6 see Figure 7.4)

7.3.4 Water Resources and Beneficial Uses

7.3.4.1 Water supply

There is no record of surface water abstractions from the River Deel for human consumption. There is a public water supply scheme in operation in Crossmolina Town (c1,500 population), along with a number of Group Water Schemes (GWSs) in operation in and in the vicinity of the Study Area (Figure 7.9). This is supported by well card data by the GSI that indicates that a number of wells approximately 3-4 km southwest of Crossmolina are used for Group Schemes (Tobermore GWS, the Carrowkeel GWS) and the Crossmolina Public Water Supply Scheme, agricultural and domestic supply. The wells are located in a productive sand/ gravel aquifer. The abstractions for GWSs are located in Ballinabaun and Moylaw. The abstractions for agriculture and domestic use are located in Creevy and Kinard. The yield for the well at Kinard is described as 'excellent' on the GSI database. Crossmolina Gravel's are protected for the abstraction of drinking water (Article 7, Water Framework Directive (2000/60/EC)). The public supply to Crossmolina Town is fed by a combination of the Ballina Regional Water Supply Scheme (RWSS) and a local groundwater source (Tobermore). The Ballina RWSS is supplied from Lough Conn from an intake works at Wherrew, located downstream of Crossmolina on the north eastern shore of the lake. This abstraction supplies Ballina Regional Water Supply Scheme which in turn supplies a number of public GWSs including Ballyholan, Ballysakerry, Cloonsilaun, Quignamanger, Rathcash, Ross, Slievenagark, Tullegan, and Sraheen GWSs.

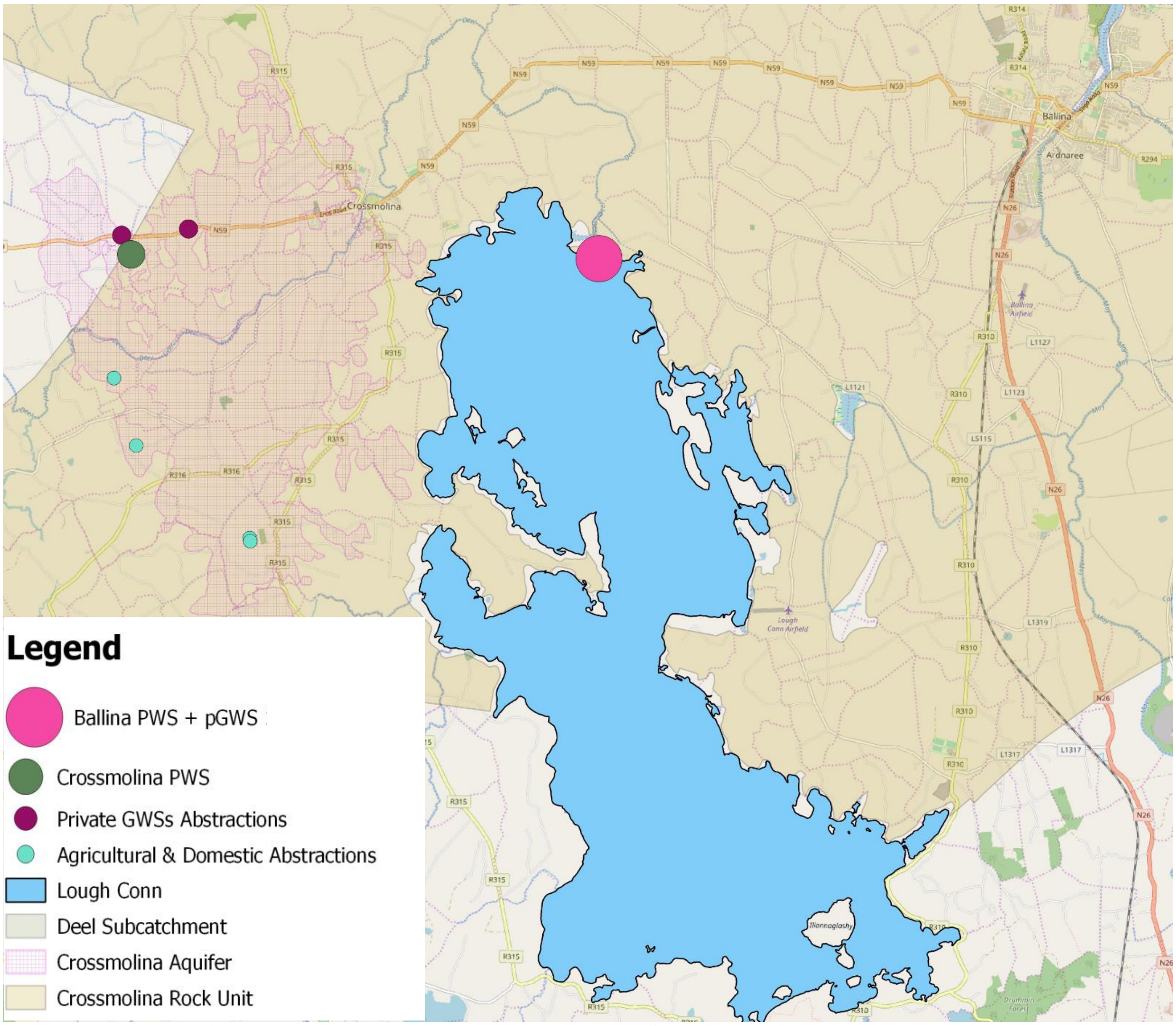

Figure 7.9 Map of groundwater and surface water abstractions for public and private water supplies, domestic and agricultural use.

7.3.4.2 Recreation and landscape value

The Deel and its catchment provide opportunities for a range of recreational activities. The lower section of the River Deel is popular with kayakers.

The River Deel provides valuable salmon and trout spawning and nursery habitat for the Lough Conn and River Moy fisheries, and provides the main spring salmon spawning and nursery habitat for these fisheries. As the largest of the Moy tributaries it offers a wide range of angling experiences from dry fly fishing for trout together with spring salmon fishing in the lower reaches, to lively brown trout and grilse fishing in the remote upper reaches. Spring salmon were mostly caught downstream of Deel Castle on spinner and worm, and grilse fishing begins in late May/ Early June, peaking the first week in July.

7.3.4.3 Sub-catchment pressures

Upstream catchment pressures with regard to nutrient and suspended sediment include forestry and specifically clearfelling, channelization and peat extraction. Peat extraction operations ceased in 2003 and

Bord na Mona implemented a bog rehabilitation plan which has been reported to have reduced peat sediment loss significantly since its establishment.

Downstream catchment pressures include agricultural activity and wastewater discharge (Crossmolina WWTP).

7.4 POTENTIAL IMPACTS AND MITIGATION

An analysis of the predicted impacts of the proposed Drainage Scheme on the hydrology/ hydrogeology and water quality, during and after the construction phase, has been completed in line the guidance documents listed in Section 7.2.

In line with Step 3 of the IGI Guidelines (IGI, 2013), the baseline information indicates the hydrogeological environment is determined to have *Type E - Groundwater dependent eco systems*.

This is based on the fact that the area is underlain by two groundwater systems, one of which is a superficial aquifer in the poorly/moderately sorted sand and gravel deposits that overlie bedrock to a depth of <25m and extend over the greater part of the lower Deel catchment; and the second, a selectively karstified bedrock aquifer in the Carboniferous limestone which is recharged via swallow holes in the River Deel channel and the sinking stream draining Lough Agawna, the only known outlets of which are the springs at Mullenmore.

The site also represents elements of Type A (underlain by Locally Important Sand/Gravel Aquifer); Type B (Regionally Important Aquifer – Karsified); Type C (nearby groundwater abstractions); and Type D (Sensitive geological / hydrogeological environment which intercepts a groundwater source protection zone for the Crossmolina PWS.

The potential impacts of the proposed construction activities on the hydrology, hydrogeology and water quality relate to:

- Earthworks;
- Storage/ transmission of leachable and/ or hazardous materials;
- Lowering of groundwater levels by pumping or drainage;
- Discharges to surface water and groundwater;
- Excavation of materials above and below the water table; and
- Land spreading.

Potential impacts of the proposed operation of the river flow control structure and intake weir are:

- Flooding of washlands;
- Impact of reduced and increased water volumes on natural instream conditions (i.e. velocities, bed load and ecological status) on the lower River Deel waterbodies and Mullenmore South stream respectively;
- Discharge of flood water to the receiving surface water and groundwater via the drainage channel.

7.4.1 Rating Site Attribute Importance

The Deel (Crossmolina) Site Importance of the Hydrological Attribute was determined using NRA (now TII) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (2008), and in particular the use of five important criteria from the guidelines –

Extremely High, Very High, High, Medium and Low depending on attribute quality (Table 7.4). The four attributes in the Study Area that are potentially affected by the Proposed Scheme are the underlying aquifer, the Deel River, Mullenmore Springs and Lough Conn.

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale.	River, wetland or surface water body ecosystem protected by E.U Legislation e.g. Salmonids River or SAC/SPA
Very High	Attribute has a high quality or value on a regional or national scale.	River, Wetland or Surface Water body ecosystem protected by national legislation e.g. pNHA Regionally Important Aquifer with multiple wells, Potable Water Supply >2500 homes
High	Attribute has a high quality or value on a local scale	Salmon Fishery, Regionally Important Aquifer, Potable Water Supplying >1000 homes.
Medium	Attribute has a medium quality or value on a local scale	Coarse Fishery, Locally Important Aquifer Local potable water supply to >50 homes.
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer Local potable supply <50 homes.

Table 7.4 Criteria for rating Site Importance for Hydrological Attributes at EIS stage.

Based on the high level of protection on the surface waterbodies (River Moy SAC and Lough Conn Lough Cullin SPA, Salmonid River); the bedrock aquifer classification of Regionally Important; and the population depending on the water body for potable water supplies, this Study Area is given a rating of Extremely High. While the Mullenmore Springs are not located within the River Moy SAC and Lough Conn Lough Cullin SPA, they are hydrologically connected to the SAC and SPA.

7.4.2 Do Noting 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 the mobilisation and transport of suspended sediment and nutrients downstream could have catastrophic effects on the lower River Deel waterbodies (Bunn and Arthington, 2002)
- potential 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

If the “do nothing” option were chosen, the opportunity to protect Crossmolina Town 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.

7.4.3 Potential Impacts of Proposed Scheme

The construction and operation of the proposed Deel (Crossmolina) Drainage Scheme will result in a number of potential impacts. This section considers and assesses these impacts of the development with regard to the hydrological, hydrogeological, water quantity and water quality aspects.

Construction Phase:

7.4.3.1 Generation of Silt-Laden Run-off & Increase in Suspended Solids

Potential Short Term Significant Negative Impact

The preparation phase, site investigation, site clearance, instream works, wash lands preparatory groundworks, road and bridge construction, and site compound set-up, will lead to exposure of bare ground and the potential for the generation of silt-laden run-off in works areas along the river bank. The potential for the generation of silt-laden surface run-off on the adjacent banks and along access and egress routes is likely to continue through the construction phase of the works and until the ground has consolidated. Stockpiled excavated material also poses an increased threat of increased siltation in the watercourse.

The Works Area lies within and in close proximity to surface waterbodies, the River Deel (ID), Mullenmore South Springs and Lough Conn. The works area lies above highly vulnerable groundwater bodies Crossmolina Gravels (Locally important aquifer) and Ballina (Regionally important aquifer). Findings from the karst hydrogeological assessment (refer to Appendix 7A) indicate sinks are upstream of the works area (Figure 7.4) and as such only localised groundwater will be potentially impacted upon. The River Deel has been characterised as having a spate nature which could potentially leave little time for securing stockpiled excavated material should the river flood during the construction phase.

Increases in suspended sediment concentrations can be detrimental for freshwater pearl mussel and aquatic fauna, i.e. clog and cause abrasions to fish gills, interfere with fish navigation, induce stress which can affect feeding, affect egg and fry development and affect the food web for which the fish diet is based. Where deposited, excessive amounts of silt may damage aquatic faunal habitat by clogging interstices between gravels rendering unsuitable for egg incubation. Deposited silt can also impact on the habitat of bottom dwelling aquatic invertebrates and fry . The potential impacts on freshwater pearl mussel and aquatic fauna are assessed in Chapter 5.

7.4.3.2 Use of Potential Water Contaminants

Potential Short term, Significant, Negative Impact

Many substances used and produced on construction sites have the potential to pollute both groundwater and surface water if not properly managed and treated (i.e. lubricants, cement, mortar, silt, soil, waste from site compound facilities, and other substances which arise during construction). The washing of construction vehicles and equipment also poses a pollution risk to watercourses. The spillage or leaking of fuel or oil from fuel tanks or construction vehicles has the potential to contaminate soils, groundwater and surface water.

The works area lies within and in close proximity to surface waterbodies, the River Deel (ID), Mullenmore South Springs and Lough Conn. The works area lies above highly vulnerable groundwater bodies Crossmolina Gravels (Locally important aquifer) and Ballina (Regionally important aquifer). Findings from the karst hydrogeological assessment (refer to Appendix 7A) indicate sinks are upstream of the works area (Figure 7.4) and as such only localised groundwater will be potentially impacted upon.

Such substances entering the receiving surface water and groundwater bodies could damage the habitat of local populations of fish and aquatic invertebrates and also cause direct harm to aquatic fauna.

Mitigation Measures - Generation of Silt-Laden Run-off & Increase in Suspended Solids & Use of Potential Water Contaminants

The following mitigation measures will be put in place to protect the ground and surface waters in the Study Area and will ensure no leaching of sediment or pollutants to enter localised groundwater or surface water.

The extent of development work will be managed by completing the works in a number of distinct stages which will enable an orderly and structured site development. An outline of the construction sequencing is provided in Section 3.4, Chapter 3 and the construction sequence drawings (Appendix 3B).

Measures to minimise the suspension and transfer of sediment and pollutants to ground and surface waters will be implemented. These measures are as follows:

- Where dewatering is required, waters will be pumped to lands that are over 30 metres from any watercourse and discharged via a silt bag to a discharge point. The discharge point will consist of a circle of triple silt fences surrounding a circle of straw bales wrapped in Terram. All waters pumped from the excavation will filter though the silt bag, straw bales and silt fences before diffusely discharging to the ground. The discharge points will be constructed prior to commencement of construction works and will be monitored on a daily basis when in use to ensure that the release of any polluting material is mitigated.
- Any stockpiling will be further than 10 metres from the river bank, and runoff will be prevented by the use of a silt fence.
- Prior to construction of the river flow control structure, the instream works areas will be constructed by creating a horseshoe cofferdam. Construction works will be carried out when the river runs dry if possible or at low flow conditions (outside of the sensitive period for spawning fish in the River Deel).
- A triple silt fence will be constructed at all interfaces of the works area with the River Deel in advance of construction works on the banks of the river at the river flow control structure. Works undertaken on the river banks will be carried out at times of good weather and low flow in the river where there is no potential for significant volumes of surface water runoff from the works area or inundation with flood waters.
- The entire boundary of the works area within the River Deel will be fenced off with a triple silt fence as shown on Construction Sequence Drawing: Stage 5 (Appendix 3B) for the construction of the intake structure. A solid wall of sand or soil bags will be constructed inside the silt fences to create a solid barrier between the works area and the river. All bankside works will be undertaken at times of good weather and low flow in the River where there is no potential for the works area to become inundated with water.
- All works undertaken on the banks will be fully consolidated to prevent scour and run off of silt. Consolidation may include use of protective and biodegradable matting (coirmesh) on the banks and also the sowing of grass seed on bare soil.
- Measures specified in the Outline Construction Environmental Management Plan (CEMP) (Appendix 3C) will be adhered to in order to ensure all works are carried out in a manner designed to avoid and minimise any adverse impacts on the receiving environment.
- All concrete works will be carried out in dry conditions, with no in-stream pouring of concrete, and in accordance with the best practice measures provided Chapter 3, Section 3.3.
- A silt fence will be erected on all sides of the temporary site compounds to prevent any run off from the perimeter of the compounds.

- There will be no refuelling of machinery within the river channel. Refuelling will take place at designated locations in the site compound at distances of greater than 30 metres from the watercourse.
- No vehicles will be left unattended when refuelling and a spill kit including an oil containment boom and absorbent pads will be on site at all times.
- Wash out of concrete truck chutes will be carried out at a designated wash out tank located in the site compound, if required.
- Any fuel that is stored on the site will be in a double skinned, bunded container that will be located within a designated site compound at a location that is removed from the river. The locations of the site compounds are shown on the construction sequence drawings (Appendix 3B). All construction materials and plant will be stored in the site compounds. The compounds will also house the site offices and portaloo toilets. The compounds will be located on ground that is not prone to flooding or will be surrounded by a protective earth bund to prevent inundation. The site compounds will be surfaced with a hard standing to prevent generation of mud. A silt fence will be erected on all sides of the compounds to prevent any run off from the perimeter of the compounds. The locations of the site compounds will be adequately buffered to prevent any surface water runoff.
- All vehicles will be regularly maintained and checked for fuel and oil leaks.
- See also Chapter 5 of this EIAR for mitigation measures for aquatic ecology.
- With regard to the diversion channel,166,000 m^3 of excavated material is anticipated. This material will be reused where possible on site or contained and transported off site as it is generated to reduce any risk of mobilisation to receiving watercourses. Excavated topsoil will be stored separately for reuse in reinstatement works on site and the storage area will be fenced off with silt fencing to prevent any run off.
- Works in the vicinity of the Mullenmore Stream will take place during a dry period to prevent any erosion of bare soil to Mullenmore South stream and subsequently Lough Conn.
- There will be no storage of materials, machinery or soil in areas that are susceptible to flooding.

Monitoring

- Runoff from works, stockpile and compound areas will be monitored and observed daily to ensure that it is not impacting on any local watercourses. Both hydrocarbons and silt cause discolouration so are easy to visually monitor for their presence.
- Alarmed Sondes will be employed to measure turbidity in the River Deel upstream and downstream of the works area during construction of the river flow control structure and intake structure. If an increase in turbidity of 20 % or greater is identified downstream of the works, all works will cease immediately until the source of the increased turbidity is identified and rectified (if caused by the construction works). If the increase in turbidity is clearly not attributed to the construction works, the works will proceed.
- If necessary, water sampling and monitoring of the local water courses will also be completed to test for Total Suspended Solids (TSS) and hydrocarbon concentrations. The necessity will be determined by the Ecological Clerk of Work.

Residual Impact

Short Term Imperceptible Negative Impact

With the abovementioned mitigation measures and monitoring in place, the residual impact on water quality resulting from the generation of silt-laden run-off, increase of suspended solids and use of potential water pollutants during the construction phase of the scheme is anticipated to be short term imperceptible negative impact. No significant effects or deterioration in water quality are anticipated.

Operational Phase

7.4.3.3 Impact on Flooding

Permanent Significant Positive Impact

The proposed River Deel (Crossmolina) Drainage Scheme includes the construction of an intake weir, river flow control structure and diversion drainage channel which will divert floods in excess of bank full flow away from Crossmolina Town to Lough Conn, thereby reducing the risk of water levels overtopping the bank and flooding streets and properties in the town. It will have a permanent significant positive impact.

The number and type of properties effected by the 1% AEP flood in Crossmolina are presented in Table 7.5.

	Total Count	Commercial	Residential	Both
Q100	116	31	73	12

Table 7.5 Properties flooded in 1% AEP

In flood events, there is a risk to water quality where pollution may arise from damage to waste or sewerage infrastructure, sewer surcharging or other sources such as chemicals or other potential pollutants within basements or buildings which become inundated during flood conditions. The proposed Scheme will have a permanent significant positive impact by protecting Crossmolina Town against the 1% AEP flood event. The proposed Scheme will improve human health and safety and protect water quality in flood conditions by significantly reducing flooding and possible contamination by polluted flood waters.

7.4.3.4 Impact of the operation of the diversion channel and washlands on the environment

Potential Occasional Moderate Negative Impact

The diversion of floods in excess of bank full flow to the drainage channel and associated wash lands could result in the mobilisation of suspended sediment and nutrient from the land to the receiving Moy_100 river waterbody and Lough Conn and culminate in reduced water quality and aquatic habitat. A large portion of the washlands have been subject to flooding from Lough Conn in the past. Refer to washlands drawings in Appendix 3A.

Mitigation Measures

The diversion channel will be grass lined and is designed in accordance with fully researched and data substantiated methodology (CIRIA, 2003) for grass lined waterways to maximise the erosion resistance of the wash land. Areas of predicted high velocities will be reinforced with a geotextile layer and scour protection. In addition, the energy dissipation structure has been designed so as to reduce the velocities of flood waters entering the washlands from the diversion channel. Consideration will be given to root growth and distribution, root penetration, root survival during drought/ management requirements, climate and seed germination/ grass growth, soil conditions and choice of grass mixtures.

During the construction phase of the Scheme, the works will be sequenced so as to ensure that flow will not be diverted to the diversion channel and wash land area until the grass has been established in the diversion channel (Chapter 3, Section 3.4).

Cattle will not be permitted on the diversion channel to minimise disturbance. Sheep grazing has been shown to be effective for maintaining the grassed area with little/ no disturbance.

Residual Impact

Occasional Slight Negative Impact

With mitigation measures in place, the operation of the diversion channel and washlands will constitute an occasional slight negative impact in terms of water quality and aquatic habitat in the Moy_100 river waterbody and Lough Conn. No significant effects or deterioration in water quality status is anticipated.

7.4.3.5 Changes to natural instream conditions (i.e. velocities, bed load and ecological status) of the River Deel during events where flows exceed bank full flow

Potential Permanent Slight Negative Impact

The purpose of the scheme is to prevent flows in the River Deel from flooding Crossmolina town during potential flood events up to an including the 1% Annual Exceedance Probability, also known as the 100 year event.

The intake structure and flow control structure have been specifically designed to ensure that the hydrological regime in the river is not altered during all but extreme flood flow conditions. This has been achieved by the adoption of the following design measures:

- The river flow control structure has been sized so that when flows in the river exceed bank full flow, excess flow will be diverted over the intake weir, along the diversion channel, to Lough Conn, via the washlands.
- The intake weir will be set back from the permanent wetted channel of the river so as to minimise the effect on the river bank and thus minimise the potential for any negligible local changes to the flow regime that could be brought about by altering the river bank.
- The steel plates in the river flow control structure and along the intake weir will be set so as to minimise any hydrological changes in the River Deel, while mitigating flood risk in Crossmolina Town. The river flow control structure will incorporate adjustable steel plates so that the level can be raised or lowered to refine the balance of flows between the River Deel and the new channel during the operation of the scheme. Adjustments may be made following recalibration of the hydraulic model. The model will be periodically recalibrated following high flow events, and based on updated hydrometric data, which will include data from the new hydrometric gauges installed in connection with this scheme.

No appreciable changes to flow velocities in the River Deel are predicted for non flood flow conditions (where the weir is not operational). When the weir becomes operational, the maximum velocities predicted downstream will not increase as they would if the River Deel were allowed to flood (in the absence of the scheme) but will remain at the high levels associated with bank full flow. Any changes to flow velocity will be limited to occasions when the weir is operational. Given that the weir will not become operational until full bank flow is exceeded, and given also the low frequency of occurrence of flood events, it is likely that the changes in velocity will not be significant.

An assessment of bed sediment characterisation, entrainment thresholds and transport rates was carried out to determine the likely significant effects of the Scheme on the hydro morphology of the River Deel. The report is provided in Appendix 7C. It was noted that differences in channel slope and flow geometries along the current channel are indicative of adjustment in response to existing human impact and intervention. The assessment of trends in critical shear stress and fractional transport rates indicate that following scheme construction, where bank full flow is exceeded, the river is likely to undergo a reduction in bedload transport rate and mobilisation of the coarser bedload fraction in the reach upstream of the river flow control structure. This may lead to aggradation upstream of the river flow control structure and a reduction in sediment delivery downstream of the river flow control structure. This reduction in sediment input is likely to see elevated movement of the existing bed material downstream of the flow control structure.

As detailed in Appendix 7C, morphological adjustments in all reaches can take time to propagate through the system (>10 years), with the reaches downstream of the river flow control structure possibly experiencing a minor sediment deficit during this period in the absence of any mitigation measures. The new 'equilibrium' condition will depend on channel adjustment and reorganization of the sediment delivery upstream of the river flow control structure and trajectories of change downstream of the structure. It is anticipated that these potential effects will be consistent with intra-reach variability in bed shear recorded by the 1D HEC-RAS model elsewhere within the existing channel. It is also worth noting that future channel adjustment will occur in the context of Climate Change that may also alter catchment-scale hydrological and sediment.

For the above reasons, it is not predicted that there will be a significant change in the hydro morphology of the River Deel as a consequence of this scheme.

Flow regime is considered the key driver of riverine physical habitat which in turn is a major determinant of biotic composition. The preferred option of diverting flood waters away from the lower River Deel waterbodies will result in these sections not receiving floods which could otherwise have catastrophic effects in terms of the mobilisation and transport of suspended sediment and nutrients downstream (Bunn and Arthington, 2002).

Mitigation Measures

Should aggradation occur upstream of the river flow control structure, removal gravels in this reach will be carried out when the river is dry using a tracked machine which will access the river bank from the vicinity of the intake structure. There will be no instream works. The top of the accumulated gravels will be removed leaving the low water channel unaffected. All gravels removed will be made available to IFI for use in fisheries enhancement elsewhere in the catchment and will be stored on site for this purpose. It is not anticipated that this maintenance will be required on a regular basis.

Monitoring

A monitoring programme will include for an annual hydro geomorphological review and comparative assessment made. Monitoring of morphological adjustment and bed sediment characteristics (Gravel tagging) in the reach upstream and downstream of the river flow control structure will be carried out to inform the frequency of gravel removal. The frequency of monitoring is dependent on the hydrodynamic conditions however it will be carried out annually at a minimum. Regular field observations will be carried out following high flow periods to assess whether any changes in bedload transport are reflected in channel adjustment. The monitoring programme will include collating photographs and the development of cross section profiles.

Data from hydrometric gauges installed in connection with the Scheme will be monitored and the hydraulic model will be periodically recalibrated following high flow events to inform if any adjustments are required to the adjustable steel plates on the river flow control structure and along the intake weir.

Residual Impact

Permanent Imperceptible Negative Impact

The implementation of the abovementioned mitigation measures and monitoring will mitigate against any impact to the hydromorphology of the River Deel resulting from the river flow control structure and the intake weir. In addition, the construction of the diversion channel will divert flood waters away from the lower reaches of the River Deel which would otherwise have significant effects in terms of mobilisation and transport of suspended sediment and nutrients downstream. The residual impact constitutes a permanent imperceptible negative impact to water quality due to changes in natural instream conditions. No significant effects or deterioration in water quality status of the River Deel is anticipated.

7.4.3.6 Increased water volumes on natural instream conditions (i.e. velocities, bed load and ecological status) on Mullenmore South Spring and associated Moy_100 river waterbody, during overflow events.

Potential Occasional Slight Negative Impact

Increased discharges and velocities, and the resultant disturbance and movement of the streambed substrates during high-flow events alter macroinvertebrate community composition and structure within streams, especially during the peaks of high-flow periods (Feeley et al., 2012). While the effects of inordinately large flood events have been shown to reduce benthic macroinvertebrate richness and density, the impact on ecological status was shown to be unchanged in a 1 in 25 year event on the east coast of Ireland (Feeley et al., 2012).

The section of the Moy_100 river waterbody will receive increased suspended sediment as a result of the proposed Scheme via the wash lands area during overflow events. Previous data has shown however, that during such events the level of Lough Conn rises and consumes this same river waterbody. A large portion of the washlands incorporating the Moy_100 river waterbody has been subject to flooding from Lough Conn in the past. Refer to washlands drawings in Appendix 3A. This will constitute a potential occasional slight negative impact.

Mitigation Measures

Mitigation has been incorporated into the Scheme Design by inclusion of an energy dissipation structure and associated scour protection. The energy dissipation structure will reduce velocities of water entering the washlands and therefore the potential for erosion. The scour protection will also reduce the potential for erosion where velocities are predicted to be highest in the Works Area.

Residual Impact

Occasional Imperceptible Negative Impact

With mitigation measures in place, the residual impact on instream conditions will be occasional imperceptible negative impact.

7.4.3.7 Lowering of water table within Type A Locally Important Sand and Gravel Aquifer

Potential Permanent Slight Negative Impact

The diversion channel will be excavated through predominantly fluvioglacial deposits between the River Deel and the Mullenmore Springs. These deposits are home to a Type A Locally Important Sand and Gravel Aquifer. The excavation of the diversion channel has the potential to lower the water table locally. Ground water monitoring carried out from 2017 to 2020 as part of an extensive hydrogeological investigation (Appendix 7A) indicates that there is a locally elevated water table to the north of the Lake Road at BH12 and that the water table will intersect and rise above the proposed channel invert at limited other locations at times during the Winter season (Figure 7A.13, Appendix 7A). Based on the available hydrometric data for the River Deel and the Mullenmore Stream, this aquifer is thought to already contribute <150 l/sec to the Mullenmore Springs outflow at low flows, with exact quantities to be confirmed.

Mitigation Measures

As part of the Scheme (hydrogeological assessment), observation boreholes have been installed adjacent to the channel route and also near the springs with sensors to continuously monitor groundwater conductivity and stage in order to determine the local hydrogeology of the subsoils and bedrock. Data collection will continue during and subsequent to channel construction, with installation of new standpipes as required to replace standpipes disturbed of removed in the course of constructing the scheme.

Excavation depths along the entire diversion channel have been minimised in so far as is practicable.

Residual Impact

The residual impact constitutes a permanent insignificant negative impact in terms of lowering the water table within Type A Locally Important Sand and Gravel Aquifer.

7.4.3.8 Alterations to ground and surface waters due to the interception of karst groundwater pathways

Permanent Imperceptible Negative Impact

Excavation works in a karst area such as the River Deel catchment, have the potential to intercept karst groundwater pathways and to drain the surrounding lands and surface waters. Any such alterations to the local watercourses or groundwater have the potential to result in significant impacts on the ecology of the area. Any changes in water level that may occur as a result of excavating through karst aquifer (such as an unexpected draining of the river as a new flowpath is excavated) has the potential to impact on a range of protected species such as White Clawed Crayfish, Atlantic Salmon and Lamprey Species, all of which are among the qualifying interests of the River Moy SAC as well as Freshwater Pearl Mussel which is a species listed on Annex II of the EU Habitats Directive but is not among the qualifying interests of the River Moy SAC.

In order to safeguard against this occurring an extensive hydrogeological assessment was carried out to investigate if the proposed Scheme would result in any changes to the river flow outside the high flood conditions. During flood conditions, the river will continue to flow at bank full flow, with flows in excess of bank full flow being diverted to the diversion channel.

The investigations concluded that the proposed route for the diversion channel is located to the north and east of the zone of concentrated groundwater flow between the Deel sinks and Mullenmore Springs. A diversion channel located north of Pollnacross is unlikely to encounter the main karst flow system but may interact with local ground water in the subsoil and upper bedrock. Excavation depths at the downstream end of the diversion channel have been minimised in so far as is practicable and a buffer will be maintained around the spring within which no deep excavations will take place. Notwithstanding this, care shall be taken where excavations take place close to the Mullenmore Springs.

Based on the extensive hydrogeological assessment, this constitutes a permanent imperceptible negative impact and significant effects on the protected species of the River Moy SAC are not anticipated.

7.5 Cumulative and In-combination Impacts Assessment

7.5.1 Cumulative Impact Assessment

All elements of the proposed Scheme were assessed in order to identify any cumulative effects.

Site activities during the construction phase have the potential to give rise to water pollution, and consequential impacts on flora and fauna that use that water within the same catchment. The proposed Scheme has been designed to minimise the potential for water pollution from the outset by limiting works on the bank of the River Deel to the minimum area necessary and by ensuring that the River Deel is unaffected by the proposed Scheme in all but high flood events. In addition, extensive mitigation is proposed to minimise the potential for water pollution arising from the works which also minimises the potential for this any cumulative or interacting effect.

The operation of the Scheme has the potential to give rise to changes to the hydrological regime of the River Deel and consequential impacts on flora and fauna that use that water within the same catchment. The proposed scheme has been specifically designed to ensure that the hydrological regime in the river is not altered during all but flood flow conditions so as to minimise the potential for any cumulative or interacting effect.

Archaeological investigations including test trenching have the potential to result in impacts on the habitats upon which the tests are being carried out and downstream watercourses. As such these procedures are either assessed as part of the project or are assessed in their own right with mitigation included where necessary to avoid any harmful impacts on biodiversity and or water quality.

7.5.2 In-Combination Impact Assessment

The proposed Scheme has been considered, in combination with plans and the projects set out in Chapter 2, Section 2.8 of the EIAR in order to assess any in-combination effects.

Bord Na Mona peat extraction ceased in the Shanvolahan sub-catchment in 2003 and a bog rehabilitation plan has been implemented to significantly reduce suspended sediment loss since its establishment. With mitigation measure in place, the proposed Scheme in combination with the bog rehabilitation will not result in significant in combination negative effects on water quality.

There is Coillte owned coniferous forestry in the upstream catchments of the Deel River. This area belongs to the Coillte Business Area Unit (BAU) 1NorthWest. Forests in the upstream catchments are:

- Tristia, 1,442 hectares
- Shannettra, 3,140 hectares

Coillte is required to operate within the 'Water Protection and Forest Operations Guidelines' to minimise impacts of forest operations on water quality and in line with the Forest Service's Code of Best Forest Practice which includes a series of Requirements, Guidelines and Notes, the following of which are relevant to water protection: Requirements on the Freshwater Pearl Mussel and Aerial Fertilisation, Guidelines on Water Quality and Harvesting and an Information Note on Appropriate Assessment Procedure. Sampling is conducted by Coillte to determine cumulative impacts of forest operations in neighbouring forests on water quality and sampling is conducted between 3-4 times per year, increasing to 6 times in areas of intense forest activity. With mitigation measure in place, the proposed Scheme in combination with the forest operations will not result in significant in combination effects on water quality.

For the reasons outlined in this Chapter and with mitigation measures in place, the proposed Scheme will not lead to any deterioration in water quality status and will not impair objectives for any European site. Following a detailed assessment of the receiving environment and potential impacts of the proposed Scheme in combination with the potential impacts of the plans and projects set out in Chapter 2, Section 2.8, no potential for significant in-combination cumulative effects on water are anticipated.