

Contents

	Page	
5	Description of Proposed Road Development	170
5.1	Introduction	170
5.2	Background	170
5.3	Proposed Road Development Description	171
5.4	Design Standards	173
5.5	Proposed Road Type and Cross-Section	174
5.6	Functionality of N6 GCRR	223
5.7	References	226

5 Description of Proposed Road Development

5.1 Introduction

The proposed N6 Galway City Ring Road (GCRR), hereafter referred to as the proposed road development, comprises the construction of approximately 5.6km of a single carriageway from the western side of Bearna as far as the Ballymoneen Road and approximately 11.9km of dual carriageway from Ballymoneen Road to the eastern tie in with the existing N6 at Coolagh, Briarhill, and associated link roads, side roads, junctions, structures and localised works to the existing electricity transmission and distribution networks (specifically comprising of the diversion of the 110kV and 38kV services). The section of the proposed road development from the tie-in with the R336 Coast Road to the N59 Letteragh Junction is a protected road¹ and the section from this junction to the tie-in with the existing N6 at Coolagh, Briarhill is a motorway.

The total area within the footprint of the development boundary is approximately 280ha. Of this total area, an area of approximately 180ha is required for the proposed road development construction works.

5.2 Background

As discussed in **Chapter 4, Alternatives Considered** there are a number of constraints within which to work and the evolution of the proposed road development took cognisance of and recognised the constraints existing in a city environment, such as Galway City, that includes Lough Corrib, the River Corrib, Galway Bay and the surrounding natural environment, the presence of designated sites as well as the constraints of the built environment of the city itself. Elements were included in the design, which allowed the proposed road development to avoid or reduce direct and indirect impacts on sensitive environmental receptors including persons and businesses potentially affected.

These avoidance measures which are incorporated as part of the design include the following:

- A bridge over the River Corrib with no instream piers and the piers located in areas of non-Annex I habitat
- A viaduct structure extending from the River Corrib Bridge to traverse NUIG Sporting Campus
- A viaduct over non-designated priority Annex I habitat at Menlough

¹ A protected road means a public road or proposed public road specified to be a protected road in a protected road scheme approved by the An Bord Pleanála. A protected road scheme approved by An Bord Pleanála may provide for the prohibition, closure, stopping up, removal, alteration, diversion or restriction of any specified or all means of direct access to the protected road from specified land or from specified land used for a specified purpose or to such land from the protected road.

- A tunnel beneath a narrow section of the Lough Corrib cSAC in Menlough at Lackagh Quarry
- A retaining wall on the southern side of the proposed road development at approximately Ch. 9+880 to Ch. 10+050 and on both sides of the proposed road development at approximately Ch. 10+850 to Ch. 11+150 to avoid the encroachment on Annex I habitat within the Lough Corrib cSAC
- A retaining wall on the southern side of the proposed road development at approximately Ch. 8+340 to Ch. 8+380 to reduce the potential impact on a private property
- Galway Racecourse Tunnel structure under the racecourse
- Lowering of the proposed road development from an overbridge to at-grade junction at Cappagh Road and changing from an overbridge at Hynes' Bóithrín in Castlegar from being in a cutting to at-grade to reduce the potential impacts on private properties
- Movement of the N59 Letteragh Junction further west and revision of the Coolagh Junction to avoid private dwellings

The provision of the above structures in the proposed road development have facilitated the avoidance of more densely populated areas of Galway City and avoided the acquisition of additional properties.

5.3 Proposed Road Development Description

5.3.1 Overview

The proposed road development is located in Galway as shown on **Figure 1.1** with the proposed plan layout shown on **Figures 5.1.01 to 5.1.15** and the plan and profile of mainline and side roads shown on **Figures 5.2.01 to 5.2.15** and **Figures 5.3.01 to 5.3.21**, respectively.

The proposed road development ties into the existing R336 Coast Road in An Baile Nua with an at-grade roundabout junction approximately 2km to the west of Bearna Village and then proceeds north and east as a single carriageway to the north of Bearna Village and onwards towards Ballymoneen. Local connectivity is maintained via the Troscaigh/Na Foráí Maola Overbridge Link whilst an at-grade roundabout is proposed at the Bearna to Moycullen (Maigh Cuilinn) Road L1321. At-grade signalised junctions are proposed at Cappagh Road and Ballymoneen Road.

To the east of the Ballymoneen Road Junction, the proposed road development is a dual carriageway and continues east to the grade separated N59 Letteragh Junction located in Letteragh. The junction connects to the N59 Moycullen Road via the proposed N59 Link Road North, and to the Letteragh Road and Ragoon Road via the proposed N59 Link Road South. The proposed road development continues eastwards to cross the existing N59 Moycullen Road at Dangan and travels on a viaduct over the NUIG Sporting Campus before crossing the River Corrib on a

bridge structure. The total length of the structure through the NUIG Sporting Campus and over the River Corrib Bridge is 620m.

It is proposed to construct an all-weather full size GAA pitch and a training pitch at the location of the existing GAA pitches at the NUIG Sporting Campus. The NUIG Sports Pavilion will be modified and will continue to function as a sports facility post construction.

East of the River Corrib the proposed road development continues east on embankment toward the Menlough Viaduct. Additional lands to the north of Menlo Castle are included as part of the proposed development to provide lands for the enhancement of the core foraging habitat for the Lesser horseshoe bat known to roost at Menlo Castle and to mitigate against potential impacts to this species. These lands will be planted with additional hedgerows, maintained as agricultural lands by the local authority and will remain in their ownership.

Continuing east the proposed road development crosses over Bóthar Nua in the townland of Menlough and remains on a viaduct section, Menlough Viaduct (length 320m), towards Seanbóthar before entering a section of cut preceding Lackagh Tunnel (length 250m) immediately west of Lackagh Quarry, and exits the tunnel in the quarry. There is a tunnel maintenance building located adjacent to Lackagh Tunnel.

The proposed road development continues east with a grade separated junction located at the N84 Headford Road Junction at Ballinfoyle and continues east through the townland of Castlegar to the grade separated junction at N83 Tuam Road². This junction provides access to both the N83 Tuam Road and the proposed Parkmore Link Road between the Ballybrit Business Park and the Parkmore Industrial Estate via the proposed City North Business Park Link road to provide full connectivity at this location.

The proposed road development then continues eastwards entering the Galway Racecourse Tunnel (length 230m) at Ballybrit to the north of the racetrack. There is a tunnel maintenance building located adjacent to the Galway Racecourse Tunnel and new stables provided for the Galway Racecourse. On emerging from the tunnel, the proposed road development continues south, crossing over the R339 Monivea Road on embankment and continuing south to enter a cutting as it reaches its junction with the existing N6 at Coolagh Junction. The proposed Coolagh Junction will be a fully grade separated junction with partial free flow on the major movements.

The proposed road development will also include extensive landscape planting for screening and the creation of specific habitat areas to compensate for loss of habitat elsewhere. To mitigate noise impacts across the proposed road development, a low noise road surface (LNRS) will be incorporated to reduce noise at source. In addition, an extensive scheme of noise barriers has also been incorporated into the design to further reduce noise levels along the proposed road development.

² Formally known as the N17 Tuam Road.

The proposed road development has been designed to a sufficient level of detail for a full environmental impact assessment of all potential direct and indirect impacts.

5.4 Design Standards

The design of the mainline, junctions, link and connector roads and non-motorised user facilities for the proposed road development have been completed in accordance with the TII current design standards available on the TII Publication's website, the TII Manual of Contract Documents for Road Works (MCDRW), the Department of Transport's Design Manual for Urban Roads and Streets (DMURS) and the National Transport Authority's National Cycling Manual. As the proposed road development is spread between urban and rural environment consideration has been given to allow for safe provision of non-motorised users within the proposed development boundary using the above standards. The following TII Publications are particularly relevant to the design:

- DN-GEO-03031 – Road Link Design
- DN-GEO-03060 – Geometric Design of Junctions (priority junctions, direct accesses, roundabouts, grade separated and compact grade separated junctions)
- DN-GEO-03036 – Cross-Sections and Headroom
- Design Manual for Urban Roads and Streets
- National Transport Authority, National Cycling Manual

In addition to the above design documents further guidance was drawn as necessary from relevant published data.

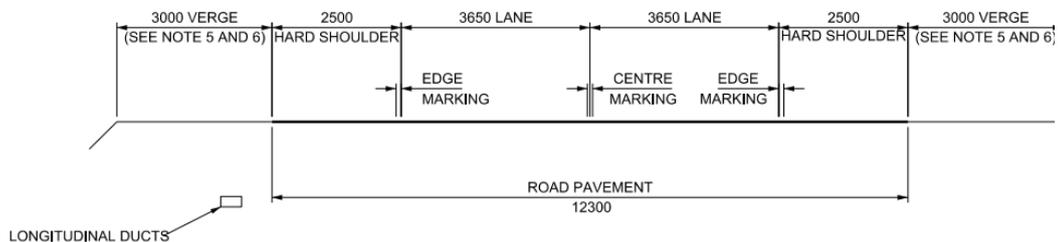
5.5 Proposed Road Type and Cross-Section

5.5.1 Mainline

From the R336 Coast Road to Ballymoneen, the mainline of the proposed road development is a Type 1 Single Carriageway in accordance with TII Publication DN-GEO-03036 (Cross Sections and Headroom). This section of mainline will be designated as a protected national road. The design speed of the mainline over this area is 85km/h. The cross section, shown in **Plate 5.1**, is as follows:

Western Verge Width (minimum):	3.0m
Western Hard Shoulder:	2.5m
Carriageway Width:	7.3m (2 x 3.65m lanes)
Eastern Hard Shoulder:	2.5m
Eastern Verge Width (minimum):	3.0m
Total Width (minimum):	18.3m

Plate 5.1: Typical cross section of the Type 1 Single Carriageway Link from the R336 to Ballymoneen



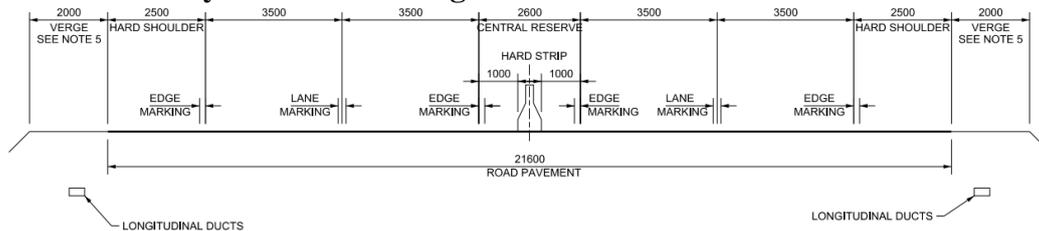
Climbing lanes are incorporated on the single carriageway at two locations, one in the eastbound direction and one in the westbound direction. These are designed in accordance with DN-GEO-03031.

From Ballymoneen Road to the eastern tie in with the existing N6 at Coolagh, Briarhill the mainline of the proposed road development is a Standard Dual Carriageway Urban Motorway (D2UM) in accordance with DN-GEO-03036. The mainline from Ballymoneen Road to the N59 Letteragh Junction will be designated as a Protected National Road and the mainline from the N59 Letteragh Junction to the N6 Coolagh Junction will be designated as a motorway, however, the cross sections remain the same. The design speed of the mainline over this area is 100km/h. The cross section, illustrated by **Plate 5.2**, is as follows:

Western Verge Width (minimum):	3.0m
Western Hard Shoulder Width (minimum):	2.5m
Western Carriageway Width:	7.0m (2 x 3.5m lanes)

Central Reserve Width (minimum):	2.6m (including 2 x 1.0m offside hardstrip)
Eastern Carriageway Width:	7.0m (2 x 3.5m lanes)
Eastern Hard Shoulder Width (minimum):	2.5m
Eastern Verge Width (minimum):	3.0m
Total Width (minimum):	27.6m

Plate 5.2: Typical cross section of the Dual Carriageway Urban Motorway Link from Ballymoneen to Coolagh



Between the N84 Headford Road Junction and the N83 Tuam Road Junction the mainline cross section will widen to 34.6m to accommodate a third lane in each direction (3 x 3.5m lane). This is to cater for the forecasted traffic between these junctions.

The cross sections at the River Corrib Bridge and Menlough Viaduct consist of the same as described above with the exception of the hard shoulder width which is reduced to 0.5m and a raised verge of 0.6m (excluding widening requirements for visibility).

The cross sections of the Lackagh Tunnel and the Galway Racecourse Tunnel differ from that required for a Standard Dual Carriageway Urban Motorway in accordance with DN-GEO-03036. These cross sections are dictated by national and international best practice with respect to tunnel layouts, geometric parameters such as stopping sight distance, the provision of space for operational equipment and the provision of safe access and egress in cases of emergency. Cross sections of both tunnels consist of 2 x 3.75m lanes in both directions, minimum nearside and offside 0.5m hard strip (excluding widening requirements for visibility) and 1.2m walkways nearside and offside. A minimum maintained headroom of 5.3m is provided in both tunnels.

5.5.2 Link Roads

There are four main link roads included as part of the proposed road development:

- N59 Link Road North
- N59 Link Road South
- Parkmore Link Road
- City North Business Park Link

A signalised grade separated junction at Letteragh connects the proposed road development to the N59 Moycullen Road via the N59 Link Road North and to the Ragoon and Letteragh Roads to the south via the N59 Link Road South.

The Parkmore Link Road forms part of the N83 Tuam Road Junction. The Link Road connects the Parkmore Industrial Estate to Ballybrit and City East Business Parks, providing a new access/egress to these estates as well as to the N83 Tuam Road. Access to the N83 Tuam Road is facilitated via City North Business Park Link. All link roads described above consist of a footpath in either direction with a minimum width of 1.8m in accordance with DN-GEO-03036. These link roads are detailed below in **Table 5.1**.

Table 5.1: Link Roads

Road Name	Lane Width	Footpath	Cycle Lane	Length	Chainage
N59 Link Road North & South	2 x 3.5m	Min 1.8m	2.0m (Ch. 1+500 – 2+220)	2200m	Ch. 7+575
City North Business Park Link	2 x 3.5m	Min 1.8m	2.0m	420m	Ch. 14+000
Parkmore Link Road	2 x 3.5m	Min 1.8m	2.0m	1350m	Ch. 14+375

5.5.3 Side Roads

Side roads which require redesign and realignment for the proposed road development have been designed in accordance with the standards noted in **Section 5.4**. **Table 5.2** details all side roads, both online and offline.

Table 5.2: Side Roads

Road Name	Lane Width	Length	Approx. Chainage	Comment
R336 Coast Road West	2 x 3m	245m	Ch. 0+030	Realignment of R336 Coast Road west to proposed roundabout, Bearna West Roundabout, at Baile Nua.
R336 Coast Road East	2 x 3m	90m	Ch. 0+030	Realignment of R336 Coast Road east to proposed roundabout, Bearna West Roundabout, at Baile Nua.
Na Foráí Maola to Troscaigh Link Road North	2 x 3m	500m	Ch. 1+400	Link road to connect existing local roads north and south of the proposed mainline via overbridge.
Na Foráí Maola to Troscaigh Link Road South	2 x 3m	730m	Ch. 1+400	Link road to connect existing local roads north and south of the proposed mainline via overbridge.
Na Foráí Maola to Troscaigh Overbridge Link	2 x 3m	200m	Ch. 0+190	Link road connecting Na Foráí Maola to Troscaigh Link Road North and Na Foráí Maola to

Road Name	Lane Width	Length	Approx. Chainage	Comment
				Troscaigh Link Road South.
L1321 Bearna to Moycullen Road North	2 x 3m	170m	Ch. 2+800	Realignment and tie into proposed Bearna East Roundabout.
L1321 Bearna to Moycullen Road South	2 x 3m	170m	Ch. 2+800	Realignment and tie into proposed Bearna East Roundabout.
L5384 Aille Road	2 x 3m	270m	Ch. 3+310	Realignment of L5384 Aille Road for proposed mainline underbridge.
Cappagh Road North	2 x 3m	140m	Ch. 4+450	Realignment and tie into proposed signalised junction.
Cappagh Road South	2 x 3m	230m	Ch. 4+450	Realignment and tie into proposed signalised junction.
Ballymoneen Road North	2 x 3m	230m	Ch. 5+650	Realignment and tie into proposed signalised junction.
Ballymoneen Road South	2 x 3m	130m	Ch. 5+650	Realignment and tie into proposed signalised junction.
Rahoon Road	2 x 3m	290m	Ch. 6+350	Redesign of Rahoon Road at Mincloon to accommodate mainline overbridge.
Clybaun Road	2 x 3m	410m	Ch. 6+350 to Ch. 6+650	Redesign of Clybaun Road at Mincloon to accommodate mainline overbridge and staggered junction.
Rahoon Road	2 x 3m	290	N59 Link Road Ch. 2+200	Redesign Rahoon Road at Gort na Bro to tie to proposed signalised junction with Letteragh Link Road South.
Gort na Bró Road	2 x 3m	270m	N59 Link Road Ch. 2+200	Redesign of Gort na Bró Road to tie to proposed signalised junction

Road Name	Lane Width	Length	Approx. Chainage	Comment
				with Ragoon Road (Ragoon Road Junction) and N59 LRS ⁺ .
Letteragh Road	2 x 3m	780m	Ch. 7+250	Redesign of Letteragh Road to tie into proposed signalised junction with Letteragh Link Road South and proposed mainline overbridge.
N59 Moycullen Road	2 x 3.5m	350m	N59 LRN* Ch. 0+000	Redesign of N59 Moycullen Road at Bushypark to tie in to proposed signalised junction with Letteragh Road North.
N59 Moycullen Road	2 x 3.5m	390m	Ch. 8+500	Redesign of N59 Moycullen Road at Dangan to accommodate proposed mainline overbridge.
Bóthar Nua	2 x 3m	260m	Ch. 10+110	Redesign of Bóthar Nua at Coolough to accommodate proposed mainline overbridge.
Sean Bóthar	2 x 3m	250m	Ch. 10+475	Realignment and tie into existing.
N84 Headford Road	2 x 3.5 lanes transitioning to 4 x 3.5m	400m	Ch. 12+125	Redesign of N84 Headford Road to accommodate proposed grade separated junction.
School Road L2134	2 x 3m	240m	Ch. 13+150	Redesign of L-2134 School Road, Castlegar to accommodate proposed mainline underbridge.
N83 Tuam Road	2 x 3.5 lanes transitioning to 4 x 3.5m 1x3.25m Bus Lane	1060m	Ch. 14+000	Redesign of N83 Tuam Road to accommodate proposed grade separated junction.

Road Name	Lane Width	Length	Approx. Chainage	Comment
N6 Bóthar na dTreabh at City East Business Park	4 x 3.5m lanes	300m	N/A	Provision of signalised junction access from N6 Bóthar na dTreabh to City East Business Park.
Briarhill Business Park Road	2 x 3.5m lanes	190m	Ch. 15+730	Redesign of Briarhill Business park road to accommodate proposed mainline overbridge
R339 Monivea Road	2 x 3.5m	275m	Ch. 15+850	Redesign of Monivea Road R339 to accommodate proposed mainline overbridge
Ballybrit Crescent	2 x 3.5m	200m	Ch. 15+850	Redesign of Ballybrit Crescent Road

Note: *N59 LRN = N59 Link Road North
 †N59 LRS = N59 Link Road South

5.5.4 Other Design Aspects

This section describes the design of other aspects of the proposed road development. Reference is made to the relevant guidance on which the design is based.

5.5.4.1 Traffic Signs

Signage will be provided along the proposed road development to ensure that clear directional and regulatory messages are transmitted to drivers and other road users and has been included in the design. The design of the signs and road marking is based on the 2010 Traffic Signs Manual issued by the Department of Transport and complemented by series 1200 of TII MCDRW, the National Cycle Manual by the National Transport Authority, and the Design Manual for Urban and Streets (DMURS) also compiled by the Department of Transport. There are 29 gantries signs, which will support advanced directional signage, proposed as part of the proposed road development.

5.5.4.2 Pedestrian and Cyclist Provision

As outlined in previous chapters of this EIAR, the proposed road development is a key element of a wider transportation strategy for Galway City and its environs, the Galway Transport Strategy (GTS). The GTS examines and provides for the needs of all modes of transport including but not limited to cyclists, pedestrians, public transport users, private motorists etc. Information on this strategy can be obtained

by visiting the Galway City Council website (<http://www.galwaycity.ie/galway-transport-strategy/>).

The proposed road development interacts with the existing road network at numerous locations along its extent. The existing networks at these locations act as multi modal corridors and as a result required particular attention and care when designing suitable provisions. An overview of the interactions along the extent of the proposed road development along with the provisions at each location is detailed below.

Bearna West Roundabout

The Bearna West Roundabout is located on the R336 Coast Road west of Bearna Village. Footpaths are provided on each arm of the junction which facilitates pedestrian crossings away from the flaring of the approaches.

Na Foráí Maola to Troiscaigh Overbridge

An overbridge with footpaths on both sides is provided in this area. These footpaths extend from the structure along the upgraded overbridge link road to maintain connectivity north and south of the proposed road development to the Na Foráí Maola and Troiscaigh area.

Bearna East Roundabout

The Bearna East Roundabout is located on the Bearna to Moycullen Road (L1321) north of Bearna Village. Footpaths are provided on each arm of the junction which facilitates pedestrian crossing away from the flaring of the approaches. The area is remote from amenities and services and there is low pedestrian activity in the area.

An Chloch Scoilte

An overbridge is provided in this area. There is no direct connection provided to the mainline of the proposed road development. Footpaths are provided on the overbridge. These footpaths extend from the structure along the upgraded Aille Road (L5384) and connect into the An Chloch Scoilte Road (L5385).

Cappagh Road Junction

A signalised junction is provided in order to enhance operational safety and performance and to facilitate the efficient movement of all road users. Footpaths are provided on each arm of the junction. These footpaths connect into the existing networks in the area.

Ballymoneen Road Junction

A signalised junction is provided in order to enhance operational safety and performance and to facilitate the efficient movement of all road users. Footpaths are provided on each arm of the junction. These footpaths connect into the existing networks in the area.

Rahoon Road

An underbridge is provided in this area. There is no direct connection provided to the mainline of the proposed road development. Footpaths are provided on the Rahoon Road. These footpaths extend from the structure along the upgraded Rahoon Road and connect into the existing road network.

Letteragh Road

A signalised junction is provided in order to enhance operational safety and performance and to facilitate the efficient movement of all road users. Footpaths are provided on each arm of the junction. Dedicated footways are provided through the junction on the N59 Link Road South, a dedicated cycleway is provided on the southern arm of this junction to Rahoon Road as per the GTS. These cycleways and footways connect into the existing networks in the area.

N59 Letteragh Junction

Signalised junctions are provided in order to enhance operational safety and performance and to facilitate the efficient movement of all road users. Dedicated crossing points are provided on each arm of the junction. Dedicated footways are provided through the junction on the N59 Link Road South as per the GTS. These footways connect into the existing networks in the area.

Bushypark Junction

A signalised junction is provided in order to enhance operational safety and performance and to facilitate the efficient movement of all road users. Footpaths are provided on each arm of the junction. Dedicated footways are provided on the N59 Link Road North. The need for this provision arose from the GTS. These footways connect into the existing networks in the area.

Rahoon Road Junction

A signalised junction is provided in order to enhance operational safety and performance and to facilitate the efficient movement of all road users. Footpaths are provided on each arm of the junction. Dedicated cycleways and footways are provided on the N59 Link Road South and footways on the Gort Na Bró Link Road as per the GTS. These cycleways and footways connect into the existing networks in the area.

Gateway Retail Junction

Gateway Retail Junction is a simple junction providing connectivity to the Gort na Bró Road from existing residential areas. The existing network provides dedicated footways and these are maintained in the design.

N59 Moycullen Road Area

An overbridge is provided in the area where the mainline of the proposed road development crosses the N59 Moycullen Road. There is no direct connection provided to the mainline of the proposed road development. Footpaths are provided in the area. These footpaths extend from the location of the structure along the upgraded N59 Moycullen Road and connect into the existing networks.

Bóthar Nua (Coolough Road)

An underbridge is provided in the area where the mainline of the proposed road development crosses Bóthar Nua. There is no direct connection provided to the mainline of the proposed road development. The existing road serves all modes. There are no footpaths or dedicated cycleways in the area. It is not proposed to provide isolated footpaths/cycleways in the area.

Seanbóthar (Menlo)

An underbridge is provided in the area where the mainline of the proposed road development crosses Seanbóthar. There is no direct connection provided to the mainline of the proposed road development. However, there is a diverge from the mainline to Seanbóthar to accommodate the egress of over height and emergency vehicles from Lackagh Tunnel. Seanbóthar is an existing access road which primarily serves agricultural traffic. Footpaths are provided along the section of road beneath the structure.

N84 Headford Road

Dedicated crossing points are provided on each arm of the junction. Dedicated footways are provided through the junction. These footways connect into the existing networks in the area.

School Road Castlegar

An overbridge is provided in this area. There is no direct connection provided to the mainline of the proposed road development. Footpaths are provided on the overbridge. These footpaths extend from the structure along the upgraded School Road (L2134) and connect into the existing road network.

N83 Tuam Road Junction and Parkmore Link Road

Signalised junctions are proposed where diverge and merge arms interact with the existing N83 Tuam Road. Signalised junctions are provided in order to enhance operational safety and performance and to facilitate the efficient movement of all road users. Dedicated crossing points for pedestrians and cyclists are provided on each arm of the junction. Dedicated cycleways and footways are provided through the junction in line with the GTS. These cycleways and footways will connect into the existing and proposed networks in the area. A dedicated inward bus only lane, as per the GTS, is also accommodated within the design.

The Parkmore Link Road is proposed to connect major industrial areas of Galway City. This is an urban street and dedicated cycleways and footways are provided along its length. The Parkmore Link Road is a key component of the GTS which has been identified as being one of the infrastructure measures to cater for public transport between the Ballybrit and Parkmore industrial estates. It facilitates the interchange of bus routes servicing these industrial estates thus increasing the level of provision of public transport into the whole of the north eastern quarter of the city. It also provides a shorter direct route with full provision of appropriate infrastructure along the desire line for both pedestrians and cyclists to the industrial estates of Parkmore and Ballybrit. City North Business Park Link provides connectivity between the proposed Parkmore Link Road and the existing N83 Tuam

Road. This link has dedicated cycleways and footways as per the GTS thereby linking the networks for all modes in the area. All of this culminates in the encouragement of a modal shift to sustainable transport measures.

Signalised junctions are proposed for each junction along the length of the Parkmore Link Road with the exception of Business Park Junctions 1 and 2. Signalised junctions are provided in order to enhance operational safety and performance and to facilitate the efficient movement of all road users. Dedicated crossing points for pedestrians and cyclists are provided at each junction location.

Ballybrit Crescent Junction

Ballybrit Crescent Junction is an existing signalised junction. The upgrade of this junction as part of the proposed road development caters for the requirements of the GTS which includes a dedicated bus lane and dedicated cycle facilities. Footpaths are maintained in the area at the current level of provision.

Lynch Junction

Lynch Junction is an existing signalised junction. This junction was previously upgraded to signalisation to enhance operational safety and performance and to facilitate the efficient movement of all road users. No works are proposed to be undertaken on the Lynch Junction at Briarhill as part of the proposed road development. The proposed road development will connect to the junction only.

City East Business Park Junction

There is currently a merge lane from City East Business Park to the existing N6 at this location. As part of the proposed road development it is proposed to provide a signalised junction. Footpaths are proposed on the City East Business Park Road. Footpaths are not proposed on the N6 Bóthar na dTreabh.

Coolagh Junction

The eastern terminus of the proposed road development connects to the existing N6 at Coolagh, Briarhill. The provision of a full movement, high quality junction at the intersection of the proposed road development and the existing N6 terminus is necessary due to the fact that the N6 is the primary access to Galway from the east and has become the primary access to Galway from the south since the opening of the M17/M18.

The existing road serves all modes. There are no footpaths or dedicated cycleways in the area. It is not proposed to provide isolated footpaths/cycleways in the area as safer alternatives are available. From the signalised junction to the east, motorway restrictions will apply.

The proposed pedestrian and cyclist provisions are shown on **Figures 5.1.01 to 5.1.15**.

5.5.4.3 Fencing and Barriers

At the beginning of the construction phase the land to be acquired as per the proposed development boundary will be fenced and access across it restricted. Temporary construction fencing or hoarding may be required during construction prior to the installation of permanent fencing to secure the site and prevent unauthorised access. Fencing will be erected from the proposed road side of the fence. In areas where the proposed development boundary includes Annex I habitat within Lough Corrib cSAC the permanent fencing will be located between the proposed road and the Annex I habitat and will not be located within the habitat areas.

Fence types will vary across the proposed road development depending on the different requirements and maybe temporary in nature. Fence types will include timber post and rail fencing, masonry walls, steel palisade fencing, noise barriers, parapets etc. Fencing, safety barriers and parapets on the proposed road development will be provided to meet the requirements of the current TII Publications and guidance documents.

Standard detailed fencing typically used on schemes of this nature will be used however site specific requirements may differ between rural and urban environments across the proposed road development. Existing residential and commercial boundary walls impacted by the proposed road development will be replaced.

A vehicle restraint system design has been completed in accordance with DN-REQ-03034 Safety Barriers and DN-STR-03011 (The Design of Vehicle and Pedestrian Parapets). All hazards located within the clear zone have been addressed as per hazard definitions, classifications, and ranking. Fencing within the defined clear zone of vehicular traffic will need to be installed as timber post and tension mesh fencing in accordance with TII Publication DN-REQ-03034. See also **Chapter 8, Biodiversity** for the location of mammal proof fencing and **Chapter 17, Noise and Vibration** for noise mitigation and their associated figures for their locations.

5.5.4.4 Lighting

The road lighting design shall meet the requirements of BS5489-1, IS EN 13201 and the UK DMRB TD 34-07 and TII addendum (DN-LHT-03038). This will ensure that light pollution is kept to a minimum.

The proposed road lighting installation has been considered and designed with limiting light trespass as a key priority.

Multiple measures have been taken to ensure that light is applied only where it is required. In addition to traditional good practice design approaches, modern and emerging technologies have been applied to limit the light spill. For the road lighting, these generally include:

- The use of LED lanterns with well-defined and controlled light beam distributions, mounted on columns with a maximum height of 10m. When compared with traditional discharge lamps and lantern technologies, this will

provide a significant reduction in light trespass to surrounding areas and properties

- The lanterns are mounted on bracket arms with a 0° tilt to the horizontal, where a 5° tilt would have been typical with older technologies or in less sensitive areas of application
- The LED lanterns emit 0% of their light above the horizontal, meaning no light is directly emitted into the night-sky. The lanterns have been selected to ensure that light directed behind the lantern is minimised

All of the above factors combine to produce a design that is compliant with the relevant standards previously quoted, but also a design that has paid due attention to the sensitive nature of the surrounding areas. It is proposed to provide public lighting at roundabouts on the proposed road development for reasons of safety. Lighting is also provided at Cappagh Road, Ballymoneen Road, N59 Letteragh, N84 Headford Road, N83 Tuam Road and the Coolagh Junctions and associated slip roads in accordance with TII Guidelines. There will also be lighting provided at the entrances to both the Lackagh Tunnel and Galway Racecourse Tunnel.

The City North Business Park Link, Parkmore Link and N59 Link Road North and South will also be lit as they are urban roads. Lighting will be provided at the car parks for the tunnel maintenance buildings at Lackagh Quarry and Galway Racecourse and the stables at Galway Racecourse. Flood lighting will also be provided at the proposed 3G pitch and training pitch at NUIG.

There is currently lighting on the Ballybrit Crescent Junction, the southern section of the existing N83 Tuam Road (Ch. 14+000), the N59 Moycullen Road and the southern portion of the Ragoon Road at the proposed Ragoon Road Junction. The lighting provision in these areas shall be extended to tie into that of the proposed road development.

The road lighting column heights and their proposed locations along with the potential light spill are shown on **Figures 5.4.01 to 5.4.15**. The proposed lighting for NUIG and the carparks are included in **Appendix A.5.1, A.15.1 and A.15.2**. The potential direct and indirect impacts of the proposed lighting on ecology is assessed in **Chapter 8, Biodiversity** and on human beings in **Chapter 12, Landscape and Visual** and **Chapter 18, Human Beings, Population and Health**.

5.5.4.5 Earthworks and Road Surfaces

The aspects relating to earthworks such as quantities, proposed site compounds and haul routes are discussed in **Chapter 7, Construction Activities** and **Chapter 9, Soils and Geology**.

The pavement design for all roads has been carried out considering the appropriate design life and axle loading in accordance with current TII document PE-SMG-02002 addendum to HD 24/06 Traffic Assessment and DN-PAV-03021 Pavement and Foundation Design. Low noise surfacing will be used for the full length of the mainline of the proposed road development and at junctions.

5.5.4.6 Structures

The proposed road development includes a total of 164 structures. **Table 5.3** below gives a summary of the 164 structures included in the proposed road development.

Table 5.3: Structures Overview

Structure Group		Overview
Major Structures	River Corrib Bridge	The River Corrib Bridge crosses the River Corrib and through the Lough Corrib cSAC. It is in close proximity to Menlo Castle and traverses the NUIG Sporting Campus. The width of the river at the crossing is approximately 153m.
	Menlough Viaduct	In the vicinity of the Menlough area, the proposed road development will be carried on a viaduct to reduce the potential impacts on Limestone pavement which is immediately adjacent to the Lough Corrib cSAC boundary and a Turlough.
	Lackagh Tunnel	The proposed road development will tunnel under the Lough Corrib cSAC immediately west of Lackagh Quarry with its primary function to avoid direct impacts on Annex I habitats at the surface, namely Limestone pavement and Calcareous grasslands. This tunnel will be constructed in such a way to avoid any deformations to the Annex I habitat at the surface. This tunnel is expected to be constructed using mined tunnels methods (drill and blast). See Chapter 7, Construction Activities for further details.
	Galway Racecourse Tunnel	The proposed road development will be accommodated in a 240m cut and cover tunnel in the Ballybrit area to reduce the residual impact on the Galway Racecourse. This tunnel is expected to be constructed using the cut and cover method. See Chapter 7, Construction Activities for further details.
Standard Overbridges		This family of structures consists of 7 standard overbridges carrying side roads over the proposed road development. These bridges will typically be 2 or 3 span bridges with clear open spans.
Standard Underbridges		This family of structures consists of 10 standard underbridges carrying the proposed road development over local and regional roads. At local roads, typically a single span portal frame arrangement will be adopted; at regional road crossings configuration with clear open span(s) will be chosen.
Other Structures	Retaining Structures	15 retaining structures are currently identified. These are expected to be of reinforced earth and/or reinforced concrete retaining wall configuration.

Structure Group		Overview
	Culverts & Minor Watercourse crossings	Currently there are approximately 43 culvert type structures, of which 28 are structural, to accommodate drainage and watercourses and wildlife under the proposed road development.
	Sign Gantries	29 sign gantries are to be constructed in accordance with DN-STR-03010 and TII Standard Construction Details for sign gantries.
	Environmental Noise Barriers	56 noise barriers are to be constructed. The location, form and type of the environmental noise barriers are shown on Figures 17.1.01 to 17.1.14 .

The following is a summary of the main structures to be constructed for the proposed road development:

River Corrib Bridge

The proposed road development crosses the River Corrib on a bridge structure (S08/04) from Ch. 8+850 to Ch. 9+500 (650m in length). The proposed structure comprises of an eight span bridge carrying the proposed road development over the River Corrib adjacent to a retained embankment with five culvert openings on the eastern approach. The proposed structure is a variable depth single concrete box without supports in the river. The proposed structure is a variable depth (between 3m and 7m) single concrete box without supports in the river with the main span over the river being 153m. The adjacent spans consist a variable depth single concrete box increasing in depth from 3m to 7m on approach to the main span. The remaining western approach spans consists of 3m constant depth single concrete box while the remaining eastern approach links into a retaining embankment with five culvert openings to facilitate the passage of wildlife. The superstructure will be supported on reinforced concrete piers. For aesthetic reasons, inclined webs instead of vertical webs are proposed.

Menlough Viaduct

A viaduct structure, Menlough Viaduct (S10/01) is proposed from Ch. 10+100 to Ch. 10+420 is located outside but adjacent to the Lough Corrib cSAC. The total length of the bridge is dictated by the area of priority Annex I habitat over which it crosses, namely Limestone pavement and a Turlough (all of which fall outside of the Lough Corrib cSAC boundary) and this will reduce the potential impact on these habitats. The viaduct has a total length of approximately 320m, and the proposed road development is on embankment on both approaches to it. The viaduct contains eight spans of a similar 40m span length. The span lengths have been adjusted to reduce the impact of the substructure and foundations on the Limestone pavement and Turlough.

The minimum distance between the soffit of the superstructure and the ground level is approximately 1.5m at one pinch point at the location of the high point in the rock outcropping on the western side. The bridge deck superstructure will consist of prefabricated precast post-tensioned beams supporting a cast in-situ concrete bridge deck. The substructure will consist of conventional reinforced concrete piers at

intermediate supports while the reinforced concrete bankseats at the abutments will be supported on a reinforced earthworks system. No substructure supports are proposed within the extents of the Turlough.

Lackagh Tunnel

Lackagh Tunnel (S11/01) is 270m long and is located at Ch. 11+150 to Ch. 11+420. The eastern portal of Lackagh Tunnel is located within the inactive Lackagh Quarry, a limestone quarry. The central section of the tunnel will pass under the Lough Corrib cSAC, while the western portal is proposed to be located in agricultural fields, outside of Lough Corrib cSAC.

The primary function of the Lackagh Tunnel and its Western Approach is to transverse the Lough Corrib candidate Special Area of Conservation (cSAC) between Lackagh Quarry and Menlough without directly impacting on the Limestone pavement and Calcareous grass within the Lough Corrib cSAC. This requires a safe method of excavation and construction of the tunnel such that there will be no impact on the Lough Corrib cSAC during the construction or operation of the tunnel, as discussed in **Chapter 7, Construction Activities** and **Appendix A.7.3**.

Galway Racecourse Tunnel

The proposed Galway Racecourse Tunnel (S14/02) consists of a 240m twin tube reinforced concrete cut and cover tunnel with central wall. The purpose of the Galway Racecourse Tunnel is to avoid by design adverse impacts, namely disruption to operations and functioning, on the Galway Racecourse. The proposed mainline passes through the north western corner of Galway Racecourse property and necessitates a cut and cover tunnel from Ch. 14+950 to Ch. 15+190, resulting in a tunnel length of approximately 240m.

Underbridges

There are 10 underbridges identified in the current design, which will carry the proposed road development over local, regional and national roads. All underbridges are single span. Three main types of underbridges are proposed:

- Type 1: Buried reinforced concrete box structure
- Type 2: Bridge deck with reinforced earth wall abutment
- Type 3: Concrete deck with side slopes

The underbridges over National Roads will incorporate open clear spans as appropriate, in recognition of the fact that higher volumes of traffic on these National Roads will make these bridges highly visible.

The proposed standard underbridges are located at chainages stated in **Table 5.4** below, along the proposed road development.

Table 5.4: Standard underbridge mainline chainages

Name of Structure	Approx. Chainage
S06/01 - Ragoon Road Underbridge	Ch. 6+335
S07/01 - Letteragh Road Underbridge	Ch. 7+290
S07/02 - N59 Link Road Underbridge	Ch. 7+570
S08/02 - N59 Moycullen Road Underbridge	Ch. 8+540
S09/01 - Menlo Castle Bóithrín Underbridge	Ch. 9+730
S10/02 – Seanbóthar Underbridge	Ch. 10+520
S12/01 - N84 Headford Road Underbridge	Ch. 12+150
S13/02 - N83 Tuam Road Underbridge	Ch. 13+975
S15/01 - Briarhill Business Park Underbridge	Ch. 15+725
S15/02 – Monivea Road R339 Underbridge	Ch. 15+880

Overbridges

There are seven overbridges proposed and the function of these are:

- Structure S01/01, S03/01, S13/01, and S14/01 are overbridges required to carry local roads over the proposed road development
- Structure S12/02 is required as a mammal crossing (green bridge) over proposed road development
- Structures S16/01 and S16/02 are required at Coolagh Junction to provide free flow access between the R446 and the proposed road development

The proposed standard overbridges are located at chainages stated in **Table 5.5** below, along the proposed road development.

Table 5.5: Standard overbridge mainline chainages

Name of Structure	Approx. Chainage
S01/01 - Na Foraí Maola to Troscaigh Overbridge	Ch. 1+375
S03/01 - Barr Aille Overbridge	Ch. 3+300
S12/02 - Castlegar Wildlife Overbridge	Ch. 12+700
S13/01 - School Road Overbridge	Ch. 13+185
S14/01 - Parkmore Link Road Overbridge	Ch. 14+375
S16/01 - Coolagh Junction Overbridge (EB diverge to R446)	Ch. 16+410
S16/02 - Coolagh Junction Overbridge (EB merge from R446)	Ch. 16+830

Culverts and Underpasses

Hydraulic culverts have been designed to minimise impact on both upstream and downstream flood risk. In addition to the hydraulic requirements for the proposed road development crossings, consideration has also been given to the passage of

mammals at some ecologically sensitive areas. Some of the hydraulic culverts have been increased in size to allow passage for a range of mammal species; for example, otters, badgers and bats.

A full list of the culverts and underpasses is provided in **Table 5.6**.

Table 5.6: Culverts and Underpasses

Name of Structure	Approx. Chainage	Function	Other Requirements
C00/00	Ch. 0+550	Mammal Underpass	-
C00/01	Ch. 0+640	Combined Hydraulic Culvert & Mammal Underpass	-
C00/02	Ch. 0+975	Hydraulic Culvert	-
C01/01	Ch. 1+550	Hydraulic Culvert	-
C02/01a	Ch. 2+740	Hydraulic Culvert	-
C02/01b	Ch. 2+840	Combined Hydraulic Culvert & Mammal Underpass	-
C03/01	Ch. 3+040	Combined Hydraulic Culvert & Mammal Underpass	-
C03/02	Ch. 3+350	Hydraulic Culvert	-
C03/03	Ch. 3+920	Combined Hydraulic Culvert & Mammal Underpass	-
C03/04	Ch. 3+640	Combined Hydraulic Culvert & Mammal Underpass	-
C04/01	Ch. 4+100	Combined Hydraulic Culvert & Mammal Underpass	Otter Ledge
C04/02	Ch. 4+895	Combined Hydraulic Culvert & Mammal Underpass	Otter Ledge
C05/01	Ch. 5+270	Mammal Underpass	-
C06/00	Ch. 6+450	Mammal Underpass	-
C06/01	Ch. 6+850	Combined Hydraulic Culvert & Mammal Underpass	-
C06/01b	Ch. 6+850	Mammal Underpass	-
C07/00	Ch. 7+100	Mammal Underpass	-
C07/01a	Ch. 1+620	Hydraulic Culvert	-
C07/01b	Ch. 1+610	Mammal Underpass	-
C07/02a	Ch. 7+210	Combined Hydraulic Culvert & Mammal Underpass	-
C07/02B	Ch. 7+290	Combined Hydraulic Culvert & Mammal Underpass	-
C07/04	Ch. 0+700	Mammal Underpass	-
C08/01	Ch. 8+640	Hydraulic Culvert	-
C08/01a	Ch. 8+450	Mammal Underpass	-
C08/02	Ch. 8+760	Mammal Underpass	-

Name of Structure	Approx. Chainage	Function	Other Requirements
C08/04	Ch. 8+570	Mammal Underpass	-
C08/05	Ch. 8+643	Mammal Underpass	-
C09/01	Ch. 9+525	Mammal Underpass	-
C09/02	Ch. 9+540	Mammal Underpass	-
C09/03	Ch. 9+560	Mammal Underpass	-
C09/04	Ch. 9+570	Mammal Underpass	-
C09/05	Ch. 9+580	Mammal Underpass	-
C09/06	Ch. 9+710	Mammal Underpass	-
C09/07	Ch. 9+920	Mammal Underpass	-
C10/01	Ch. 10+040	Mammal Underpass and spanning over exposed Limestone pavement	-
C10/02	Ch. 10+740	Combined Hydraulic Culvert & Mammal Underpass	-
C10/02a	Ch. 10+740	Mammal Underpass	-
C12/01	Ch. 12+130	Mammal Underpass	-
C12/02	Ch. 12+350	Mammal Underpass	-
C12/03	Ch. 12+390	Mammal Underpass	-
C12/04	Ch. 12+450	Mammal Underpass	-
C13/01	Ch. 13+980	Mammal Underpass	-
C13/02	Ch. 13+710	Mammal Underpass	-

Other Structures

There are a number of other structures incorporated into the proposed road development. These include retaining structures, sign gantries and noise barriers.

The proposed retaining structures are located at chainages stated in **Table 5.7** below, along the proposed road development.

Table 5.7: Retaining structures location

Name of Structure	Approx. Chainage
R04/01	Ch. 4+450
R08/01	Ch. 8+325
R08/02	Ch. 8+390
R08/03a	Ch. 8+475
R08/07	Ch. 8+550
R08/08 (N59 Link Road North)	N59 LRN* Ch. 0+100
R08/09	Ch. 8+400
R09/01	Ch. 9+510

Name of Structure	Approx. Chainage
R09/02	Ch. 9+510
R09/03	Ch. 9+825
R12/01	Ch. 12+300
R14/03	Ch. 14+550
R14/05	Ch. 14+890
R15/01	Ch. 15+630
R15/02	Ch. 15+750

Note: *N59 LRN = N59 Link Road North

It should be noted that there are other retaining structures proposed elsewhere on the proposed road development, for example at the western approach to Lackagh Tunnel, at Structure S11/01, as abutments to overbridges and underbridges, etc. These retaining structures are included with the associated structure.

The proposed sign gantries are located at chainages stated in 5.8 below, along the mainline of the proposed road development.

Table 5.8: Sign Gantries location

Name of Structure	Approx. Chainage	Gantry type	Lateral siting / span	Comments
G06/01	Ch. 6+260	Cantilever	Eastbound verge	Variable Message Sign
G06/02	Ch. 6+950	Cantilever	Eastbound verge	Advance Directional Sign
G08/01	Ch. 8+340	Cantilever	Westbound verge	Advance Directional Sign
G10/01	Ch. 10+075	Cantilever	Eastbound verge	Variable Message Sign
G10/02	Ch. 10+470	Portal	Across Eastbound lanes	Advance Directional Sign Intelligent Transport Sign
G10/03	Ch. 10+600	Portal	Across Eastbound lanes	Intelligent Transport Sign
G10/04	Ch. 10+840	Portal	Across Eastbound lanes	Advance Directional Sign Intelligent Transport Sign
G11/01	Ch. 11+030	Portal	Across entire carriageway	Intelligent Transport Sign
G11/02	Ch. 11+525	Portal	Across Westbound lanes	Intelligent Transport Sign
G11/03	Ch. 11+600	Portal	Across Eastbound lanes & diverge	Directional Sign Intelligent Transport Sign

Name of Structure	Approx. Chainage	Gantry type	Lateral siting / span	Comments
G11/04	Ch. 11+775	Portal	Across Westbound lanes & merge	Intelligent Transport Sign
G12/01	Ch. 12+060	Portal	Across Westbound lanes	Intelligent Transport Sign
G12/02	Ch. 12+450	Portal	Across Westbound merge only	Advance Directional Sign
G12/03	Ch. 12+725	Portal	Across all Westbound lanes	Directional Sign
G12/04	Ch. 12+950	Portal	Across all Eastbound lanes	Advance Directional Sign Variable Message Sign
G13/01	Ch. 13+190	Portal	Across all Westbound lanes	Advance Directional Sign Variable Message Sign
G13/02	Ch. 13+450	Portal	Across Eastbound lanes & diverge	Directional Sign
G13/03	Ch. 13+610	Portal	Across Westbound merge only	Advance Directional Sign
G14/01	Ch. 14+250	Portal	Across Westbound lanes	Intelligent Transport Sign
G14/02	Ch. 14+650	Portal	Across entire carriageway	Directional Sign Intelligent Transport Sign
G14/03	Ch. 14+810	Portal	Across entire carriageway	Advance Directional Sign Intelligent Transport Sign
G15/01	Ch. 15+290	Portal	Across entire carriageway	Advance Directional Sign Intelligent Transport Sign
G15/02	Ch. 15+510	Portal	Across Westbound lanes	Intelligent Transport Sign
G15/03	Ch. 15+690	Portal	Across Westbound lanes	Advance Directional Sign Intelligent Transport Sign Variable Message Sign
G15/04	Ch. 15+820	Cantilever	Eastbound verge	Directional Sign

Name of Structure	Approx. Chainage	Gantry type	Lateral siting / span	Comments
G15/05	Ch. 15+925	Cantilever	Westbound verge	Variable Message Sign
G16/01	Ch. 16+900	Portal	Across Westbound diverge only	Directional Sign
G17/01	Ch. 17+320	Cantilever	Westbound verge	Directional Sign
G18/01	Ch. 18+090	Cantilever	Westbound verge	Variable Message Sign

5.5.4.7 Landscaping

The aspects relating to landscaping are discussed in **Chapter 12, Landscape and Visual**.

5.5.4.8 Drainage

The proposed road development involves the construction of a new drainage system which includes the provision of a surface water collection system, earthworks drainage, sub-surface drainage, attenuation and pollution control, and the culverting of existing streams. The proposed road development has been designed such that surface water drainage and sub-surface drainage will be provided for the proposed mainline carriageway, junctions, link roads and all new sections of local roads.

Due to the contrasting geological features across the extents of the proposed road development, the type of natural drainage can be split into two different broad categories west and east of the N59 Moycullen Road.

The natural discharge of rainfall and surface water drainage west of the N59 Moycullen Road is overland to low points in the topography where shallow ditches and streams are present. The underlying bedrock is granite. This is a low importance, poor aquifer where the bedrock is generally unproductive except for local zones (ref **Chapter 10, Hydrogeology**). In general, the water table is quite close to the surface.

The natural discharge of rainfall and surface water drainage east of the N59 Moycullen Road is directly to ground, with extreme events accumulating at low points and seasonal lakes within the topography. The underlying bedrock is limestone. The aquifer is a regionally important karstified aquifer which is dominated by conduit flow (ref **Chapter 10, Hydrogeology**). Except for the River Corrib, Terryland River, Ballindooley Lough and Coolagh Lakes, there are no other significant watercourses in the area east of the N59 Moycullen Road.

The two different categories of natural drainage inform the approach to drainage design for the proposed road development. As well as the efficient removal of water from the road surface and pavement, the drainage design aims to minimise the impact of runoff from the proposed road development on the receiving environment by replicating, as much as possible, the natural water flows across the proposed

road development. This is achieved using a variety of sustainable drainage measures.

All surface water collected by the proposed carriageway drainage system will be discharged to watercourses or existing storm sewers crossed by or adjacent to the proposed road development if present, or will be discharged to ground via infiltration. Flow control measures will be provided at all outfalls and discharge points along the length of the proposed road development to ensure discharge does not cause any adverse effects upstream or downstream of the receiving watercourse or sewer. Infiltration basins have been sized to allow sufficient time for infiltration to discharge to the ground. Pollution control measures will be provided on all mainline road drainage networks prior to outfalling/discharging to ensure that receiving water bodies are not contaminated by runoff from the proposed road development.

In summary, the design basis for the drainage strategy is as follows:

- West of the N59 Moycullen Road the surface water collected by the carriageway drainage system will be discharged into watercourses crossed by, or adjacent to, the proposed road development that eventually outfall to Galway Bay
- East of the N59 Moycullen Road the surface water collected by the carriageway drainage system will be discharged to ground via infiltration, with the exception of two drainage networks (S18A and S18B refer **Figure 11.6.107**) which will discharge directly to the River Corrib and three networks (S14A, S14B and S15 refer to **Figure 11.6.106**) which discharge to tributaries which eventually outfall to the River Corrib

The procedures below have been adopted for the drainage design of the proposed road development in accordance with current TII Publications, guidance documents and best practice methods.

Watercourses

The proposed road development crosses a number of existing watercourses which includes the Bearna Stream and its tributaries, the River Corrib and a number of smaller streams. Streams and rivers will be crossed using culverts or bridge structures.

There is one major river bridge required to cross the River Corrib as outlined in **Section 5.5.4.6**.

As noted in **Section 5.5.4.6**, culverts have been designed to minimise impact on both upstream and downstream flood risk. In addition to the hydraulic requirements for the proposed road development crossings, consideration has also been given for the passage of mammals at some ecologically sensitive areas. Some of the hydraulic culverts have been increased in size to cater for a range of mammal passages for example otters, badgers and bats. **Section 5.5.4.6** summarises the proposed hydraulic culverts and bridge structures.

All of the proposed structures over existing watercourses have been submitted to the OPW for approval under Section 50 of the Arterial Drainage Act and have been

approved. Details of required stream realignments in the vicinity of the structures have also been submitted and approved.

There are a small number of Salmonid rivers interacting with the proposed road development. Inland Fisheries Ireland have been consulted regarding the requirements, for fish passage at these locations. The design of all culverts conveying watercourses provides a minimum embedment depth of 150mm on circular culverts or 300mm on rectangular box culverts below stream bed or to the minimum level as requested by Inland Fisheries Ireland. This is to encourage the re-establishment of stream bed ecology. The bed of the channel both upstream and downstream of the culvert should be reinstated with material similar to that removed during construction. This is similar to a “natural” bed contiguous with the existing stream bed, upstream and downstream of the proposed culvert. Proposed culverts encroaching on fish habitats shall be designed to ensure that the velocity of flow will be less than the swimming speed to allow passage of migrating fish. Culverts will be designed such that the velocity in the barrel will not be significantly increased from the velocity of the existing watercourse.

Gradients of proposed culverts will aim to recreate the gradient of the existing watercourse where possible. Where relevant, the culvert design shall accommodate invert baffles to facilitate fish passage upstream and downstream. Suitable measures are to be employed to ensure that livestock are prevented from entering culverts.

Interceptor Ditches

Interceptor ditches are required to intercept the overland flow from the natural catchment adjacent to the proposed road development (both during construction and the operational phases) and to prevent ponding of water adjacent to embankments. The use of interceptor ditches is to prevent drainage from the road curtilage running onto adjacent lands and vice-versa.

The interceptor ditches are provided at the top of the cutting or the base of the embankment where land falls towards the proposed road development to collect overland flow. The ditches have been sized to cater for a 1 in 75 year return period as per DN-DNG-03064 – Drainage of Runoff from Natural Catchments (HD 106). All land drains that are intercepted by the proposed works will be discharged into an interceptor ditch. Scour protection shall be provided where velocities exceed 2.5m/s in the interceptor ditches.

To the west of the N59 Moycullen Road, interceptor ditches will discharge to existing streams, rivers and storm sewers. Due to the undulating nature of the natural topography of the land along the route of the proposed road development, there are some considerable areas of cutting required for earthworks drainage. To the east of the River Corrib, interceptor ditches will discharge to stone filled infiltration trenches located adjacent to the proposed road development. Cross-drains will be provided to convey flow from the interceptor ditches beneath the proposed road development to the outfall/discharge locations where required.

Carriageway Drainage

A surface water collection system will be provided so as to comply with the design requirements of DN-DNG-03022 – Drainage Systems for National Roads (HD33/15). This includes providing suitably sized longitudinal carrier drains to accommodate a 1 year return period storm in-bore without surcharging, with no flooding of the proposed carriageway for a 1 in 5 year return period for filter drains. Where combined surface and ground water drains are proposed, a 1 in 5 year return period storm will not rise above the formation level, or sub-formation level where a capping layer is present. The drainage networks are designed to include an increase of 20% in rainfall depth to cater for the impact of climate change.

In the western section of the proposed road development from the R336 Coast Road to the N59 Moycullen Road, the drainage network is in accordance with Figure 3.1 of DN-DNG-03022 (HD33/15). However, in the eastern section of the proposed road development from the N59 Moycullen Road to the connection point with the existing N6 at Coolagh, Briarhill, due to the karstic nature of the underlying bedrock and the vulnerability of the underlying aquifers, there is a requirement for a fully sealed system to accept the proposed carriageway runoff. Therefore, the network collecting the drainage from the proposed carriageway will be kept separate to the groundwater and sub-surface drainage network. This will be achieved by using either a kerb, gully and carrier pipe system or a surface water channel and carrier pipe system. This allows for controlled treatment of surface waters prior to discharge to the ground thereby reducing the risk to the underlying aquifer. For cuttings and low embankments, a separate filter drain will be provided for sub surface flows **Table 5.9** summarises the proposed mainline drainage networks.

Table 5.9: Summary of Mainline and Junction Drainage Networks

Drainage Network Ref. No.	Mainline / Junction	Chainage	Approx. Total Drainage Area (ha)	Outfalling to	Drainage System Type (Sealed / Non-Sealed)
S1	Mainline	Ch. 0+000 to Ch. 0+700	2.05	Watercourse	Non-Sealed
S2	Mainline	Ch. 0+700 to Ch. 1+000	0.55	Watercourse	Non-Sealed
S3	Mainline	Ch. 1+000 to Ch. 1+475	2.31	Watercourse	Non-Sealed
S4A	Mainline	Ch. 1+475 to Ch. 1+900	0.96	Watercourse	Non-Sealed
S5A	Mainline	Ch. 1+900 to Ch. 2+850	2.45	Watercourse	Non-Sealed
S7A	Mainline	Ch. 2+850 to Ch. 3+050	0.30	Watercourse	Non-Sealed
S7B	Mainline	Ch. 3+050 to Ch. 3+910	2.94	Watercourse	Non-Sealed
S8	Mainline	Ch. 3+910 to Ch. 4+125	0.42	Watercourse	Non-Sealed

Drainage Network Ref. No.	Mainline / Junction	Chainage	Approx. Total Drainage Area (ha)	Outfalling to	Drainage System Type (Sealed / Non-Sealed)
S9	Mainline	Ch. 4+125 to Ch. 4+940	1.75	Watercourse	Non-Sealed
S10	Mainline	Ch. 4+940 to Ch. 5+640	2.19	Watercourse	Non-Sealed
S11	Mainline	Ch. 5+640 to Ch. 6+300	2.02	Existing Sewer	Non-Sealed
S12	Mainline	Ch. 6+300 to Ch. 7+300	3.15	Watercourse	Non-Sealed
S13	Mainline	Ch. 7+300 to Ch. 7+525	0.91	Watercourse	Non-Sealed
S14A	Mainline	Ch. 7+525 to Ch. 8+250	5.66	Existing Culvert	Non-Sealed
S14B	Mainline	Ch. 8+250 to Ch. 8+525	0.85	Watercourse	Non-Sealed
S18A	Mainline	Ch. 8+525 to Ch. 9+250	1.75	Watercourse	Sealed
S18B	Mainline	Ch. 9+250 to Ch. 10+150	2.27	Watercourse	Sealed
S19A	Mainline	Ch. 10+150 to Ch. 10+730	1.95	Infiltration Basin	Sealed
S19B	Mainline	Ch. 10+730 to Ch. 11+150	2.22	Infiltration Basin	Sealed
F19	Mainline	Ch. 11+150 to Ch. 11+420	N/A	Foul Sewer	Sealed
S20	Mainline	Ch. 11+420 to Ch. 12+020	4.95	Infiltration Basin	Sealed
S21B	Mainline	Ch. 12+020 to Ch. 13+630	8.28	Infiltration Basin	Sealed
S22A	Mainline	Ch. 13+360 to Ch. 14+350	5.68	Infiltration Basin	Sealed
S22B	Mainline	Ch. 14+350 to Ch. 14+950	3.06	Infiltration Basin	Sealed
F24	Mainline	Ch. 14+950 to Ch. 15+200	N/A	Foul Sewer	Sealed
S30	Mainline & Junction & Side Road	Ch. 15+200 to Ch. 15+700 Galway Racecourse Tunnel to Briarhill Coolagh Junction to Briarhill Tie-in Realigned	6.33	Existing Sewer	Sealed

Drainage Network Ref. No.	Mainline / Junction	Chainage	Approx. Total Drainage Area (ha)	Outfalling to	Drainage System Type (Sealed / Non-Sealed)
		Briarhill Business Park Road			
S26	Mainline	Ch. 15+750 to Ch. 16+750	5.12	Existing Sewer	Sealed
S27	Mainline	Ch. 16+750 to Ch. 17+535	5.47	Existing M6 Infiltration Basin	Sealed
S21A	Junction	Ch. 12+125 N84 Headford Road Junction	3.31	Attenuation Basin	Sealed
S22E	Junction	Ch. 14+400 N83 Tuam Road Junction (northern loop of junction and northern section of Parkmore Link Road)	0.79	Infiltration Basin	Sealed
S29	Junction	Ch. 16+500 Coolagh Junction south to tie-in with R446	2.73	Existing Sewer	Sealed

Suitably sized and located outfalls have been designed in accordance with DN-DNG-03071 – Design of Outfall and Culvert Details (HD 107).

Sub-Surface Drainage

A sub-surface drainage system of the road pavement will be provided in order to control groundwater levels in the vicinity of the proposed road development and to drain the road foundation. This is required in areas of cuttings and low embankments (<1.5m). In general, this is achieved using a network of filter drains or narrow filter drains.

Due to the karstic nature of the catchments to the east of the N59 Moycullen Road a hydrogeological risk assessment for each surface water drainage network catchment has been carried out at the location of each infiltration basin. This assessment is included in **Chapter 10, Hydrogeology**.

Structure Drainage

A separate isolated sealed drainage system will be utilised for the Lackagh Tunnel and the Galway Racecourse Tunnel structures. The drainage system will be designed in accordance DN-STR-03015 – Design of Road Tunnel (BD78). The sealed system of slot drains and carrier pipes will be used in both tunnels to pick up groundwater ingress, surface water from wheels, fire flows and tunnel wash down, all of which will be drained to sumps and pumped to the closest foul sewer. This system mitigates against the potential for pollution of groundwater and also minimises the risk to the Lough Corrib cSAC surface water bodies.

A watertight seal will be installed on the underside of the road base and cuttings on the western approach to the Lackagh Tunnel and on the eastern approach to the Galway Racecourse Tunnel up to the known high winter groundwater level. This is to protect against groundwater inflow and prevent contamination of groundwater and no dewatering is permitted in the operational phase of the proposed road development at these locations (see **Chapter 10, Hydrogeology**).

Drainage of the proposed bridge structures will be managed so as to achieve the requirements set out in DN-DNG-03022 – Drainage Systems for National Roads (HD33/15). For the long lengths of the Menlough Viaduct and the River Corrib Bridge a specialised sealed drainage system will capture the runoff on the bridge deck, transport it beneath the structure in a network of slung sealed carrier drains, before descending into the ground at suitable pier locations and discharging to a wetland and attenuation treatment area. This is required due to the sensitivity of the areas which the bridges are crossing above i.e. Limestone pavement and Turlough (Priority Annex 1 habitats) and the River Corrib (Lough Corrib cSAC).

Link Road and Side Road Drainage

The side roads and proposed link roads where drainage is proposed include the R336 Coast Road, L5386 Na Foráí Maola Road, L5387 Troscaigh Road, Na Foráí Maola to Troscaigh Link Road North, South and Overbridge Link, L1321 Bearna to Moycullen Road, L5384 Aille Road, Cappagh Road, Ballymoneen Road, Ragoon Road, Clybaun Road, L1323 Letteragh Road, N59 Link Road North and South, Seanbóthar, N84 Headford Road, L2134 School Road, N83 Tuam Road, Parkmore Link Road, Briarhill Business Park Road, Ballybrit Crescent and R339 Monivea Road. These roads require kerbs at locations including at bridge or junction locations or where footways are required and will therefore be drained using gullies with carrier drains or combined filter/carrier drains. Piped drains will discharge to an outfall, a sealed drain or to the mainline drainage system. **Table 5.10** summarises the proposed link road drainage networks.

Table 5.10: Summary of Link Road and Side Road Drainage Networks

Drainage Network Ref. No.	Link Road/Side Road	Road Name and Chainage	Approx. Total Drainage Area (ha)	Outfalling to	Drainage System Type (Sealed/Non-Sealed)
S4B	Link Road	Troscaigh Road	0.12	Watercourse	Non-Sealed
S15	Link Road	N59 Link Road North	1.89	Watercourse	Non-Sealed
S16A	Link Road	N59 Link Road North and South	4.16	Existing Sewer	Non-Sealed
S17A	Link Road	Letteragh Road - Ch. 1+625 to Ch. 2+210	1.08	Existing Sewer	Non-Sealed
S22C1	Link Road	City North Business Park Road - Ch. 14+400	1.46	Existing Sewer	Sealed
S22C2	Link Road	Parkmore Link Road - Ch. 14+400	0.55	Infiltration Basin	Sealed
S5B	Side Road	Upgrading of Bearnna to Moycullen Road South - Ch. 2+800	0.24	Watercourse	Non-Sealed
S16B	Side Road	Letteragh Rd - Ch. 1+500	0.12	Existing Sewer	Non-Sealed
S17B	Side Road	Gort Na Bró Realignment - Ch. 2+210	0.34	Existing Sewer	Non-Sealed
S31A	Side Road	Upgrading of Letteragh Road - Ch. 7+275	0.09	Watercourse	Non-Sealed
S31B	Side Road	Upgrading of Letteragh Road - Ch. 7+275	0.15	Watercourse	Non-Sealed
S31C	Side Road	Upgrading of Letteragh Road - Ch. 7+275	0.25	Existing Sewer	Non-Sealed
S32	Side Road	Realigned Clybaun Road and Rahoon Road - Ch. 6+325	0.80	Existing Sewer	Non-Sealed

Drainage Network Ref. No.	Link Road/Side Road	Road Name and Chainage	Approx. Total Drainage Area (ha)	Outfalling to	Drainage System Type (Sealed/Non-Sealed)
S33	Side Road	Realigned Racecourse Avenue - Ch. 15+000	0.83	Existing Sewer	Sealed
S36A	Side Road	Realigned Aille Road North - Ch. 3+300	0.24	Watercourse	Non-Sealed
S36B	Side Road	Upgrading of Aille Road South - Ch. 3+300	0.10	Existing Ditch	Non-Sealed
S37	Side Road	Upgrading of Cappagh Road South - Ch. 4+450	0.21	Existing Sewer	Non-Sealed
S38	Side Road	Upgrading of Ballymoneen Road North - Ch. 5+650	0.14	Existing Sewer	Non-Sealed
S39	Side Road	Realigned entrance of Gateway Retail Park in Knocknacarra	0.22	Existing Sewer	Non-Sealed
S40	Side Road	Upgrading of Seanbóthar and access road - Ch. 10+500	0.16	Infiltration Basin	Sealed
S41	Side Road	School Road - Ch. 13+150	0.24	Existing Sewer	Sealed

Side roads that do not require kerbs will be drained using either over-the edge drainage or combined filter drains where appropriate in accordance with the principles described above. The drains will discharge to an outfall, a sealed drain or to the mainline drainage system.

Outfalls, Attenuation Ponds and Infiltration Basins

West of the N59 Moycullen Road the surface water collected by the carriageway drainage system will be discharged to watercourses crossed by, or adjacent to, the proposed road development. In order to prevent discharge from the road increasing the peak flow rate of water within many of the watercourses, which may compound any flooding downstream of the proposed road development, flow restriction and attenuation storage is proposed. Attenuation ponds have been selected as the main attenuation facility provided along the proposed road development. Attenuation ponds will not be lined to the west of the N59 Moycullen Road and can become a feature of the landscape in time and is in line with current best practice guidelines. The proposed outfalls, with proposed attenuation ponds, have been chosen at appropriate locations along the route of the proposed road development typically as close as possible to an existing watercourse. **Table 5.11** details the drainage networks that discharge to watercourses and the associated volumes of storage required to attenuate peak flows up to the 1 in 100 year return period storm event.

Table 5.11: Proposed Mainline and Link Road Drainage Networks Discharging to Surface Waterbodies

Drainage Network Ref. No.	Approx. Total Drainage Area (ha)	Approx. Pavement Area (ha)	Approx. Attenuation Pond - Volume of Storage (m³)	Network Discharge Q100 (l/s)
S1	2.05	1.29	894	8.4
S2	0.55	0.38	184	5.0
S3	2.31	1.28	1028	8.7
S4A	0.96	0.62	324	5.2
S5A	2.45	1.53	977	9.7
S7A	0.30	0.24	81	4.8
S7B	2.94	1.07	1081	11.5
S8	0.42	0.26	114	4.7
S9	1.75	1.19	796	8.2
S10	2.19	1.22	873	8.3
S12	3.15	2.45	1697	11.5
S13	0.91	0.63	378	5.0
S14A	5.66	2.20	1975	21.0
S14B	0.85	0.65	613	5.2
S18A	1.75	1.58	N/A	427.7
S18B	2.27	1.95	N/A	494.8
S21A	3.31	1.36	1568	5.2

Drainage Network Ref. No.	Approx. Total Drainage Area (ha)	Approx. Pavement Area (ha)	Approx. Attenuation Pond - Volume of Storage (m ³)	Network Discharge Q100 (l/s)
S4B	0.12	0.07	21	4.2
S15	1.89	0.73	692	7.5

Where the drainage system outfalls to a watercourse the final outfall level (after the attenuation and treatment measures) shall be set above the 1 in 5 year flood level of the watercourse where possible. Furthermore, an assessment of the impact of the outfall from the pond on the hydraulic regime of the watercourse has been undertaken (**Chapter 11, Hydrology**).

A flow control device (Hydro-Break or similar) will be installed at the outfall location of all attenuation ponds to restrict the flow rate from the pond to the receiving watercourse. The discharge rate for each drainage catchment is set to the Q_{bar} greenfield runoff rate to replicate the existing environment or to a minimum of 5 l/s to minimise the risk of blockage from debris within the network.

There are a number of outfalls to existing sewers along the proposed road development. The surface water sewers are generally located in the more urbanised areas adjacent to the proposed road development, where existing streams and ditches have already been previously culverted to facilitate development. **Table 5.12** details the drainage networks that discharge to existing storm sewers.

Table 5.12: Proposed Mainline & Link Road Drainage Networks Discharging to Storm Sewers

Drainage Network Ref. No.	Approx. Total Drainage Area (ha)	Approx. Pavement Area (ha)	Network Discharge Q100 (l/s)	Receiving Storm Sewer Diameter (mm)
S11	2.02	1.57	7.8	300
S26	5.12	3.47	4.5	900
S29	2.73	2.07	5.0	900
S30	6.33	4.58	5.7	900
S16A	4.16	2.15	16.1	450
S17A	1.08	0.98	5.7	1500
S22C1	1.46	1.36	5.0	900

To the east of the N59 Moycullen Road the surface water collected by the carriageway drainage system will be discharged to ground via an infiltration basin where a positive outfall to a watercourse is not available. Ground investigations have been undertaken at the proposed locations of the infiltration basins to determine the permeability of the existing soil and bedrock and inform the design of the infiltration basins. Where the infiltration rate is outside the range of the permissible flow rates (e.g. discharge directly to karst limestone bedrock) then the base layer of the infiltration basin will be created synthetically to reduce the infiltration rate artificially. The design infiltration rate for the proposed road development is 0.036m/hr. The infiltration basins have been sized so as to drain

down to half volume in a 24-hour period. The infiltration basins will not be lined so as to allow for infiltration to ground. **Table 5.13** details the proposed drainage networks that discharge to ground via infiltration basin.

Table 5.13: Proposed Mainline and Link Road Drainage Networks Discharging to Ground via Infiltration Basins

Drainage Network Ref. No.	Approx. Total Drainage Area (ha)	Approx. Pavement Area (ha)	Infiltration Basin - Volume of Storage (m ³)	Approx. Invert Level (mAOD)
S19A	1.95	1.66	1226	11.15
S19B	2.22	1.68	1112	10.24
S20	4.95	2.23	1928	14.74
S21B	8.28	4.82	4227	18.53
S22A	5.68	3.94	2953	14.07
S22B	3.06	2.76	2543	37.93
S27	5.47	N/A	N/A	N/A
S22E	0.79	0.69	300	45.71
S22C2	0.55	0.52	290	38.64

To the East of the N59 Moycullen Road, where attenuation ponds and discharge to watercourses or public sewers are proposed in the karst limestone area, the base of the attenuation ponds will be lined to prevent infiltration to groundwater using a synthetic or suitable clay liner.

All attenuation ponds and infiltration basins will cater for return period up to a 1 in 100 year storm event minimising any increase in flood risk to adjacent properties as set out in Clause 7.5 of DN-DNG-03022 (HD33/15). A minimum freeboard of 300mm is provided between the maximum water level in the attenuation pond or infiltration basin and the top level of the pond/basin or the pond/basin protection bund. Peak discharge rates from the proposed road development will not exceed the peak discharge rates in the greenfield scenario for the critical storm return period. The pond/basin will be bunded to a level 500mm above any adjacent 1 in 100 year flood levels in rivers or streams. To reduce the risk of receiving water and groundwater being contaminated by runoff from the proposed road development, pollution control measures will be provided as detailed in the following section.

Pollution Control

Pollution control measures are proposed prior to each outfall/discharge point from the carriageway to reduce the risk of watercourses or groundwater being contaminated by runoff from the proposed road development. A range of pollution control measures have been adopted along the length of the proposed road development which includes combined filter drains, attenuation ponds, grassed surface water channels, petrol and oil interceptors, emergency spill containment areas, surface flow wetlands and infiltration basins.

Sustainable drainage systems (SuDS) have been considered in the first instance. Only where there is insufficient space or the road geometry precludes their

inclusion (e.g. on embankments higher than 1.5m or in cuttings with groundwater drainage problems) were other conventional methods used. In general, where the risk to groundwater is low combined filter drains form the first treatment against pollutants making their way into surrounding water bodies as combined filter drains can reduce the release of pollutants. The filter material will trap suspended solids and other contaminants thus reducing the downstream pollution risk. Where the proposed road development carriageway runoff will drain into grassed surface water channels, the slow moving flow through the wide shallow grassed channels will allow for the processes of sedimentation and adsorption to take place while carrying the runoff to the outfall.

Where the groundwater is highly vulnerable, typically in the karstic area to the east of the River Corrib, a sealed drainage system will collect and distribute surface water runoff to a suitable outfall location/discharge point (e.g. carrier pipe with gullies, concrete surface water channels, slot drains etc.) Sub surface flow will be collected in a series of narrow filter drains.

At each mainline and link road drainage network across the proposed road development, a SuDS surface flow (SF) treatment wetland will also be provided upstream of each attenuation pond or infiltration basin to further treat runoff. The surface flow wetlands have been sized to store the 'First Flush' runoff from their associated road pavement catchments in the permanent pool. This comprises a volume equal to a 15mm depth of rainfall on the road catchment. This 'First Flush' runoff carries the highest load of pollutants, compared to runoff discharged later in the rainfall event. The minimum depth of the permanent pool is 600mm which will further encourage settlement of suspended solids and will be lined to reduce the risk of watercourses or groundwater being contaminated by runoff from the proposed road development. Suitable planting and additional measures will be employed to encourage the settlement of silt and absorption of any remaining pollutants i.e. silt traps, reed beds. The increased retention time provided by the wetland will provide additional time for further adsorption and sedimentation to take place and will also allow for a range of natural biological processes (including biodegradation, microbial action and plant uptake) to further remove waterborne pollutants.

Oil and petrol interceptors will be provided upstream of the wetland and attenuation pond/infiltration basin to prevent any contamination from hydrocarbons, such as oil or petrol spillages, from entering the receiving water or groundwater. The interceptors will be sized for each drainage catchment according to the inflow. Along the mainline of the proposed road development a minimum emergency spill containment volume area equal to 25m³ will be provided at all outfall locations as set out in the TII Drainage Standards.

The outfalls of each drainage network have been assessed individually for potential impacts to the water environment as part of the HD45 assessments and appropriate methods of treatment applied in accordance with TII requirements, the assessments are detailed in the **Chapter 10, Hydrogeology** and **Chapter 11, Hydrology**. The adopted pollution control measures are listed in **Table 5.14**.

Table 5.14: Proposed Pollution Control Measures for Mainline, Link Road and Side Road Drainage Networks

Drainage Network Ref. No.	Discharging to	Pollution Control Measure
S1	Watercourse	Spillage Containment Pipe, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S2	Watercourse	Spillage Containment Pipe, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S3	Watercourse	Spillage Containment Pipe, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S4A	Watercourse	Spillage Containment Area, Oil and Petrol interceptor, Wetland, Attenuation Pond
S5A	Watercourse	Spillage Containment Area, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S7A	Watercourse	Spillage Containment Pipe, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S7B	Watercourse	Spillage containment Area, Oil and Petrol interceptor, Wetland, Attenuation Pond
S8	Watercourse	Spillage containment Area, Oil and Petrol interceptor, Wetland, Attenuation Pond
S9	Watercourse	Spillage Containment Area, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S10	Watercourse	Spillage Containment Pipe, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S11	Existing Sewer	Spillage Containment Area, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S12	Watercourse	Spillage Containment Area, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S13	Watercourse	Spillage Containment Area, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S14A	Existing Culvert	Spillage Containment Pipe, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S14B	Watercourse	Spillage Containment Pipe, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S18A	Watercourse	Spillage Containment Pipes, Oil and Petrol Interceptor, Wetland
S18B	Watercourse	Spillage Containment Area, Oil and Petrol Interceptor, Wetland
S19A	Infiltration Basin	Spillage Containment Area, Oil and Petrol Interceptor, Wetland, Infiltration Basin
S19B	Infiltration Basin	Spillage Containment Area, Oil and Petrol Interceptor, Wetland, Infiltration Basin
F19	Foul Sewer	Spillage Containment Area, Oil and Petrol Interceptor discharging to Foul Sewer. Discharge to be treated at Mutton Island Waste Water Treatment Works

Drainage Network Ref. No.	Discharging to	Pollution Control Measure
S20	Infiltration Basin	Spillage Containment Area, Oil and Petrol Interceptor, Wetland, Infiltration Basin
S21B	Infiltration Basin	Spillage Containment Area, Oil and Petrol Interceptor, Wetland, Infiltration Basin
S22A	Infiltration Basin	Spillage Containment Area, Oil and Petrol Interceptor, Wetland, Infiltration Basin
S22B	Infiltration Basin	Spillage Containment Area, Oil and Petrol Interceptor, Wetland, Infiltration Basin
F24	Foul Sewer	Spillage Containment Area, Oil and Petrol Interceptor discharging to Foul Sewer. Discharge to be treated at Mutton Island Waste Water Treatment Works.
S26	Existing Sewer	Spillage Containment Pipe, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S27	Existing M6 Infiltration Basin	Existing M6 Infiltration Pond
S21A	Attenuation Basin	Spillage Containment Pipe, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S22E	Infiltration Basin	Spillage Containment Area, Oil and Petrol Interceptor, Wetland, Infiltration Basin
S29	Existing Sewer	Spillage Containment Area, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S30	Existing Sewer	Spillage Containment Area, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S4B	Watercourse	Spillage Containment Area, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S15	Watercourse	Spillage Containment Area, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S16A	Existing Sewer	Spillage Containment Area, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S17A	Existing Sewer	Spillage Containment Pipe, Oil and Petrol Interceptor, Wetland, Attenuation Pond
S22C1	Existing Sewer	Spillage Containment Pipe, Oil and Petrol Interceptor, Attenuation Pond
S22C2	Infiltration Basin	Spillage Containment Pipe, Oil and Petrol Interceptor, Infiltration Basin
S5B	Watercourse	None Required, overlay of existing local road
S16B	Existing Sewer	Online Attenuation - Flow Control and Oversized Pipes
S17B	Existing Sewer	Online Attenuation - Flow Control and Oversized Pipes
S31A	Watercourse	None Required, overlay of existing local road
S31B	Watercourse	None Required, overlay of existing local road
S31C	Existing Sewer	Online Attenuation - Flow Control and Oversized Pipes
S32	Existing Sewer	Attenuation Pond

Drainage Network Ref. No.	Discharging to	Pollution Control Measure
S33	Existing Sewer	Attenuation Tank
S36A	Watercourse	None Required, upgrade of existing local road
S36B	Existing Ditch	None Required, overlay of existing local road
S37	Existing Sewer	Online Attenuation - Oversized Pipes
S38	Existing Sewer	None Required, overlay of existing local road
S39	Existing Sewer	None Required, overlay of existing local road
S40	Infiltration Basin	Spillage Containment Area, Oil and Petrol Interceptor, Infiltration Basin
S41	Existing Sewer	None Required, overlay of existing local road

The regular inspection and maintenance of drainage systems is essential for continued protection of the natural water regime into which the road runoff discharges and must take priority. Maintenance procedures are to be undertaken as set out in TII Publications, guidance documents and best practice methods.

5.5.4.9 Utilities

The infrastructure of a number of service providers is impacted by the proposed road development. The provision of the proposed road development shall ensure there are no permanent disruptions to services provided by these bodies and that all temporary disruptions must be kept to a minimum. Where services diversions are required all design works and construction works must be carried out in coordination with the relevant statutory bodies and services providers.

Furthermore, these services are being developed and expanded on an on-going basis. In order to avoid trenching in the new road for services after completion, provision must be made at construction stage for future crossing by services where agreed with local authority.

The following statutory bodies and service providers were consulted to identify conflict areas between their services and the proposed road development:

- Galway County Council – Watermain, Surface Water Drainage, Foul Sewer
- Galway City Council – Watermain Surface Water Drainage, Foul Sewer
- Irish Water – Watermain, Foul Sewer
- Eir
- ESB Networks – Low to Medium Voltage
- ESB Networks as the Transmission system Owner and EirGrid as the Transmission System Operator ESB International (ESBI), – High Voltage
- Gas Network Ireland – Transmission and Distribution
- E-Net
- Virgin Media

- BT Ireland
- SSE Airtricity
- Three Networks Ireland

All works required for the diversion or protection of any of the above services in conflict with the proposed road development have been confirmed with each of the service providers. Further details on the locations, potential utility impacts and proposed measures are included in **Chapter 15, Material Assets Non-Agriculture**.

5.5.4.10 Noise Barriers

The aspects relating to noise barriers are discussed in **Chapter 17, Noise and Vibration**.

5.5.4.11 Biodiversity measures

Four new artificial bat roosts and the modification of one existing building to become a bat roost are proposed as part of the proposed road development. Full details of these roosts are discussed in **Chapter 8, Biodiversity**.

5.5.4.12 Permanent Maintenance Facilities

There are two permanent maintenance facilities proposed as part of the proposed road development. These tunnel services, monitoring and maintenance buildings (TSB) will house operations personal and tunnel plant and equipment and will include an office area, control room, technical equipment room(s) (TER(s)), staff welfare facilities, stores and plant rooms to assist with the monitoring and control of traffic and systems both leading up to and within the tunnel.

Both are located in close proximity to the proposed tunnel structures. These permanent maintenance facilities will serve as tunnel services, monitoring and maintenance buildings. One facility is located in Lackagh Quarry on the south side of the eastern portal of Lackagh Tunnel and the other is located at Galway Racecourse adjacent to the western portal of the Galway Racecourse Tunnel as shown on **Figure 5.1.8** and **5.1.10** respectively.

These buildings will be serviced with electrical services, surface water drainage, potable water supply and foul water drainage. Heating, ventilation and air conditioning will be required to the TSB.

The surface water drainage design for the Lackagh TSB and Galway Racecourse Tunnel TSB site compounds are designed in accordance with best practice and BS EN-752 – Drain and Sewer Systems outside buildings. Roof runoff is collected from the rainwater down pipes and discharged to a system of carrier pipes located within the site compound. Runoff from the service yard and car parking areas will be collected using road gullies. Discharge from the service yard area will be routed through a Class 1 full retention forecourt oil and petrol interceptor located within the TSB site compound. The outfall discharge from the Lackagh TSB site is to ground via an infiltration basin which is provided as part of the mainline road drainage system. The outfall discharge from the Galway Racecourse Tunnel TSB

site is to the existing trunk storm sewer located to the north of the eastern Racecourse Tunnel portal. The flow will be attenuated in an underground attenuation tank and released at a design discharge flow of 5l/s.

The water demand for the potable water supply is based on 10 staff per building with an assumed usage of 60 litres per person per day. The water connections will also be utilised as needed to fill the tunnel fire water storage tanks. A pre connection enquiry form has been approved in principle by Irish Water for the connection to the existing public watermains. The watermain connection for the Lackagh Tunnel TSB is to the existing 150mm diameter public watermain located in Coolough Road. The proposed new watermain connection for the Racecourse Tunnel TSB is to the proposed new 100mm watermain diversion, located in the realigned racecourse avenue.

Pre-Connection Enquiries have been approved in principle by Irish Water for the proposed foul connections required for the TSBs. The foul wastewater discharge for the Lackagh Quarry TSB will be pumped to the public foul sewer at the Barr na Coille (Crestwood) housing estate adjacent to the Coolough Road. The foul wastewater discharge for the Galway Racecourse Tunnel TSB will be by gravity to the realigned IDA foul sewer west of the eastern Galway Racecourse Tunnel portal.

The main access for Lackagh Quarry TSB will be from the existing main entrance of Lackagh Quarry on Coolough Road. The main access to the Racecourse Tunnel TSB will be from the realigned Racecourse Avenue. Emergency access is also provided from the proposed road development to both buildings. Car parking will also be provided at both sites.

Drawings of the details on these tunnel services, monitoring and maintenance buildings are included in **Appendix A.5.1**.

5.5.4.13 Land and Property Requirements

Galway County Council, together with Arup, undertook a series of meetings with affected landowners.

The findings of these meetings have been combined with land registry records to produce a comprehensive landownership mosaic for the proposed road development (ref **Figures 14.01 to 14.15**).

This landownership mosaic together with information gained during individual meetings was used to establish access requirements and to evaluate side road and mainline realignments. Requests made by the impacted landowners and the general public were evaluated and included to the extent that this was reasonably possible having regard to the objectives of the proposed road development.

The accommodation works proposed will be introduced to serve the landowners in the following ways:

- To ensure landowners are given access to the local road network in the area, and that access can be gained between the local road and primary road networks
- To provide access between severed and separated land parcels

The accommodation works include access roads to allow access to land severed by the proposed road development. These access roads are 4.0m wide with 1.0m grass verges on either side and shall be designed in accordance with TII Standard Construction Details (SCDs) CC-SCD-02754 and CC-SCD-00706.

The following is a list of access roads identified. These access roads will be private roads with a private right of way provided to those parties listed in the **Table 5.15** below under the reference number.

Table 5.15: Access Roads

Location		Plot ID / Landowner Reference	Comments
Approx. Chainage	Description		
Ch. 0+000	80m access road AR0/01	102, 103	Provides access to houses and land parcels both via single field gates as current access is onto the existing R336
Ch. 0+000 to Ch. 0+250	320m access road AR0/02	106, 107, 108, 109, 112	Provides access to attenuation ponds and land parcels via single field gates as current access is severed by the proposed road development
Ch. 0+650 to Ch. 0+700	65m access road AR0/03	-	Provides access to attenuation ponds.
Ch. 0+850 to Ch. 0+950	160m access road AR0/04	114, 117	Provides access to land parcels
Ch. 0+990	30m access road AR0/05	-	Provides access to attenuation ponds only
Ch. 1+100 (Troscaigh Road L5387)	35m access road AR1/01	130, 131, 7891	Re-graded entrance to a house and land parcels as current access via Foraí Maola Road is severed by the proposed road development
Ch. 1+300 (Troscaigh Road L5387)	30m access road AR1/03	144, 145	Provides access (via the proposed Na Foraí Maola to Troscaigh link road) to land parcels as current access arrangement is impacted by the proposed road development
Ch. 1+500	15m access road AR1/04	156, 157	Proposed access to tie-in to existing access to houses. Current access arrangement via Troscaigh Road L5387 is impacted by the proposed road development
Ch. 1+550	25m access road AR1/05	154	Provides access to land parcel as current access arrangement via Troscaigh Road L5387 is severed by the proposed road development
Ch. 1+550 to Ch. 1+675 (Troscaigh Road L5387)	215m access road AR1/06	149, 150, 151, 152, 153	Access to houses and land parcels but also provides access to attenuation ponds

Location		Plot ID / Landowner Reference	Comments
Approx. Chainage	Description		
Ch. 1+750 to Ch. 2+550	830m access road AR2/02	197, 171, 147, 174, 173, 172, 170, 169, 167, 166, 146, 165,	Provides access to houses and land parcels as current access via Ann Gibbons Road L13215 is severed by the proposed road development
Ch. 2+475 to Ch. 2+550	65m access road AR2/01	176	Provides access to land parcel via Ann Gibbons Road L13215 as land parcel is being severed by proposed development
Ch. 3+275	10m access road AR3/01	199	Provides access to land as current access via Aille road is altered by the proposed road development (located north of proposed Aille Overbridge S03/01)
Ch. 3+325 to Ch. 3+900	620m access road AR3/02	197, 205, 208, 209, 210	Provides access to land parcels via Aille Road L5384 as current access is severed by the proposed road development. Also provides access to attenuation ponds
Ch. 4+025 to Ch. 4+050	75m access road AR4/01	-	Provides access to attenuation ponds
Ch. 4+240 to Ch. 4+360	140m access road AR4/02	-	Provides access to attenuation ponds
Ch. 4+450 (South of Cappagh Road Junction)	20m access road AR4/03	213	Access re-alignment required due to the proximity with the proposed Cappagh Road signalised Junction
Ch. 4+450 (North of Cappagh Road Junction)	10m access road AR4/04	215	Access re-alignment required due to the proximity with the proposed Cappagh Road signalised Junction
Ch. 4+450 to Ch. 4+675 (North of Cappagh Road Junction)	185m access road AR4/05	216, 223, 226	Provides access onto land parcels as current access via Boleybeg Bóthrin is severed by the proposed road development
Ch. 4+525 to Ch. 4+650	145m access road AR4/06	223, 224, 226, 227	Re-alignment of Boleybeg Bóthrin as currently being severed by the proposed road development. Provides access onto land parcels

Location		Plot ID / Landowner Reference	Comments
Approx. Chainage	Description		
Ch. 4+950 to Ch. 4+990	60m access road AR4/07	-	Provide access to attenuation ponds. Pond access gate to be provided
Ch. 5+360 to Ch. 5+660 North of Ballymoneen Road Junction	345m access road AR5/01	223, 232, 230	Provide access to farmyard and land parcels as current access is directly onto the existing Ballymoneen Road
Ch. 5+600 to Ch. 5+625 South of Ballymoneen Road Junction	30m access road AR5/02	232	Access already provided to houses located directly onto Ballymoneen Road, but re-alignment needed due to the proximity with the proposed signalised Junction
Ch. 6+375 to Ch. 6+475	110m access road AR6/01	243	Provide access to land parcel as existing access via Clybaun Road is severed by the proposed road development
Ch. 6+525 to Ch. 6+560	45m access road AR6/02	312	Provides access to farmyard. Access provided as part of Clybaun Road re-alignment
Ch. 6+600 to Ch. 6+960	370m access road AR6/03	241, 239, 247	Provide access to land parcels as being severed by the proposed road development
Gort na Bró Link Road	25m access road AR6/06	479	Access provided to tie the proposed road development in to the existing access road which eventually provides access to Gateway Retail Park
Gort na Bró road	100m Gateway Retail Park Link Road AR6/04	-	Realignment of access to Gateway Retail Park Link Road including roundabout
Gort na Bró road	30m access road AR6/05	-	Access provided to tie the proposed road development in to the existing access road to Gort na Bró housing estate
Gort na Bró road - North	15m access road AR6/06	-	Provides access to Gateway Retail Park
N59 Link Road South Ch. 1+900	50m access road AR7/01	481	Provides access to land parcels as part of the proposed road development
N59 Link Road South Ch. 1+900	60m access road AR7/02	-	Provides access to Bun a' Chnoc and Culgharraí housing developments as part of the proposed road development
N59 Link Road South Ch. 1+900	55m access road AR7/03	-	Provides access to Bun a' Chnoc and Culgharraí housing developments as part of the proposed road development. Ties-in to AR7/02
Ch. 7+225 to Ch. 7+300	60m access road AR7/04	250	Located just off Letteragh Road L1323. Provides access to land parcel as current access is severed by the proposed road development

Location		Plot ID / Landowner Reference	Comments
Approx. Chainage	Description		
Ch. 7+260 to Ch. 7+450	200m access road AR7/05	272	Located just off Letteragh Road L1323. Provides access to land parcel as current access is severed by the proposed road development. Also access to attenuation ponds
N59 Link Road South Ch. 1+500	60m access road AR7/06	486	Located just off Letteragh Road L1323, near the at-grade Letteragh Road junction. Provides access to house as current access is impacted by the provision of the junction
N59 Link Road South Ch. 1+350 to Ch. 1+400	80m access road AR7/07	486, 272	Provide access to land parcels as current access is severed by the proposed road development
N59 Link Road South Ch. 1+140 to Ch. 1+190	70m access road AR7/08	289	Provides access to house as current access is provided via a private access road
N59 Link Road Ch. 0+700 to Ch. 0+860	210m access road AR7/09	289, 502, 505, 501	Provides access to land parcels as current access is severed by the proposed road development
Ch. 7+800 to Ch. 7+850. Access from local road network	160m access road AR7/10	506 504	Provides access to land parcel as current access is severed by the proposed road development. Access via The Heath housing development
N59 Link Road South Ch. 1+760	10m access road AR7/11	484	Provides access to land parcel as current access is severed by the proposed road development
Ch. 8+360 to Ch. 8+500	115m access road AR8/01	518, 517	Located just off the N59. Provides access to house and ties-in to existing housing development access (517). Current access is severed by the proposed road development. Also provides access to attenuation ponds
Ch. 8+375 to Ch. 8+450	165m access road AR8/02	515	Provides access to house as current access is severed by the proposed road development. Access connected to Circular Road L1020
Ch. 8+525 to Ch. 8+625	115m access road AR8/03	-	Located just off the N59. Provides access to Aughnacurra Estate (houses and land parcels) as current access is severed by the proposed road development. Access is to tie-in with the remainder of the existing access
Ch. 8+450	30m access road AR08/04	-	Located just off the N59 (northern part of the proposed road development). Ties-in to existing access road
Ch. 8+500	640m access road AR8/05	-	Provides access to attenuation ponds

Location		Plot ID / Landowner Reference	Comments
Approx. Chainage	Description		
Ch. 9+090 to Ch. 9+160	110m access road AR9/01	-	Provides access to NUIG Sporting Campus as current access is severed by the proposed road development. Also provides access to an attenuation pond located near-by
Ch. 9+710	120m access road AR9/02	559, 553	Underbridge that maintains and provides a link to land parcels to the south of Menlo Castle Bóithrín severed by the proposed road development. Also provides access to AR9/03 & AR9/04
Ch. 9+560 to Ch. 9+710	145m access road AR9/03	-	Provides access to attenuation ponds. Accessed from AR9/02
Ch. 9+710 to Ch. 9+850	160m access road AR9/04	565	Provides access to land parcel as current access is severed by the proposed road development. Accessed from AR9/02
Ch. 9+550	120m access road AR9/05	-	Provides access to land parcel as current access is severed by the proposed road development
Ch. 9+500	120m access road AR9/06	549	Provides access to land parcel as current access is severed by the proposed road development
Ch. 10+050 to Ch. 10+140	85m access road AR10/01	563, 568, 564	Located off Bóthar Nua, provides access to land parcels as current access is severed by the proposed road development
Ch. 10+475 to Ch. 10+890	420m access road AR10/02	581	Provides access to land parcels as current access is severed by the proposed road development; but also provides access to attenuation ponds - via AR10/03, AR10/04, AR10/05, AR10/06, or AR10/07
Ch. 10+625	100m access road AR10/03	563	Provides access to land parcel as current access is severed by the proposed road development. Also provides access to attenuation pond. Ties-in to AR10/02 & AR10/04
Ch. 10+625 to Ch. 10+670	65m access road AR10/04	553	Provides access to land. Ties-in to AR 10/03 & AR10/05
Ch. 10+625 to Ch. 10+725	125m access road AR10/05	-	Ties-in to AR 10/02 and AR 10/03. Loop around attenuation pond to allow the Over Height Vehicles coming from the emergency slip road (prior the Lackagh tunnel) exit the AR network
Ch. 10+825	20m access road AR10/06	-	Allow for turning movement of the Over Height Vehicles coming from the emergency slip road (prior the Lackagh tunnel) exit the AR network. Access road accessed from AR10/02
Ch. 10+620 to Ch. 10+700	70m access road AR10/07	-	Provides the last exit point for Over Height Vehicles travelling east-bound on the N6 GCRR before to enter the Lackagh tunnel. Connects to AR10/02
Ch. 11+075 to Ch. 11+575	615m access road AR11/01	-	Provides re-routing for Over Height Vehicles engaged on the N6 GCRR prior entering the Lackagh Tunnel when travelling west-bound.

Location		Plot ID / Landowner Reference	Comments
Approx. Chainage	Description		
			Also provides access to attenuation ponds, and Tunnel services building
Ch. 11+990 to Ch. 12+125	245m access road AR11/02	583, 603	Provides access to farmyards and land parcels along the existing Ballindooley Bóithrín as current access is severed by the proposed road development
Ch. 12+110 to Ch. 12+240	130m access road AR12/01	602	Provides access to commercial premises. Slight Re-alignment of the existing access as located in close proximity with the proposed N84 grade separated junction
Ch. 12+290 to Ch. 13+090	100m access road AR12/03	602	Provides access to land parcel of the commercial premises. Work required to realign existing access as it is located in close proximity with a proposed retaining wall
Ch. 12+540 to Ch. 13+100	630m access road AR12/04	626, 627	Provides access to land parcels via School Road, as current access is severed by the proposed road development. Also provides access to attenuation ponds. Maintains access to the northern portion of Hynes' Bóithrín
Ch. 13+140 to Ch. 13+180	70m access road AR13/01	631, 635, 7103	Re-alignment of the existing Spellman's Bóithrín access road due to the close proximity with the Overbridge S13/01. Provides access to houses and land parcels via School Road
Ch. 13+140 to Ch. 13+290	180m access road AR13/02	625, 651, 627	Provides access via School Road to land parcels as current access is severed by the proposed road development
Ch. 13+390 to Ch. 13+425	45m access road AR13/03	625, 658	Provides access to land parcels as current access is severed by the proposed road development. Located on an existing access road that connects with School Road
City North Business Park Link	145m access road AR13/04	690,	Provides access to City North Business Park commercial premises as existing access (from the N83 Tuam Road) is severed by the proposed road development. Access to be re-located onto the proposed City North Park Link. Also provides access to attenuation ponds
Ch. 13+725 (Off the N83 Tuam Road)	25m access road AR13/05	-	Provides access to attenuation ponds
Ch. 13+825 to Ch. 14+175 (Off the N83 Tuam Road)	470m access road AR13/06	683, 682, 681, 680, 679, 678, 677, 676,	Provides a new access to individual houses and land parcels which are currently accessed directly from the N83 Tuam Road. Access road will be segregated from N83 Tuam Road

Location		Plot ID / Landowner Reference	Comments
Approx. Chainage	Description		
		675, 674, 673, 658,	
Parkmore Link Road	50m access road AR13/07	695, 696	Re-alignment of the existing access to commercial premises (Ballybrit Business Park) so as to accommodate the proposed Parkmore Link Road
Parkmore Link Road	35m access road AR13/08	695	Re-alignment of the existing access to commercial premises (Ballybrit Business Park) so as to accommodate the proposed Parkmore Link Road
Parkmore Link Road	50m access road AR13/09	695	Re-alignment of the existing access to commercial premises (Ballybrit Business Park) so as to accommodate the proposed Parkmore Link Road
Parkmore Link Road	20m access road AR14/04	701	Provides access to land parcel as current access is severed by the proposed road development
Parkmore Link Road	45m access road AR14/05	696	Connects the proposed Parkmore Link Road with the existing Parkmore Industrial Estate internal road
Parkmore Link Road	75m access road AR14/07	691	Provides access to Galway Racecourse
Parkmore Link Road	20m access road AR14/08	691	Provides access to Galway Racecourse
Ch. 14+790 to Ch. 15+000	235m access road AR14/09	-	Provides the last exit point for Over Height Vehicles travelling east-bound on the proposed road development before to enter the Galway Racecourse Tunnel. Connects to AR15/01
Ch. 15+125	470m access road AR15/01	691, 707, 713	Re-alignment of the Racecourse Avenue which provides access to commercial premises, as current access is severed by the proposed road development. Also provides access to proposed Galway Racecourse Tunnel services building. Ties-in to AR14/09 but also AR 15/06
Ch. 15+200 to Ch. 15+725	545m access road AR15/02	691, 716, 701, 718, 719	Provides access to land parcels as current access is severed by the proposed road development. Also provides access to attenuation ponds. Ties-in to AR15/03 to the south, and to AR15/06 to the north; also provides access to AR15/07 users (Over Height Vehicle re-routing option)
Ch. 15+700 to Ch. 15+725	185m access road AR15/03	719, 721, 733	Provides access to Briarhill Business Park commercial premises (from Parkmore Road) as current access is severed by the proposed road development. The access road is proposed to pass

Location		Plot ID / Landowner Reference	Comments
Approx. Chainage	Description		
			under S15/02 bridge. Provides access to AR15/04 and to AR15/02
Ch. 15+690 to Ch. 15+720	30 m access road AR15/04	720, 719	Slight re-alignment of the current access to a commercial premise (from proposed AR 15/03) as it is in close proximity with the proposed S15/02 Underbridge
City East Business Park Junction	55m access road AR15/05	691	Re-alignment of the existing access road to the Galway Racecourse as part of the near-by junction's upgrade
Ch. 15+150 to Ch. 15+200	120m access road AR15/06	-	Provides connection (over the Galway Racecourse Tunnel) to AR15/01 and AR15/02 to facilitate the re-routing of Over Height Vehicles
Ch. 15+425 to Ch. 15+475	50m access road AR15/07	-	Provides re-routing for Over Height Vehicles engaged on the proposed road development prior entering the Galway Racecourse Tunnel when travelling west bound. Connects to AR15/02
Briarhill Link	55m access road AR16/01	724	Provides access to land parcel as current access is severed by the proposed road development
Ch. 16+800 to Ch. 16+830	30m access road AR16/02	756, 757	Upgrade/slight re-alignment of an existing access road to serve land parcel severed by proposed development boundary
Ch. 16+950 to Ch. 17+475	560m access road AR17/01	754, 753, 752	Provides access to land parcels as current access is severed by the proposed road development. Connects to existing access road

Alternative pitch facilities will be provided at NUIG to replace the existing pitches directly impacted by the proposed road development. The facilities include a floodlit 3G GAA pitch and a floodlit 3G training area and associated site infrastructure for the drainage of these pitches and furniture such as ball-stop netting. The proposed road development also intercepts the existing sports pavilion resulting in direct impacts to its western end and the building will be modified as follows:

- the existing western plant room, 1 no. changing room, 1 no. storage area, 1 no. weights area and associated access hallways on both ground floor and upper levels will be demolished
- the western plant room and its associated plant will be relocated
- Construction and reconfiguration of the internal and external walls, roof, windows and door locations

Refer also to **Chapter 15, Material Assets Non-Agriculture** and **Appendix A.15.1**.

Temporary stables will be provided for Galway Racecourse during the construction of the proposed road development until such time as the Galway Racecourse Tunnel

is complete and the permanent stables are constructed. This is further discussed in **Chapter 15, Material Assets Non-Agriculture** and **Appendix A.15.2**.

5.5.4.14 Demolitions and Acquisitions

One of the project objectives for the proposed road development was “to seek to preserve existing well established communities”. Therefore, from the outset of the design of the proposed road development every effort was made to avoid property demolitions where possible. However, there are still unfortunately and unavoidably a number of property demolitions that are necessary for the construction of the proposed road development and to secure the many benefits the proposed road development offers as follows:

- 44 residential properties
- 2 industrial properties (one property includes four buildings)
- 2 commercial properties

In addition to the demolition of 44 residential properties, an additional 10 residential properties require full acquisition.

In addition to the demolition of 44 residential properties, an additional 10 residential properties, one commercial property and one landholding that has a full residential planning permission require full acquisition.

It is proposed that 17 farm buildings will be acquired to accommodate the proposed road development.

These properties and structures are also discussed in more detail in the following chapters of the EIAR:

- Chapter 12, Landscape and Visual
- Chapter 13, Architectural Heritage
- Chapter 14, Material Assets Agriculture
- Chapter 15, Material Assets Non-Agriculture
- Chapter 18, Human Beings, Population and Health

5.5.4.15 Planning Permission Modifications

The proposed road development will require the acquisition of lands from five properties upon which there is currently full planning permission for residential development or commercial development. These acquisitions will result in either the revocation or the need for modification of the planning permission. These properties are listed below in **Table 5.16** and set out in the Seventh Schedule of the Protected Road Scheme and Motorway Scheme.

Table 5.16: Non-Agricultural Planning Permissions affected by the proposed road development

PRS / MS Ref. Number	Townland	Description	Area of Property (Ha)	Description of Landtake/ Modification	Land to be Acquired (ha)
124	Na Foraf Maola	House and garden	0.47	Acquisition of whole site	0.47
149	Troscaigh Thiar	Planning permission for roadside boundary wall and existing access point as constructed with all associated works and ancillary services.	0.20	Boundary Wall relocation, Road Bed acquisition	0.01
229	Ballyburke	Planning permission granted for the demolition of two existing houses shed and outbuildings, construction of crèche, 3 no retail units, 3 no office units, bar/restaurant and 299 residential units in varying design and form, in two and three storey blocks, bin storage, ESB substation, surface and basement car parking and all associated external and site development works including 3 vehicular access points and road widening along Ballymoneen Rd. (1454) (Extension of time to 18/07/2019)	9.2	Severance of site	1.45
528_543	Dangan Lower	Permission for new all-weather sports pitch on the site of existing training pitch (including floodlighting)(14104)	95.896	Partial acquisition of property	6.293
528_543	Dangan Lower	Permission for flood lighting of existing GAA pitches adjacent to the river. (17159)	95.896	Partial acquisition of property	6.293

5.6 Functionality of N6 GCRR

The function of the N6 GCRR is to facilitate the reduction of existing traffic congestion and future proof the effectiveness of this part of the national road network. To achieve this dual functionality, the proposed road development design sought to:

1. provide for the strategic need of the TEN-T comprehensive road network and connectivity of Galway City and the West Region to the national road network
2. provide an additional crossing of the River Corrib, thus facilitating the reduction of congestion on city centre roads, and allow the reallocation of road space in the city network to non-motorised modes of transport, thereby facilitating the effective implementation of all the elements contained in the GTS, namely the improvement of public transport, cycling and walking measures

The transport strategy for Galway (i.e. the GTS) has been developed to segregate and direct people to the most appropriate mode, which allows the road component of this strategy to serve the function for which it is designed. The N6 GCRR will serve the strategic traffic currently trying to cross the city via the existing N6 as well as the strategic traffic that is currently trying to rat-run through the city using the existing city street network due to the congestion levels on the national road network. The N6 GCRR will free up road space in the city centre that can be used by other modes of transport. The city at its heart serves a strategic function as the economic engine for the West Region and must be free of congestion to enable it to do so.

The grade separated junctions on the N59 Moycullen Road, N84 Headford Road, N83 Tuam Road and Coolagh Junction provide the necessary connections to distribute traffic in accordance with demand, whilst also being of a standard to comply with TEN-T regulations (ref **Chapter 2, Planning and Policy Context**) which require that all roads that form part of the TEN-T Comprehensive network, as a minimum, be a high quality road. Regulation (EU) No 1315/2013 sets out the requirements for high quality roads that shall form part of the network, both Core and Comprehensive.

The N59 Letteragh Junction is a standard grade separated junction, but is offset from the N59 Moycullen Road. The purpose of this offset from the N59 Moycullen Road is two-fold, firstly to minimise the direct impact on residential property at the N59 Moycullen Road bridge crossing and secondly to provide better connectivity and traffic distribution from the proposed road development to Knocknacarra and the crossing of the N59 Moycullen Road area. The N59 Link Road South connects to the Letteragh Road and Ragoon Road which effectively distributes traffic accessing National University of Ireland, Galway (NUIG) South (south of the Quincentary Bridge), Knocknacarra and University Hospital Galway (UHG), whilst the N59 Link Road North facilitates traffic accessing NUIG North (Sporting Campus), N59 Moycullen Road and Connemara.

The N84 Headford Road Junction is a standard grade separated junction located on the N84 Headford Road to connect with the N84 Headford Road national road traffic. The layout as shown on **Figures 5.1.08** and **5.1.09** is the minimum footprint

achievable. However, this junction does directly impact on residential property in this area due to the presence of ribbon development along the N84 Headford Road (ref **Chapter 15, Material Assets Non-Agriculture**).

The N83 Tuam Road Junction is a combined junction to serve the demand arising from the N83 Tuam Road and the demand arising from the business parks in the Parkmore and Ballybrit area. As the forecast volume of movements in the N83 Tuam Road area could not be accommodated via single junction slips, alternative layouts had to be considered. The solution determined as most suitable and capable of delivering suitable capacity was a merge / diverge arrangement split between the N83 Tuam Road and Parkmore Link Road. The key features of this layout are as follows:

- Eastbound diverge from the proposed road development to the existing N83 Tuam Road and westbound merge from the existing N83 Tuam Road to the proposed road development
- No direct connection from the existing N83 Tuam Road to the proposed road development travelling eastbound or no direct connection from the proposed Parkmore Link Road to the proposed road development travelling westbound. However, the forecast volume of such movements was minimal and they were therefore accommodated via the provision of a connection from the proposed Parkmore Link Road to the existing N83 Tuam Road, the City North Business Park Link Road

The proposed N83 Tuam Road Junction arrangement facilitates the efficient movement of all road users (motor vehicles, buses, trucks, bicycles, and pedestrians). The layout has the benefit of minimising the number of traffic conflicts by segregating the major movements and by providing connections between the proposed and existing road networks as appropriate.

The grade separated junction at the eastern terminus of the N6 at Coolagh provides an efficient partial free-flow transfer of traffic from the existing N6 to the proposed road development. Traffic destined for the eastern part of the city diverges from the existing N6 to an at-grade junction in the vicinity of the existing N6 Coolagh Roundabout. Clear signage at this signalised junction, together with appropriate gantry signage in advance of the split for the proposed road development will enable drivers to make the appropriate choice to arrive at their destination.

5.7 References

DoEHLG and National Construction & Demolition Waste Council (NCDWC). *Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects*.

BS5489-1, ISEN13201 Code of Practice for the Design of Road Lighting, Part 1: lighting of Roads and Public Amenity Areas

Department for Transport, Tourism and Sport (DTTAS):

- Traffic Signs Manual, 2010
- Design Manual for Urban Roads and Streets (DMURS), 2013

Transport Infrastructure Ireland (TII) Publications:

- DN-GEO-03031– Road Link Design
- DN-GEO-03057– Geometric Design to Improve Surface Drainage
- DN-GEO-03043– Geometric Design of Major/Minor Priority Junctions and Vehicular Access to National Roads
- DN-GEO-03033– Geometric Design of Roundabouts
- DN-GEO-03035– Layout of Grade Separated Junctions
- DN-GEO-03036– Cross-Sections and Headroom.

TII Environmental Guidelines:

- *Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan*

National Transport Authority (NTA), *National Cycle Manual*, 2011

UK DMRB:

- HD 33/06 and 2009 NRA addendum – Surface and Sub-Surface Drainage Systems for Highways
- TD 16/06 and 2009 NRA addendum – Geometric Design of Roundabouts
- TD 22/06 and 2009 NRA addendum – Layout of Grade Separated Junctions
- TD 34/07 - Design of Road Lighting for the Strategic Motorway and Trunk Road Network