

A5 Western Transport Corridor

Environmental Statement

Volume 1

February 2016

Produced for

transportni



Department for
**Regional
Development**
www.drdni.gov.uk

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Preface

The Department for Regional Development, Transport NI is proposing an upgrade of the A5 corridor by building a new dual carriageway between New Buildings and Aughnalcoy – the A5 Western Transport Corridor. This Environmental Statement 2016 (ES) reports the findings of detailed environmental assessments undertaken during the development of the Proposed Scheme 2016.

Information relating to the Environmental Statement and supporting documentation is available in three Volumes:

Volume 1 – Environmental Statement

Volume 2 – Figures

Volume 3 – Appendices (5 Parts)

A copy of the Environmental Statement, together with a Non-Technical Summary outlining the information provided in the ES, has been deposited at each of the locations indicated overleaf and will be available for inspection, free of charge, until 4th April 2016 during normal opening hours.

Hard copies of the Non-Technical Summary and electronic copies of the whole ES (CD) are available free of charge, on written request, from: Seamus Keenan, Transport NI Western Division, Boaz House, 15 Scarffe's Entry, Omagh, BT78 1JE.

The whole ES can also be viewed on the project website (www.a5wtc.com)

Deposit Locations

The Environmental Statement is available for inspection, free of charge, at the following deposit locations.

TransportNI Western
Division
County Hall
Drumragh Avenue
Omagh
BT79 7AF

TransportNI Londonderry &
Strabane Section Office,
1 Crescent Road,
Londonderry
BT47 2NQ

TransportNI
Fermanagh & Omagh
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BT79 0JJ

TransportNI
Headquarters Room 213
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98 Strand Road,
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BT48 7NN

Derry City & Strabane
District Council
47 Derry Road
Strabane
BT82 8DY

Fermanagh and Omagh
District Council
The Grange
Mountjoy Road
Omagh
BT79 7BL

Donegal County Council
Public Services Centre
Drumlonagher
Donegal

Monaghan County Council
Roads Office
Mtek II Office
Armagh Road
Monaghan

Expressions of support, representations, or opinions should be sent to the Divisional Manager, Roads Service Western Division, County Hall, Drumragh Avenue, Omagh, BT79 7AF. Expressions of support, representations, or opinions will be accepted up to 4th April 2016.

Document Control Sheet

Project Title	A5 Western Transport Corridor
Report Title	Environmental Statement Volume 1
Revision	REV A
	Document Reference Number: 718736-3000-R-008
Status	FINAL
Control Date	February 2016

Record of Issue

Issue	Status	Author	Date	Check	Date	Authorised	Date
1	FINAL	S. Ireland	10.01.16	P. Reid	11.01.16	P. Edwards	15.01.16

Distribution

Organisation	Contact	Copies
Department for Regional Development, TransportNI	David Millar	1 (e)
	Seamus Keenan	1 (e)

Contents

VOLUME 1: ENVIRONMENTAL STATEMENT

1	INTRODUCTION.....	1-1
1.1	The A5 Western Transport Corridor (A5WTC)	1-1
1.2	The Proposed Scheme	1-1
1.3	Phasing	1-2
1.4	The Environmental Impact Assessment	1-3
1.5	The content of the Environmental Statement	1-3
1.6	The structure of the Environmental Statement	1-5
2	THE NEED FOR THE SCHEME	2-1
2.1	Policy Context	2-1
2.2	The Existing A5	2-2
3	CONSULTATION.....	3-1
3.1	Overall Approach	3-1
3.2	Public Exhibitions	3-1
3.3	Statutory Consultees and Other Stakeholders	3-3
3.4	Landowners and other Affected Parties.....	3-4
4	ALTERNATIVES.....	4-1
4.1	Alternative alignments.....	4-1
4.2	Refinement of the preferred route.....	4-6
4.3	Development of the Proposed Scheme	4-9
5	THE EXISTING ENVIRONMENT	5-1
5.1	Context.....	5-1
5.2	New Buildings to South of Strabane	5-1

5.3	South of Strabane to South of Omagh.....	5-2
5.4	South of Omagh to Aughnacloy.....	5-5
6	THE PROPOSED SCHEME.....	6-1
6.1	Introduction.....	6-1
6.2	Design Standards.....	6-1
6.3	Predicted traffic flows.....	6-2
6.4	Road alignment.....	6-3
6.5	Junctions.....	6-14
6.6	Side roads.....	6-16
6.7	Structures.....	6-16
6.8	Flood compensation areas.....	6-20
6.9	Watercourse diversions.....	6-20
6.10	Deposition areas.....	6-20
6.11	Drainage.....	6-21
6.12	Lighting.....	6-23
6.13	Works to existing utilities.....	6-23
6.14	Land Use Requirements.....	6-25
6.15	Landscape proposals and environmental mitigation.....	6-26
6.16	Construction.....	6-37
7	SCOPING AND INTRODUCTION TO THE ASSESSMENTS.....	7-1
7.1	Scoping of potential impacts.....	7-1
7.2	Format of the assessment chapters.....	7-2
8	AIR QUALITY.....	8-1
8.1	Executive summary.....	8-1
8.2	Scope of the assessment.....	8-1

8.3	Statutory and planning context	8-4
8.4	Methods of assessment	8-5
8.5	Baseline Environment	8-10
8.6	Predicted impacts and mitigation	8-12
8.6	Conclusions and effects	8-20
9	CULTURAL HERITAGE	9-1
9.1	Executive summary.....	9-1
9.2	Scope of the assessment.....	9-1
9.3	Statutory and planning context	9-2
9.4	Method of assessment.....	9-2
9.5	Baseline environment	9-8
9.6	Predicted impacts.....	9-27
9.7	Proposed Mitigation	9-31
9.8	Conclusions and effects.....	9-35
10	LANDSCAPE EFFECTS.....	10-1
10.1	Executive summary.....	10-1
10.2	Scope of the assessments.....	10-1
10.3	Method of assessment.....	10-3
10.4	Baseline environment – landscape character.....	10-13
10.5	Baseline environment – visual context	10-27
10.6	Predicted effects and mitigation – landscape character	10-33
10.7	Predicted effects and mitigation – visual effects.....	10-58
10.8	Conclusions and effects.....	10-80
11	ECOLOGY AND NATURE CONSERVATION.....	11-1
11.1	Executive summary.....	11-1

11.2	Scope of the assessments.....	11-1
11.3	Statutory and planning context	11-6
11.4	Methods of assessment	11-8
11.5	Baseline environment	11-16
11.6	Predicted impacts and mitigation	11-42
11.7	Conclusions and effects.....	11-91
12	GEOLOGY AND SOILS.....	12-1
12.1	Executive summary.....	12-1
12.2	Scope of the assessments.....	12-1
12.3	Statutory and planning context	12-2
12.4	Methods of assessment	12-3
12.5	Baseline environment	12-5
12.6	Predicted impacts.....	12-12
12.7	Proposed mitigation	12-13
12.8	Conclusions and effects.....	12-13
13	NOISE AND VIBRATION.....	13-1
13.1	Executive summary.....	13-1
13.2	Scope of the assessment.....	13-1
13.3	Methods of assessment	13-4
13.4	Baseline environment	13-12
13.5	Predicted impacts and mitigation	13-13
13.6	Conclusions and effects.....	13-28
14	EFFECTS ON ALL TRAVELLERS	14-1
14.1	Executive summary.....	14-1
14.2	Scope of the assessments.....	14-1

14.3	Statutory and planning context	14-2
14.4	Methods of assessment	14-2
14.5	Baseline environment	14-5
14.6	Predicted impacts and mitigation	14-10
14.7	Conclusions and effects.....	14-18
15	COMMUNITY AND PRIVATE ASSETS	15-1
15.1	Executive summary.....	15-1
15.2	Scope of the assessments.....	15-1
15.3	Methods of assessment	15-2
15.4	Baseline environment	15-8
15.5	Predicted impacts and mitigation	15-12
15.6	Conclusions and effects.....	15-17
16	ROAD DRAINAGE AND THE WATER ENVIRONMENT	16-1
16.1	Executive summary.....	16-1
16.2	Scope of the assessments.....	16-1
16.3	Statutory and planning context	16-5
16.4	Methods of assessment	16-6
16.5	Baseline environment	16-14
16.6	Predicted impacts and mitigation	16-27
16.7	Conclusions and effects.....	16-48
17	INTERACTIONS AND CUMULATIVE EFFECTS.....	17-1
17.1	Executive summary.....	17-1
17.2	Scope of the assessment.....	17-1
17.3	Cumulative effects	17-1

18	SCHEDULE OF ENVIRONMENTAL COMMITMENTS	18-1
	18.1 Introduction	18-1
19	REFERENCES.....	19-1

VOLUME 2: FIGURES (CHAPTERS 4, 6 AND 8 TO 16)

VOLUME 3: PART 1 – APPENDICES

Appendix 3 – Consultation

Appendix 10 – Landscape Effects

VOLUME 3: PART 2 – APPENDICES

Appendix 6 – Proposed Scheme

Appendix 8 – Air Quality

VOLUME 3: PART 3 – APPENDICES

Appendix 11 – Ecology and Nature Conservation

Appendix 12 – Geology and Soils

Appendix 13 – Noise and Vibration

VOLUME 3: PART 4 – APPENDICES

Appendix 7 – Scoping

Appendix 9 – Cultural Heritage

Appendix 14 – Effects on All Travellers

Appendix 16 – Road Drainage and the Water Environment

VOLUME 3: PART 5 – APPENDICES

Appendix 15 – Community and Private Assets

Glossary

“A”- Weighting: a reduction/weighting applied to the low and high frequency components of noise applied to obtain a single number representing the sound pressure level of a noise containing a wide range of frequencies in a manner approximating the response of the human ear.

Abstraction: removal of water from surface water or groundwater, usually by pumping and typically used for industrial, agricultural or drinking water supply.

Accidental Spillage: an incident on the road that results in the escape of potentially polluting substances onto the road surface, which may subsequently enter the road drainage system and lead to an acute pollution incident. This may include spillages, vehicle fires or road traffic collisions.

Accuracy: a measure of how well a set of data fits the true value.

Acoustic: pertaining to sound or to the sense of hearing.

Acute Pollution: a pollution incident resulting from a one off or short term event.

Air Quality Action Plan: a plan put together by a local authority to improve the air quality in the Air Quality Management Area.

Air Quality Management Area: an area declared by a local authority where the air quality objectives are not likely to be achieved.

Air Quality Objective: policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances with a specific timescale.

Air Quality Standard: the concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups.

Air Quality Strategy: the AQS sets a framework for reducing hazards to human health from air pollution and ensuring that international commitments are met in the UK. The AQS is designed to be an evolving process that is monitored and regularly reviewed

Ambient Noise: the total of all noise in the environment, other than the noise from the source of interest.

Anglo-Norman: the Anglo-Normans were the descendants of the Normans who ruled England following the conquest by William of Normandy in AD 1066. AD 1169 marks the invasion of Ireland by the Anglo-Normans.

Annual Average Daily Flow: a daily total traffic flow (24 hour), expressed as a mean daily flow across all 365 days of the year.

Annual Mean: the average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some chemical species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between 2 years, which is useful for pollutants that have higher concentrations during the winter months.

Archaeology: the scientific study of past human life and change through analysis of material remains that humans have left behind

Artefact: an object or part of an object which has been used or created by a human and provides physical clues to the activity carried out by humans in the area of discovery (This can range from Pottery, Metalwork, Woodwork, Worked Stones through to mortar samples)

Attenuation (Sound): the reduction of sound intensity by various means (e.g., air, humidity, porous materials).

Attenuation Pond (Water): a pond designed to accept large inflows from the road drainage system, but to discharge slowly to the receiving watercourse, thereby attenuating high road drainage flows which could otherwise cause flooding downstream. Also known as a balancing pond.

Background Noise: the noise in the environment, other than the noise from the source of interest.

Barrier (Sound): a sound barrier is any solid obstacle, which is relatively opaque to sound that blocks the line of sight from the sound source to receiver. Barriers may be erected specifically to reduce noise, for example: solid fences, earth berms, or freestanding walls.

Barrow: circular burial monument of the Bronze Age and Iron Age with a central area defined by a ditch and an external bank.

Base Flow Index: the proportion of the flow in a watercourse made up of groundwater. Base flow sustains the watercourse during extended periods of dry weather.

Bawn: a fortified enclosure normally associated with a Tower House. They date from the fifteenth century onwards.

Benthic Invertebrates: aquatic animals with no backbone such as crustaceans and larval insects which inhabit the bottom of a stream or lake.

Biodiversity Action Plan: a framework for achieving the conservation of biodiversity based on the targeting of resources towards priority habitats and species.

Biosecurity: procedures or measure designed to protect livestock against harmful biological or biochemical substances.

Brown Earth: freely draining soil.

Bryophytes: non-flowering plants such as mosses, hornworts and liverworts.

Bypass Oil Separator: highway drainage component which removes oil and other hydrocarbons from highway runoff. They are designed to capture and control flows from a rainfall event of up to 5mm/hr.

Cereal Field Margin: strips of land lying between cereal crops and the field boundary, and extending for a limited distance into the crop.

Cairn: mound composed of stones, sometimes with internal structures; usually a burial monument, but they are sometimes used as a memorial.

Chronic Pollution: a pollution incident resulting from continuous or regular discharges over a long period of time.

Cist: small box-shaped stone-lined grave, usually from the Bronze Age, containing the cremated remains in an urn or a crouched burial.

Conacre: the rental of land for agricultural production negotiated annually for an 11 month period.

Court Tomb: a Neolithic tomb found mainly in the UK and Ireland consisting of a chamber tomb adjoined by an open space marked off by large standing stones.

Cropmark: an archaeological site no longer visible on the ground due to the removal of upstanding remains (often by ploughing). The sites are recorded from aerial photographs by differential crop growth over buried features such as pits, ditches and walls.

Data Capture: the percentage of all the possible measurements for a given period that were deemed valid.

Decibel (dB): the decibel is a logarithmic unit of measure of sound pressure. One tenth of the bel.

Designated Site: an area which has been granted special protection under European, UK and/or Northern Ireland legislation, e.g. Special Protection Areas and Areas of Special Scientific Interest.

Diffusion Tube Monitoring: monitoring campaign using passive diffusion tube samplers to collect nitrogen dioxide pollutants by molecular diffusion along an inert tube to an efficient chemical absorbent. After exposure for a known time, the absorbent material is chemically analysed and the concentration calculated.

Discharge: release of effluent to surface water or groundwater, this may include treated sewage from wastewater treatment works and septic tanks, industrial effluent and road runoff.

Driver Frustration: a driver's inability to drive at a speed consistent with his or her own wishes in relation to the general standard of the road.

Driver Stress: the adverse mental and physiological effects experienced by a driver traversing a road network.

Drumlins: an elongated hill or ridge of glacial drift.

Earthwork (Archaeology): any monument made entirely or largely of earth.

Enclosure: any monument consisting of an enclosing feature, such as a bank or a ditch, usually earthen, such as barrows or ringforts.

Environmental Noise: unwanted sound from various outdoor sources which produce noise. Environmental noise sources include aircraft, cars, trucks, buses, railways, industrial plants, construction activities, etc.

Environmental Quality Standards (EQS): the maximum permissible concentration of a potentially hazardous chemical. It is used to assess the risk to the health of aquatic flora and fauna, and is typically quoted as an annual average concentration limit.

European Protected Species: any species (plant or animal) listed on Annex 2 or 4 of Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora; or bird species listed on Annex 1 of Council Directive 2009/147/EC on the conservation of wild birds.

Eskers: a long, narrow ridge of coarse gravel deposited by a stream flowing in or under a decaying glacial ice sheet.

Evaluation (Archaeology): a limited programme of non-intrusive and/or intrusive fieldwork, which determines the presence or absence of archaeological features, structures, deposits, artefacts within a specified area. This may take the form of an intrusive investigation of a percentage of the site, geophysical or topographical survey. The results of this investigation will establish the requirements for any further work.

Excavation: intrusive fieldwork with a clear purpose, which examines and records archaeological deposits, features and structures and recovers artefacts, ecofacts and other remains within a specified area or site. This will lead to both a further programme of Post Excavation and Publication and perhaps further excavation.

Exceedance: a period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate environmental standard.

Façade Corrections: a façade noise level is the noise level 1m in front of the most exposed window or door on the face of a building. The effect of reflection is to produce a slightly higher (+3dB) sound level than it would if the building was not there. This factor needs to be added when predicting noise levels.

Flow (Q_{95}): the flow rate of a watercourse that is exceeded for 95% of the time, a measure of low flow.

First Flush: During rainfall events the pollutants which have built up on the road surface during the antecedent dry period are washed off first. Typically, the runoff from the first 10mm of rainfall is often the most seriously polluted and is referred to as the first flush effect.

Frequency (Sound): number of complete oscillation cycles per unit of time. The unit of frequency is the Hertz (Hz).

Fulachta Fiadh: or Burnt Mound. Cooking / boiling sites characterised by a mound of burnt stones and charcoal and an accompanying trough and occasional hearth (for heating stones to be dropped into the water to heat it). Usually built in damp areas, where the trench for cooking in would fill with water; usually found in groups.

Geophysical Survey: a method of seeing beneath the ground surface using a number of methodologies, including Ground Penetrating Radar (GPR), Resistivity and magnetometry. It takes a specialist to both use the field equipment and interpret the data. When used with topographic survey the results can be very effective, though it is very dependent on soil and geological conditions within the site area.

GIS: Geographical Information System. A range of techniques using the graphic capabilities of computers for an integrated analysis of maps, images, sites and finds. GIS has rapidly become essential in the interpretation of fieldwork data and is used within County and other archaeological units.

Gley: poorly drained, clay based soils.

Groundwater: all water which is below the surface of the ground in the saturation zone (below the water table) and in direct contact with the ground or subsoil.

HAWRAT: Highways Agency Water Risk Assessment Tool, a Microsoft Excel based application which assesses the acute and chronic pollution impacts associated with soluble and sediment bound pollutants commonly found in routine runoff from roads.

Hertz: a unit of frequency, equivalent to one cycle per second.

Hillfort: large Late Bronze Age/Iron Age defensive hilltop enclosure defined by one or more large ramparts and consisting of banks with external ditches.

Holy Well: a natural spring or well associated with a saint or a tradition of cures.

Husbandry: the care, cultivation and breeding of crops and animals

In Situ: in its original place.

Insertion Loss of Barriers: the difference in sound pressure levels at a specified receiver position before and after the installation of a barrier, provided that the noise source, terrain profiles, ground and meteorological conditions have not changed.

L_{A10}: noise level that is exceeded for 10% of the measurement period, and gives an indication of the noisier portion of the climate. It is a unit that has been used over many years for the measurement and assessment of road traffic noise.

L_{A90}: the noise level that is exceeded for 90% of the measurement period and gives an indication of the noise level during the quieter periods. It is often referred to as the 'background' noise level.

L_{Aeq}: equivalent A-Weighted Sound Level, defined as the constant sound level that, in a given time period, would convey the same sound energy as the actual time-varying A-weighted sound.

L_{Amax}: the maximum sound level of an event, or time period, measured with a sound level meter or analyzer that is frequency weighted and time integrated. The frequency weighting (for example, A, C, unweighted) and time integrating (for example, slow, fast) must be specified.

Land Parcel: the extent of land belonging to a landowner.

LCA: Landscape Character Area (Northern Ireland Landscape Character Assessment).

LCSZ: Landscape Character Sub-Zone (as defined by project character assessment).

LCZ: Landscape Character Zone (as defined by project character assessment).

Linear Earthwork (Archaeology): a long bank or ditch, often a territorial boundary such as the Pale or a prehistoric cursus monument; can be of any date, but often late prehistoric. British and continental versions are usually territorial or military, defensive demarcations in the landscape (e.g. 'the Vallum' of Hadrian's Wall).

LNS: low noise road surfacing also referred to as a thin wearing course/surface. The UK Highways Agency advises that a reduction of in the region of 3.5 dB(A) can be achieved by the use of thin wearing course/surface compared to hot rolled asphalt (HRA). The principle effect is to reduce the noise within the mid and higher frequencies associated with the interaction of the vehicle tyres and the road surface. However, it is less effective in attenuating the low frequency noise primarily generated by HGV's

L_{peak}: the maximum sound pressure level as measured with an exponential time constant of 50 microseconds or smaller. Often referred to as unweighted peak sound level (dBp). Weighting should not be used to measure peak sound pressure level.

Level: the logarithm of the ratio of a quantity to a reference quantity of the same kind. The base of the logarithm, the reference quantity, and the kind of level must be specified.

Limit Value: a legally enforceable limit on the chemical characteristics a source of emission to air normally expressed as a maximum permissible concentration of a specified substance.

Logarithm: the exponent that indicates the power to which a number must be raised to produce a given number. For example, for the base 10 logarithm, used in acoustics, 2 is the logarithm of 100.

Manhole Silt Trap: chambers incorporated into the highway drainage pipe network, which capture sediment and sediment bound pollutants through settlement.

Mannings Coefficient, n: the effective roughness of a watercourse channel, it is a function of channel velocity, flow area, slope, vegetation and irregularity.

Megalithic Tomb: literally 'large stone' tomb. Communal burial tombs during the Neolithic period, characterised by a burial chamber usually constructed of unhewn stones and covered by a mound of earth or stones (cairn).

Model Adjustment: following model verification, the process by which modelled results are amended. This adjusts for systematic error.

Motte and Bailey: an Anglo-Norman defensive structure consisting of a large, steep-sided earthen mound-the motte-with a rectangular enclosure at the base- the bailey; date from the twelfth and thirteenth centuries.

Noise: any disagreeable or undesired sound or other disturbance.

Noise Contours: continuous lines of equal noise level usually drawn around a noise source. The lines can be drawn in any increments specified on an appropriate legend. Noise contours are generally used in depicting the noise exposure around airports, highways, and industrial plants.

Noise Map: a noise map is a set of noise contours based upon measurements or predictions of noise in the region of interest.

Noise Survey: a noise survey is a set of measurements of the sound levels or sound exposures in an environment of interest. In some surveys octave band (or even narrower band) analysis may be included.

Passage Tomb: Megalithic tomb dating to the Neolithic characterized by an oval or circular mound, kerbing, and a passage, often terminating with a chamber in which cremated burials were placed; often situated on hilltops.

PM₁₀: particulate matter with an aerodynamic diameter of less than 10 micrometres

Podzol: freely draining, slightly acidic, well leached soils.

Propagation: the passage of a signal from its source to a receiver. Some of the processes involved in propagation are absorption, reflection, and transmission.

Q95: A flow which is equal to or exceeded 95% of a total flow record. The Q95 is regarded as a flow which is significantly low and used as a standard flow measure with regards to water quality.

QMean: The mean annual flow value for a total flow record of a watercourse.

Rath: a ringfort, usually with earthen banks, or any circular enclosure.

Receiver: the listener or measuring microphone which detects the sound transmitted by the source.

Ring Barrow: barrow with raised or domed central area.

Ring Ditch: barrow with flat or dished central area.

Ringfort: Early Christian defended settlement consisting of a bank and external ditch defining a central circular area; also called fairy fort, rath, lios, or cashel. They are one of the most conspicuous and certainly the most prolific type of monument in the Irish Countryside.

Routine Runoff: the normal runoff from roads that may include the contaminants washed off the road surface in a rainfall event and can result in acute or chronic impacts. It excludes the affect of spillages and major leaks which usually result in acute impacts.

Road Drainage Outfall: location where water draining from the road surface is discharged

Severance: the state of being separated or cut off.

Site (Archaeology): specific description of the area for an archaeological investigation, this is usually defined as an area of excavation but could refer to a building, or survey area.

Source-Pathway-Receptor: A model that is used in risk assessment to identify the source of any contamination, what the source may affect (receptor) and how the source may reach the receptor (pathway).

Souterrain: underground passages, probably built for storage purposes or possibly as temporary refuges; often associated with ringforts. These artificial underground structures are built of drystone walling and covered with large stone lintels or cut into bedrock or hard boulder clay. Some are built partly or entirely of wood.

Species Rich Hedge: a hedge where the structural species making up a 30m section of hedgerow include at least five woody species that are either native somewhere in the UK, or which are archaeophytes. Climbers and brambles do not count towards the total except for roses. Hedgerows that contain fewer woody species but have a rich basal herbaceous flora may also be defined as species-rich, but criteria to define these have to be set on a local basis as there is no national definition.

Species Poor Hedge: hedges which do not meet the criteria for Species Rich Hedges. All hedges are now listed on the Habitat Action Plan for hedges.

Specification: a written schedule of works required for a particular project (by a curator, planning archaeologist or client), set out in sufficient detail to be quantified, costed, implemented and monitored. Normally prepared by or agreed with the relevant curator.

Standing Stone: upright stone, usually single but sometimes in pairs and groups. They can be shaped or natural and are usually dated to the Bronze Age.

Statutes: written law passed by a legislative body.

Surface Flow Wetland: a shallow, permanently wet basin planted with common reed swamp vegetation and used to treat highway runoff. They are effective in the removal of suspended solids and associated heavy metals through the physical processes of settlement and filtration.

Surface Water: Waters including rivers, streams, ditches, loughs, ponds, canals, reservoirs, coastal waters and estuaries

Till: largely sandy clay or stony clay, deposited beneath, on the margins of or at the sides of glaciers. Can also be largely granular with little clay content in some locations.

Tough Book: laptop computer designed for field survey and recording of data.

Tower House: small castle, usually of three storeys, dating from the fourteenth to sixteenth centuries.

Turbary Rights: the legal right to cut turf or peat for fuel on common ground or on another person's ground.

µg/m³: a measure of concentration in terms of mass per unit volume. A concentration of 1 µg/m³ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.

Uncertainty: a measure, associated with the result of a measurement that characterises the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it on recent European legislation.

Univallate: of ringfort and hillforts, with a single set of ramparts.

Verification: comparison of modelled results versus any local monitoring data at relevant locations.

Veteran Trees: a tree which due to its great age, size or condition is of exceptional cultural, landscape or nature conservation value.

Vibration: the oscillating, reciprocating, or other periodic motion of a rigid or elastic body or medium forced from a position or state of equilibrium.

Wedge Tomb: a megalithic burial chamber that narrows at one end (usually decreasing both in height and width from west to east), producing a wedge shape in elevation. Usually containing a separate burial chamber and the structure is usually covered by a cairn.

Windshield: a porous device used to cover the microphone of a sound level measurement system which is designed to minimize the effects of wind on the sound levels being measured. Typically made of open cell polyurethane foam and spherically shaped.

Abbreviations

A5WTC	A5 Western Transport Corridor
AADT	Annual Average Daily Traffic
AAWT	Annual Average Weekly Traffic flows
ADMS	Advanced Dispersion Modelling System
AEP	Annual Exceedance Probability
AFBI	Agri-Food and Biosciences Institute
AME	Annual Mean Equivalent
AOD	Above Ordnance Datum
AoHSV	Area of High Scenic Value
AONB	Area of Outstanding Natural Beauty
APIS	Air Pollution Information System
AQEG	Air Quality Expert Group
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
ASPT	Average Score Per Taxon
ASSI	Area of Special Scientific Interest
AURN	Automated Urban and Rural Network
BAP	Biodiversity Action Plan
BBS	Breeding Birds Survey
BFI	Base Flow Index
BMW	Best and Most Versatile
BMWP	Biological Monitoring Working Party
BNL	Basic Noise Level
BoCC	Birds of Conservation Concern
BS	British Standard
BSBI	Botanical Society of the British Isles
BT	British Telecom
BTO	British Trust for Ornithology
C	Carbon
CAAN	Countryside Access and Activity Network
CAFE	Clean Air For Europe
CEDAR	Centre for Environmental Data and Recording
CEMP	Construction Environment Management Plan
CFA	Continuous Flight Auger

Ch.	Chainage
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
CoPA	Control of Pollution Act
COSHH	Control of Substances Hazardous to Health
CP	Construction Plant
CRTN	Calculation of Road Traffic Noise
CV	Coefficient of Variance
DARD	Department of Agricultural and Rural Development
dB	Decibel
DCC	Derry City Council
DECAL	Department of Culture, Arts and Leisure
DEFRA	Department for Environment, Food & Rural Affairs
DfT	Department for Transport
DM	Do-Minimum
DMRB	Design Manual for Roads & Bridges
DoE	Department of the Environment
DRD	Department for Regional Development
DS	Do-Something
DSTC	Dungannon and South Tyrone Borough Council
EA	Environment Agency
EC	European Commission
EclA	Ecological Impact Assessment
EFT	Emission Factor Toolkit
EHD	Environmental Health Departments
EHOs	Environmental Health Officers
EIA	Environmental Impact Assessment
EID	Ecology Identity Areas
EPS	European Protected Species
EPUK	Environmental Protection UK
EQR	Ecological Quality Ratio
EQS	Environmental Quality Standard (water quality)
ES	Environmental Statement
ESCRS	Earth Science Conservation Review Sites
EU	European Union
FEH	Flood Estimation Handbook

FFD	Freshwater Fish Directive
FHS	Fisheries Habitat Survey
FRA	Flood Risk Assessment
GI	Geotechnical Investigation
GIS	Geographical Information System
GNR	Great Northern Railway
HAWRAT	Highways Agency Water Risk Assessment Tool
HC	Hydrocarbons
HGVs	Heavy Goods Vehicles
H DVs	Heavy Duty Vehicles
HMWB	Heavily Modified Waterbody
HRA	Habitats Regulations Assessment
IAN	Interim Advice Note
IAQM	Institute of Air Quality Management
IDP	Investment Delivery Plan
IEEM	Institute of Ecology and Environmental Management
HEMA	Institute of Environmental Management and Assessment
IHR	Industrial Heritage Record
ISNI	Investment Strategy for Northern Ireland
IUCN	International Union for Conservation of Nature
IWT	Irish Wildlife Trust
JNCC	Joint Nature Conservation Committee
Kg N ha ⁻¹ y ⁻¹	Kilograms of Nitrogen per Hectare per Year
LA	Loughs Agency
LAMM	Lake Acidification Macroinvertebrate Metric
LAP	Landscape Policy Areas
LAQAP	Local Air Quality Action Plan
LAQM	Local Air Quality Management
LAQM.TG	Local Air Quality Management Technical Guidance
LBAP	Local Biodiversity Action Plan
LCA	Landscape Character Area
LCSZ	Landscape Character Sub Zone
LCZ	Landscape Character Zone
LDP	Local Development Plans
LE	Landscape Element
LFACAS	Less Favoured Area Compensatory Allowance Scheme

LGVs	Light Goods Vehicles
LNS	Low Noise Surfacing
LWS	Local Wildlife Site
MBR	Monuments and Buildings Record (holds SMR, IHR, Listed Buildings and historic mapping information)
MS	Method Statement
N	Nitrogen
NAQIA	National Air Quality Information Archive
NB	North Bound
NBN	National Biodiversity Network
NCC	Nature Conservancy Committee
NCR	National Cycle Route
N-Deposition	Nitrogen deposition
NETCEN	National Environmental Technology Centre
NHA	Natural Habitat Area
NI	Northern Ireland
NIBAP	Northern Ireland Biodiversity Action Plan
NICS	Northern Ireland Countryside Survey
NIE	Northern Ireland Electricity
NIEA	Northern Ireland Environment Agency
NIMVO	Notice of Intention to Make a Vesting Order
NIR	Noise Insulation Regulations
NIW	Northern Ireland Water
NMU	Non-Motorised Users
NO ₂	Nitrogen dioxide
NO _x	Oxides of nitrogen
NPWS	National Parks and Wildlife Service
NRMM	Non-road mobile machinery
NSCA	National Society for Clean Air
NTEM	National Trip End Model
NTS	Non-Technical Summary
NVC	National Vegetation Classifications
ODC	Omagh District Council
OS	Ordnance Survey
OSNI	Ordnance Survey Northern Ireland
OTF	Omagh Thrust Fault
Pb	Lead

PCBs	Polychlorinated Biphenyls
PED	Pre Earthworks Drainage
PIA	Personal Injury Accident
PM ₁₀	Particulate Matter
pNHA	Proposed Natural Habitat Area
PPG	Pollution Prevention Guidelines
PPS	Planning Policy Statements
PPV	Peak Particle Velocity
PRoW	Public Right of Way
PSNI	Police Service of Northern Ireland
pSPA	Potential Special Protection Area
PTE	Permission to Enter
RA	Rivers Agency
RDS	Regional Development Strategies
RHS	River Habitat Survey
RICT	River Invertebrate Classification Tool
RMSE	Root Mean Square Error
ROI	Republic of Ireland
RS BAP	Road Service Biodiversity Action Plan
RSNI	Road Service Northern Ireland
RSPB	Royal Society for the Protection of Birds
RSTN	Regional Strategic Transport Network
RSTN – TP	Regional Strategic Transport Network – Transport Plan
RTS	Regional Transport Strategy
SAAR	Standard Annual Average Rainfall
SAC	Special Area of Conservation
SB	South Bound
SDC	Strabane District Council
SDR	Scenic Driving Routes
SLNCIs	Sites of Local Nature Conservation Importance
SMP	Silt Management Plan
SMR	Sites and Monuments Record
SoCC	Species of Conservation Concern
SPA	Special Protection Area
SPG	Supplementary Planning Guidance
SRI	Strategic Roads Improvements

SuDS	Sustainable Drainage System
SW	South west
SWMP	Site Waste Management Plan
TEOM	Tapered Elemental Oscillating Microbalance
TRRL	Transport and Road Research Laboratory
TSP	Total Suspended Particulate
TSS	Total Suspended Solids
UK	United Kingdom
ULSD	Ultra low sulphur tax-exempt diesel
UNECE	United Nations Economic Commission for Europe
UV	Ultra Violet
UWE	University of the West of England
UWT	Ulster Wildlife Trust
VO	Vesting Order
WeBS	Wetland Bird Survey
WebTAG	Web Transport Analysis Guidance
WFD	Water Framework Directive
WO 85	Wildlife (Northern Ireland) Order 1985
WSI	Written Scheme of Investigation
WWT	Wildfowl and Wetlands Trust
WWTW	Wastewater Treatment Works
ZTV	Zone of Theoretical Visibility
µg/m ³	Micrograms per cubic meter

1 INTRODUCTION

1.1 The A5 Western Transport Corridor (A5WTC)

1.1.1 TransportNI, on behalf of the Department for Regional Development (the Department), is promoting the introduction of a new dual carriageway, the A5 Western Transport Corridor (A5WTC), as part of a programme to improve the strategic road network in Northern Ireland.

1.1.2 The objectives are:

- to improve road safety;
- to improve the road network in the west of the Province and North/South links;
- to reduce journey travel times along the A5WTC;
- to provide improved overtaking opportunities for motorists along the A5WTC; and
- to develop the final proposals in light of safety, economic, environmental, integration and accessibility considerations.

1.2 The Proposed Scheme

1.2.1 The Proposed Scheme 2016 (hereafter referred to as the Proposed Scheme) provides for the construction of some 85 kilometres of dual carriageway running between New Buildings and the N2 highway in the Republic of Ireland (ROI) at the Moy Bridge border crossing south of Aughnacloy. Subject to approval to proceed to implementation, it would provide a strategic link between the urban centres in the west of the province and provide a strategic link with international gateways.

1.2.2 Travelling north to south, the Proposed Scheme would commence north of New Buildings with a new at-grade roundabout on the existing A5. The first 1.5km section would comprise a single 2+1 carriageway running west of New Buildings along the eastern margin of the River Foyle. A second roundabout, at the southern end of the single carriageway section, would accommodate a short link road between the Proposed Scheme and the existing A5.

1.2.3 South of the second roundabout, there would be a 82.5km-long two-lane dual carriageway extending as far as a new at-grade roundabout on Caledon Road to the south of Aughnacloy. A 1kmlong section of single carriageway road would provide for the merging of the A5WTC and the existing A5 between the roundabout on Caledon Road and the Moy Bridge border crossing.

1.2.4 Grade-separated junctions would provide for access between the Proposed Scheme and the existing road network north and south of Strabane, west of Victoria Bridge, west of Newtownstewart, north, south and west of Omagh, at Moylagh and north of Aughnacloy.

- 1.2.5 An at-grade roundabout would provide for access between the Proposed Scheme and the N14 highway in the ROI via a proposed bridge over the River Finn on the south-west fringe of Strabane. The proposed bridge over the Finn River does not form part of the Proposed Scheme. The at-grade roundabout south-west of Ballygawley would provide access between the A4 and the Proposed Scheme.

1.3 Phasing

- 1.3.1 It is intended the Proposed Scheme would be constructed in three phases corresponding with the anticipated four-yearly budget periods 2016-2020, 2020-2024 and 2024-2028. For the purposes of the Environmental Statement 2016, it is necessary to look at the entirety of the Scheme.
- 1.3.2 In terms of each of the three phases, Phase 1 would involve construction of sections between the new roundabout north of New Buildings and the proposed grade-separated junction north of Strabane at Ballymagorry and between the proposed grade-separated junction south of Omagh and the proposed roundabout on the existing A4 south-west of Ballygawley. It is anticipated that this phase would be constructed between 2017 and 2019 and would be opened to use in 2019.
- 1.3.3 Phase 2 would involve construction of a section between the proposed grade-separated junction north of Strabane at Ballymagorry and the proposed grade-separated junction south of Omagh. It is anticipated this phase would be constructed between 2021 and 2023 and would be opened to use in 2023.
- 1.3.4 Phase 3 would involve construction of a section between the proposed roundabout on the existing A4 south-west of Ballygawley and the tie in with the existing A5 south of Aughnacloy. It is anticipated for assessment purposes that this phase would be constructed between 2026 and 2028 and the phase and fully completed scheme would be opened to use in 2028. The Department accepted the Inspector's Report from the 2011 Public Inquiry, which recommended that the section south of the A4 at Ballygawley should not be progressed until there was a firm commitment from the Irish Government in relation to the N2 improvement scheme; and certainty in relation to funding provision for the construction of the section of the scheme between Ballygawley and Aughnacloy. Therefore, the proposed dates for Phase 3 are purely indicative at this stage, as no firm commitment on delivery of this Phase can be given until the conditions relating to the N2 and funding are met.

1.4 Environmental Impact Assessment (EIA)

- 1.4.1 The Proposed Scheme comprises EIA development as defined in European Directive 2011/92/EU (the Directive¹) and Part V of The Roads (Northern Ireland) Order 1993 (the

¹ A newly amended Directive, 2014/52/EU came into force in May 2014. Member states are required to introduce legislation applying the amended rules in the new directive by May 2017. The A5WTC Environmental Statement has accordingly been prepared in accordance with the requirements of the current Order and Regulations.

Order) as substituted by the Roads (Environmental Impact Assessment) Regulations (Northern Ireland) 1999 and amended by The Roads (Environmental Impact Assessment) Regulations (Northern Ireland) 2007 (the Regulations). The Order and Regulations require the promoter of EIA development to prepare an environmental statement (ES) for their project and to publish notice of it².

- 1.4.2 TransportNI has previously published an environmental statement (the A5WTC ES 2010) for a proposed A5WTC in 2010. The environmental information provided in the A5WTC ES 2010 was subsequently considered at public inquiry and found to be robust in scope and content.
- 1.4.3 The Proposed Scheme which forms the focus of this ES is substantially similar to the scheme proposed in 2010. Notwithstanding the similarity and robustness of the environmental information provided in the A5WTC ES 2010, there are a number of factors which have resulted in a need for the preparation of a new project specific ES for the Proposed Scheme.
- 1.4.4 Firstly, time has elapsed since the completion of baseline studies and surveys which informed the assessments reported in the A5WTC ES 2010 such that it has been concluded that further studies and surveys should be undertaken for many of the likely effects which were previously identified and remain pertinent to the Proposed Scheme.
- 1.4.5 Secondly, it has been recognised that the intention to phase construction and opening of sections of the Proposed Scheme, could result in additional environmental effects to those associated with the presence and use of the fully completed scheme.
- 1.4.6 Thirdly, there have been modifications to assessment and design standards for strategic road schemes since publication of the orders and ES for the scheme proposed in 2010.
- 1.4.7 Fourthly, notwithstanding the similarity between the scheme previously proposed in 2010 and the currently Proposed Scheme, there are a number of changes arising from recommendations made by the inspectors following the public inquiries for that scheme which have required modifications to the Vesting Order for the Proposed Scheme.

1.5 The content of the environmental statement

1.5.1 The Order and Regulations stipulate that the information detailed in Annex IV of the Directive should be included in an environmental statement for EIA development, provided that:

- a) it is relevant to the specific characteristics of the project and of the environmental features likely to be affected by it; and

² An Environmental Impact Assessment (EIA) is intended to look at relevant impacts on the environment. Publication of the EIA in the form of an Environmental Statement affords the public an opportunity to make their views known. For this reason, the EIA takes into account the proposed scheme in its totality and the surrounding area. This approach must be taken whether a firm delivery programme is in place or not.

- b) the information may reasonably be gathered (having regard among other matters to current knowledge and methods of assessment).

1.5.2 The information stipulated in Annex IV of the Directive is detailed below along with an indication of where it can be found in this ES.

1. A description of the project, including in particular:
 - a) a description of the physical characteristics of the whole project and the land-use requirements during the construction and operational phases (Chapter 6);
 - b) a description of the main characteristics of the production processes, for instance, the nature and quantity of the materials used (Chapter 6);
 - c) an estimate, by type and quantity, of expected residues and emissions (water, air and soil pollution, noise, vibration, light, heat, radiation, etc.) resulting from the operation of the proposed project (Chapter 6).
2. An outline of the main alternatives studied by the developer and an indication of the main reasons for this choice, taking into account the environmental effects (Chapter 4).
3. A description of the aspects of the environment likely to be significantly affected by the proposed project, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the interrelationship between the above factors (Chapters 8-16).
4. A description of the likely significant effects of the proposed project on the environment resulting from:
 - (a) the existence of the project (Chapters 8-16);
 - (b) the use of natural resources (Chapters 8-16);
 - (c) the emission of pollutants, the creation of nuisances and the elimination of waste (Chapters 8-16).
5. A description by the developer of the forecasting methods used to assess the effects on the environment referred to in point 4 (Chapters 8-16).
6. A description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment (Chapters 8-16).
7. A non-technical summary of the information provided under headings 1 to 6.
8. An indication of any difficulties (technical deficiencies or lack of know-how) encountered by the developer in compiling the required information (Chapters 8-16).

1.6 The structure of the environmental statement

- 1.6.1 The ES is presented in three volumes:
- Volume 1: Environmental Statement
 - Volume 2: Figures
 - Volume 3: Appendices
- 1.6.2 A non-technical summary (NTS) is included in the front of Volume 1 and is available as a separate brochure upon written request to Seamus Keenan, Project Sponsor, TransportNI Western Division, County Hall, Drumragh Avenue, Omagh BT79 7AF. Alternatively, an electronic version of the NTS is available for viewing at www.a5wtc.com.
- Volume 1**
- 1.6.3 There are 19 chapters in Volume 1.
- 1.6.4 Chapter 1 introduces the Proposed Scheme and its underlying objectives, explains the statutory context and required content for an ES as defined in the Directive, Order and Regulations and outlines the structure which has been adopted for the ES for the Proposed Scheme.
- 1.6.5 Chapter 2 outlines the need for the Proposed Scheme.
- 1.6.6 Chapter 3 describes the consultation process adopted during the planning, design and assessment of the Proposed Scheme and specific consultations which have informed the assessments reported in the ES.
- 1.6.7 Chapter 4 outlines the alternatives considered during identification of the Preferred Route and the factors leading to the choice of the Preferred Route. It also describes design options which have been considered during the development and design of the Proposed Scheme.
- 1.6.8 Chapter 5 provides an overview of the existing environment in which the Proposed Scheme would be located.
- 1.6.9 Chapter 6 describes the key design components, construction activities and timescales and operational characteristics associated with the Proposed Scheme.
- 1.6.10 Chapter 7 explains how the scope of the assessments reported in the ES has been identified. It further describes the relationship between environmental impacts and their effects and sets out a common format for the various detailed assessments reported in the ES.
- 1.6.11 Chapters 8 – 16 report the findings of the studies and assessments which have been undertaken and describes the predicted environmental effects.
- 1.6.12 Chapter 17 describes predicted cumulative impacts.

1.6.13 Chapter 18 provides a schedule of environmental commitments, comprising design and mitigation measures proposed in relation to impacts associated with the environmental aspects considered.

1.6.14 Chapter 19 provides a list of information sources and references.

Volume 2

1.6.15 Volume 2 includes figures, referred to in Volume 1, in support or explanation of the description of the existing environment and the Proposed Scheme and the evaluation and assessment of the predicted impacts and their effects.

Volume 3

1.6.16 Volume 3 comprises appendices containing documentation relevant to the assessments and detail relating to the studies, surveys and calculations which have been undertaken.

2 THE NEED FOR THE SCHEME

2.1 Policy context

- 2.1.1 In September 2001, the Department for Regional Development (DRD) formulated “Shaping Our Future: the Regional Development Strategy (RDS) for Northern Ireland 2025”. This strategy was intended to guide the future development of the region up to 2025 and provided guidance on a range of social, economic and environmental matters which are implemented through the plans and strategies of Government Departments.
- 2.1.2 An integral feature of the RDS 2025 was the requirement to develop a Regional Transportation Strategy having a vision of “*a modern, integrated and sustainable transportation system which benefits society, the economy and the environment and which actively contributes to social inclusion and everyone’s quality of life*”. In July 2002, the Assembly approved the strategic direction and underlying principles of the ‘Regional Transportation Strategy for Northern Ireland 2002-2012’ (RTS). The RTS identified strategic transportation investment priorities and considered potential funding sources over a 10 year period as well as setting down guidance as to how funding would be split between areas and transport modes.
- 2.1.3 The Regional Development Minister launched a revised RDS 2035 on 15th March 2012. In recognition of the changing challenges facing the region, the Executive agreed that the RDS 2025 published in 2001 (and amended in 2008) needed to be reviewed. Whilst many of the objectives of the previous strategy are still valid, this new document now replaces it. The RDS 2035 provides an overarching strategic planning framework to facilitate and guide the public and private sectors.
- 2.1.4 “Ensuring a Sustainable Transport Future: A New Approach to Regional Transportation” (later referred to as the “New Approach”) was published on 28th March 2012. Unlike the 2002 Strategy, the New Approach does not include details of schemes or projects. Rather, the Department has set three high level aims for transportation along with twelve supporting strategic objectives, covering the economy, society and the environment. The new approach to regional transportation complements the RDS 2035 and aims to achieve the transportation vision. The document recognises the need to complete the work identified in the current Regional Strategic Transport Network Transport Plan and Strategic Road Improvement Programme, while new programmes of work are developed for the main roads and railways.
- 2.1.5 The Regional Strategic Transport Network - Transport Plan 2015 (RSTN TP), published in March 2005 is one of 3 multi modal transport plans which facilitated the delivery of the RTS. This Plan will be reviewed in light of the New Approach.
- 2.1.6 The Regional Strategic Transport Network (RSTN) of Northern Ireland comprises the rail network, 5 Key Transport Corridors, 4 Link Corridors, the Belfast Metropolitan Transport Plan and the remainder of the trunk road network. A number of priority schemes to improve the RSTN were ongoing and appraisal work (based on the Government’s five key criteria of environment, safety, economy, accessibility and integration) was undertaken to identify further Strategic Roads Improvements (SRI) schemes for inclusion

in the RSTN TP. The RSTN TP followed the funding levels envisaged in the RTS, although they were extrapolated to match the longer period of the RSTN TP (2005 – 2015).

- 2.1.7 Delivery of the RDS received a boost in 2005 with the announcement of the Investment Strategy for Northern Ireland (ISNI). In July 2006, Roads Service published the consultation document 'Expanding the Strategic Road Improvement Programme 2015' which included schemes to the value of the ISNI programme as well as a list of schemes that performed well in assessment but were not affordable within anticipated ISNI funding for the period 2005 - 2015.
- 2.1.8 In 2008, the Northern Ireland Executive agreed its first Budget and endorsed a revised 10 year Investment Strategy, covering the period 2008 – 2018. This strategy included a contribution of £400 million from the Irish Government for investment in the A5 and A8 dualling projects. A further budget covering the period 2011-2015 was subsequently agreed by the Executive. It included in the region of £1.2 billion of capital road improvements which embraced the continuing commitment from the Irish Government to an investment of £400 million towards the A5 and A8 dualling projects.
- 2.1.9 As a consequence of the downturn in the world economy, the Irish Government deferred its £400 million contribution in November 2011, but committed £25 million per annum towards the project in 2015 and 2016. Following a review of spending priorities the Executive announced a revised budget on 14 February 2012, in which £500 million would be invested in road infrastructure over the subsequent four-year period. The £330 million investment in the A5 would allow two sections to progress: the section from Londonderry to the north of Strabane and the section from south of Omagh to Ballygawley.
- 2.1.10 The RSTN TP has 8 primary objectives including the need *“to examine access to regional gateways and cross border links with an emphasis on improving connections from the 5 key transport and 4 link corridors”*. This is also reflected in Strategic Objective 1 of the New Approach, i.e. to improve connectivity within the region.
- 2.1.11 One such corridor identified in the RSTN TP is the A5 Western Transport Corridor (A5WTC) which runs from Londonderry to Aghnacloy. This corridor is also an important all-island route as it forms part of the main route from Dublin to the North West. The scheme was one of the projects that was included in the Investment Delivery Plan (IDP) for Roads which was published in April 2008.

2.2 The existing A5

- 2.2.1 There are some aspects associated with the existing road which are in conflict with the strategic objectives described above which the Proposed Scheme would address. These predominantly relate to safety and traffic flows.

Safety

- 2.2.2 The horizontal and vertical alignment of the existing A5 carriageway has been assessed for compliance with current design standards. Within each section, the lengths of the A5 that do not comply with current design standards are:

- from New Buildings to the South of Strabane approximately 10km (38%);
- from South of Strabane to South of Omagh approximately 10.5km (35%); and
- from South of Omagh to Aughnacloy approximately 11.8km (41%).

2.2.3 The principal areas of non-compliance are achievement of Full Overtaking Sight Distance and Stopping Sight Distance, both of which contribute significantly to a reduction in the safety of the existing A5. Fourteen percent of the stopping sight distances northbound and southbound do not achieve current design standards.

2.2.4 The cross-section widths of the carriageway vary throughout, and on occasion, do not meet the current standard requirements either in terms of road or verge widths, or by virtue of the absence of a hard strip. These discrepancies generally occur between settlements.

Accidents

2.2.5 Accident data collected from the DRD for the period 2008 to 2012 inclusive, for the A5 and its key side roads, indicate that the substantial part of these strategic and local roads had Personal Injury Accident (PIA) rates lower than the national average (UK). Over the five year period there were a total of 266 PIA which included 8 fatal accidents and 42 serious accidents on the A5. It is anticipated that the Proposed Scheme would not only maintain this relatively low rate but potentially reduce rates further.

Access

2.2.6 There are approximately 1360 residential, farm and commercial accesses and side road junctions onto the existing road. As a result there are inevitable conflicts between local and strategic traffic, a situation which would worsen with traffic growth. These are factors which affect traffic speed and certainty of journey times, as well as safety. The separation of local and strategic traffic and restriction of access provided by the Proposed Scheme would serve to alleviate these existing conflicts.

Traffic flows

2.2.7 Traffic forecasts predict an overall increase in traffic demand (trips) of 26% between 2013 and 2028 and 43% by 2041. As a result, traffic in A5WTC study area is likely to experience deterioration in travel conditions during peak travel times. For example, average end to end journey times along the A5 would increase by some 6% from 70 minutes to 74 minutes over the next fifteen years and 9% over next twenty-eight years from 2013. The start point of journey time is at the junction with A5 Victoria Road/Prehen Road and end point is the junction just beyond the border south of Aughnacloy.

2.2.8 These forecasts show that continued traffic growth, in the absence of the A5WTC, would have a severe impact on the existing A5. Strabane, Omagh and urban roads in other areas would also come under increased pressure.

3 CONSULTATION

3.1 Overall approach

3.1.1 There has been an extensive process of consultation which has informed the planning, design and assessment of the Proposed Scheme. This has included:

- a series of public exhibitions;
- liaison with statutory consultees and other organisations to gather environmental data and discuss the scope of the assessments, adopted methods of assessment and mitigation measures; and
- discussions with affected parties and landowners.

3.1.2 The Department for Regional Development (DRD) Transport NI has also established a dedicated project website (www.a5wtc.com) with links to the DRD website. The website has served to support the overall consultation strategy for the project, providing an additional means by which statutory, public and private stakeholders have been given access to scheme updates and announcements.

3.1.3 An 0845 telephone information line has been operated as a facility for receipt of public enquiries. A facility catering for international calls has also been operated to ensure that potential cross-border enquiries from the community in the ROI can be similarly addressed.

3.2 Public exhibitions

April/May 2008

3.2.1 A series of Public Awareness days were held during April/May 2008 (28th/29th April and 8th/9th May). It involved individual one day events in Ballygawley, Omagh, Strabane and Londonderry. The purpose was to:

- advise the public that the Department was promoting the scheme;
- explain the objectives of the scheme;
- introduce the key transport, engineering, economic and environmental criteria that would inform the planning, design and assessment process;
- outline the statutory process that would be followed;
- introduce the public to the extent of the initial study areas being considered; and
- seek initial information and responses from attendees.

3.2.2 Feedback was received by making a written record of conversations at the Public Information days, completion of event questionnaires, subsequent correspondence and via the project website.

February 2009

- 3.2.3 A series of Public Consultation days were held in February 2009 for the exhibition of the Preferred Corridor and potential route options. These events adopted the same format, and used the same locations, as the 2008 Public Information days. The Preferred Corridor and the route options had emerged following preliminary consideration of key constraints. Comments were sought relating to the preliminary route options and the public were encouraged to provide information relating to the corridors. This information assisted with the refinement and, where relevant, modification of the route options prior to their subsequent evaluation and selection of a Preferred Route.
- 3.2.4 The feedback from this second public consultation included concerns relating to local ecology, the severance of farms, potential impacts on floodplains and on designated ecological and heritage sites, impacts on the landscape, interactions with proposed development sites, loss of traffic from the existing A5 and the potential impacts that would result on local businesses, community severance and loss of community facilities (e.g. sports fields) and impacts on property and homes.

July 2009

- 3.2.5 A series of Public Exhibitions were held in July 2009 over four consecutive days in Omagh, Strabane, Londonderry and Ballygawley. This was to present the Department's Preferred Route to the public. Visitors to the exhibitions were invited to comment on the Preferred Route and individual landowners, who would be potentially affected, were offered the opportunity for individual discussions with members of the Project Team.
- 3.2.6 The feedback from these events included issues similar to those raised previously including the severance of dairy farms and the locations of junctions as well as more local issues with regard to moving the alignment to avoid natural features (away from rivers and floodplains), public amenities (e.g. footpaths) and community severance.

November 2010

- 3.2.7 Pre-Orders Public Exhibitions for the scheme proposed in 2010 were held in November 2010 over four consecutive days in Omagh, Strabane, Londonderry and Ballygawley. This involved presentation of the Department's proposals to the public. The aims and objectives of this event were to:
- demonstrate the assessments carried out so far and explain how the proposals had been developed including the approach to alternatives;
 - highlight the key factors which had influenced the choice and development of the proposals;
 - present the junction layouts;
 - explain the direct or indirect effects that the proposals would have on property, the community and the environment;
 - detail the next steps in the process;

- inform the public of the statutory procedures and anticipated programme to the opening of the road;
- increase public awareness of the project; and
- engage with a range of stakeholders.

3.2.8 Following the Pre-Orders Public Exhibitions the draft Orders were published in November 2010. There was an 8 week formal consultation period associated with this which ended on 21st January 2011.

2016 Statutory Orders

3.2.9 The Department is publishing new draft Orders in 2016 as follows:

- Environmental Statement;
- Notices of Intention to Make a Vesting Order;
- Notice of Intention to Make a Direction Order;
- Notice of Intention to Make a Stopping Up Order.

Associated with the publication of these Orders, as in 2010, will be a series of Public Exhibitions.

March 2016

3.2.10 Orders Public Exhibitions will be held in March 2016 in Omagh, Strabane, Londonderry and Ballygawley. This will involve presentation of the Department's Proposed Scheme to the public. The aims and objectives of these events will be to:

- demonstrate the assessments carried out so far and to explain how the Proposed Scheme has developed since the Public Inquiry in 2011;
- highlight the key factors which have influenced the development of the Proposed Scheme to date;
- explain the anticipated phased approach to the draft Orders, assessment and construction programme;
- explain the direct and / or indirect effects that the Proposed Scheme would be likely to have on property, the community and the environment;
- inform the public of the statutory procedures and the next steps for the Proposed Scheme; and
- engage with a range of stakeholders.

3.2.11 Information relating to all of these events is available on the project website www.a5wtc.com.

3.3 Statutory consultees and other stakeholders

3.3.1 A wide range of statutory authorities and organisations have been consulted as part of the studies and assessments which have been undertaken during the preparation of the Orders and ES for the Proposed Scheme.

- 3.3.2 Meetings have been held with many stakeholders including Northern Ireland Environment Agency (NIEA), the Loughs Agency (LA), the Rivers Agency (RA), the National Parks and Wildlife Service (NPWS), the Royal Society for the Protection of Birds (RSPB), the Department of Agriculture and Rural Development (DARD), the Department of the Environment (DoE), the Planning Service and Local Authorities.
- 3.3.3 A full schedule of authorities, agencies and bodies consulted is provided in Appendix 3A. The objective has been to:
- collect and verify known environmental data relevant to the wider study area and specific to the Proposed Scheme;
 - seek comment relating to the assessment process, the scope of the ES and the methods of assessment adopted; and
 - discuss mitigation requirements and measures.

3.4 Landowners and other affected parties

- 3.4.1 Specific consultation with landowners and other parties, who would be directly affected by the Proposed Scheme, has generally involved a series of landowner/stakeholder meetings, held during key stages of the design development.
- 3.4.2 The issues discussed at these meetings have been considered throughout the process of appraising alternatives (refer to Chapter 4, Alternatives) and when developing the Proposed Scheme (Chapter 6).
- 3.4.3 The objectives for each of the meeting types are outlined below.

Introduction meetings (August - October 2009)

- 3.4.4 These meetings were held to:
- introduce specific landowners to the reasoning behind the selection of the Preferred Route;
 - confirm the lines of communication between each landowner and the project team;
 - gather data from landowners to further inform local design development and identify potential mitigation needs;
 - explain the process through to the preparation of Orders; and
 - outline the expected programme of subsequent meetings.

Mitigation meetings (April 2010 - October 2010)

- 3.4.5 These meetings were held to:
- update landowners on progress and any emerging information such as development of side roads, junctions and alignments;

- review impacts specific to each landowner including potential landtake in light of the further development of the design proposals; and
- discuss and seek agreement to proposed mitigation measures and outline accommodation works.

Pre-vesting meetings (October/November 2010)

3.4.6 These meetings were held to:

- confirm the extent of landtake proposed and other impacts specific to each landowner/stakeholder;
- confirm the proposed design and mitigation measures specific to each landowner/stakeholder; and
- reprise the statutory context and rights relative to landowners and potential sources of advice.

Additional meetings (September 2011 - April 2015)

3.4.7 A series of landowner meetings have been held over the 2011 – 2015 period. With regard to environmental issues, the key items discussed included:

- confirmation of the land ownership and interests and particular recording changes that may have taken place since the previous orders; and
- to note any recent planning applications or change in use, conacre etc.

Written communication (2012 – 2015)

3.4.8 In addition to the meetings, there has been a series of written communications issued to landowners to keep them appraised of scheme updates, these are listed in Appendix 3B.

4 ALTERNATIVES

4.1 Alternative alignments

- 4.1.1 Alternative alignments have been considered at three stages during the planning, design and assessment of the Proposed Scheme.
- 4.1.2 An initial consideration of alternatives involved evaluation of a preliminary study area to identify potential broad corridors and establish a preferred corridor.
- 4.1.3 A second consideration of alternatives involved the identification, evaluation and comparison of route options within the preferred corridor. This culminated in the identification of a preferred route.
- 4.1.4 A third consideration of discrete lengths of alternative alignments involved refinement, and where appropriate, modification of the preferred route leading to the establishment of the alignment included within the Proposed Scheme.
- 4.1.5 An outline of the approach, findings and conclusions for each stage is provided below. Detailed information relating to each of the stages is provided in the following project reports, which can be viewed at www.a5wtc.com:
- Preliminary Options Report, Mouchel (2008);
 - Preferred Options Report, Mouchel (2009); and
 - Alternatives Discussion Paper, Mouchel (2010).

Establishment of the preferred corridor

- 4.1.6 It was decided at a very early stage in the process in 2008 that initial engineering and environmental study areas would be defined to provide focus to the project teams for data collection. In addition and at the same time, from a project management and procurement strategy point of view, the scheme should be split into three sections of approximately 30km each. For the purposes of recording and assessment the division of the preferred corridor was finalised into three sections:
- New Buildings to South of Strabane;
 - South of Strabane to South of Omagh; and
 - South of Omagh to Aughnacloy.
- 4.1.7 The establishment of the preferred corridor involved preliminary consideration and evaluation of three potential corridors:
- one focused on the existing A5 corridor;
 - one to the west of the existing road; and
 - one to the east of the existing road.

- 4.1.8 The three corridors were made up of a series of links between nodes which could be combined to establish the emerging preferred corridor. The links were tested against a combination of primary engineering, economic, environmental and traffic associated constraints and criteria. Key constraints included:
- European and Nationally designated sites of nature conservation interest;
 - Nationally designated sites, features and buildings of cultural heritage value;
 - Requirements for extensive property demolition;
 - Areas of very high / steep ground;
 - Areas of extensive peat;
 - Areas of nationally designated landscapes; and
 - Implications relative to floodplains.
- 4.1.9 Consideration was also given to areas where the assessment team concluded that the relationship between primary criteria and/or a combination of environmental interests framed areas of high environmental sensitivity to the form of development proposed.
- 4.1.10 Key economic and traffic-related criteria included connectivity with other parts of the national network and with the Republic of Ireland (ROI), accessibility to the principal settlements along the corridors and their overall length and cost.
- 4.1.11 The preliminary evaluation established that the location of primary engineering and environmental constraints, combined with traffic related and economic criteria, precluded the adoption of any of the three options listed in 4.1.7 in their entirety and that corridors, utilising sections of each, would need to be considered. This involved:
- a further evaluation of potential options comprising parts of the initial corridors against the primary criteria;
 - interrogation of the findings of the evaluation at a Preferred Corridor Workshop attended by the Roads Service project team and Mouchel's engineering, traffic and environment teams. This is documented in Chapter 7 of the Preliminary Options Report; and
 - a final review of the emerging preferred corridor against the key project objectives and modification of the corridor, concluding with the confirmation of the preferred corridor as shown in Figures 4.1 – 4.6.
- 4.1.12 The preferred links within each corridor were chosen to avoid the following receptors/constraints:
- New Buildings to south of Strabane*
- Bready Archaeological Area, the Foyle floodplain and the River Foyle & Tributaries Special Area of Conservation (SAC)/Area of Special Scientific Interest (ASSI) and west of the existing A5 between New Buildings to Drumenny via Bready.

- The Foyle floodplain, the River Foyle & Tributaries SAC/ASSI, McKean's Moss ASSI and peat bog, west of the existing A5 between Ballydonaghy and Greenbrae.
- Areas of high ground, high relief and the Sperrin Area of Outstanding Natural Beauty (AONB), east of the existing A5 between Milltown Burndennet to Ballee via Artigarvan.
- The communities of Ballymagorry and Artigarvan and the River Foyle & Tributaries SAC/ASSI east of the existing A5 between Milltown Burndennet and Greenbrae via Ballymagorry.
- Areas of high ground, high relief and the Sperrin AONB, around Liskinbwee to the east of Sion Mills (Carrigullin).
- Floodplains, the Mourne River SAC/ASSI, properties in Strabane and on the existing A5 between Greenbrae and Sion Mills via Strabane.

South of Strabane to south of Omagh

- Towns and heritage, especially Sion Mills and Victoria Bridge along the existing A5 from Sion Mills to north of Ardstraw.
- Sperrin AONB from Douglas Bridge to east of Mountjoy and east of Mountjoy to east of Omagh.
- Properties in Omagh and along the existing A5, from Fairy Water bridge to south of Omagh.

South of Omagh to Aughnacloy

- Deroran Bog SAC/ASSI at Tattykeeran.
- Properties in Omagh and other communities.
- Martray House and Lough and Slievemore Ridge.
- The Thistle (heritage feature), substantial low-land raised peat bog and the River Blackwater floodplain at Ravellea, to the west of Aughnacloy.
- Substantial low-land raised peat bog at Ballynamullan, Golan Donaghanie, Seskinore, Tullyvally, Tattyreagh, Glebe and Mullaghmore.

Route options

4.1.13 A large number of initial route options were identified in each section, terminating and originating at the common nodes south of Strabane and Omagh which formed the interfaces between the three sections. The initial identification of the route options was based on a broad evaluation of engineering feasibility and environmental constraints. These were then subject to further evaluation taking into account engineering and environmental constraints and opportunities at the local level, in addition to those considered during the preferred corridor appraisal. The evaluations were undertaken using a framework of five overarching criteria against which government tests all major transport projects (environment, safety, economics, accessibility and integration). Additional criteria were also used as follows:

- Avoidance of residential properties wherever possible, then commercial properties followed by agricultural buildings;
- Avoidance of designated sites/buildings in the hierarchy of international, European, UK, NI and local importance;
- Avoidance of areas where a combination of minor constraints would result in significant impacts;
- Avoid areas of alluvial/peat materials which may also be flood plains and require expensive construction; and
- Avoidance of flood plains where mitigation by compensatory area would not be readily achievable.

4.1.14 This further evaluation resulted in the identification of four potential route options within each section of the preferred corridor. The route options within each section and their colour coding at the time of the assessment are shown in Figures 4.1 – 4.6

The emerging preferred route

4.1.15 A detailed evaluation of the four route options within each section of the preferred corridor was then completed using the government's criteria and the additional criteria stated in paragraph 4.1.13 above.

4.1.16 The findings of this evaluation were tested at a Preferred Route Workshop (5th – 7th May 2009). This is detailed in chapters 4 and 5 for the New Buildings to south of Strabane Section, chapters 6 and 7 for the South of Strabane to south of Omagh Section and chapters 8 and 9 for the South of Omagh to Aughnacloy Section of the Preferred Options Report. This culminated in the identification of an emerging preferred route which was subject to final review against the project objectives. Chapter 12 of the Preferred Options Report summarises these decisions. The resultant preferred route is shown in Figure 4.7. This is the preferred route that was subject to ministerial announcement on the 21st July 2009 and taken to the public consultation exhibitions the following week.

- 4.1.17 The findings of the route options appraisal and the basis for the selection of the preferred route within each section are outlined below.

New Buildings to south of Strabane (Figures 4.1 and 4.2)

- 4.1.18 In this section the Purple Route was preferred from New Buildings to Magheramason to avoid potential impacts on settlements and areas of high ground to the east. South of Magheramason the Pink Route was chosen to avoid environmentally sensitive areas to the west of Bready before passing to the west of Burndennet Bridge and Ballymagorry, whilst ensuring that protected areas such as McKean's Moss ASSI would be avoided. The emerging preferred route continued to the west on the Pink Route before adopting the Black Route to skirt around the western boundary of Strabane, avoiding the high ground and protected/sensitive areas to the east and providing better connectivity to the town and ROI.

South of Strabane to south of Omagh (Figures 4.3 and 4.4)

- 4.1.19 In this section the Black Route was preferred. Factors considered included potential impacts on landscape and interaction with the Sperrin AONB, the presence of sites of heritage value in Newtown Stewart, both on the east (Franciscan Friary and Graveyard) and west side (Harry Avery's Castle), and the potential impacts on Grange Wood ASSI, the Rivers Strule and Owenkillew which are tributaries of the River Foyle and the Tully Bog which are all designated Special Areas of Conservation (SAC). In addition, issues relating to community severance at Mountjoy were considered.

South of Omagh to Aughnacloy (Figures 4.5 and 4.6)

- 4.1.20 In this section the emerging preferred route initially followed the alignment of the Red Route to offer better connectivity to Omagh via a junction with the existing A5 and to avoid large areas of peat which, at that time, without the benefit of ground investigation data, was felt would result in buildability issues and high costs. It then crossed to the western side of the preferred corridor with a junction on the B46, providing strategic connectivity to Fintona and Beragh. The route continued southwards passing to the east of Newtownsaville intersecting the A4 with another junction to link the A4 and the proposed A5 west of Ballygawley. The route then transferred from the Red Route to the Pink Route and passed to the west of the Tullyvar section of the A4 and A5 Improvements Project and east of Aughnacloy to avoid The Thistle (a Registered Park, Garden and Demesne) and to provide connectivity with the A28. The route then tied in with the existing A5 north of Moy Bridge.

4.2 Refinement of the preferred route

4.2.1 Following the preferred route announcement in July 2009 some thirty-one alternatives for localised sections of the corridor were identified and evaluated in light of further information relating to ongoing environmental surveys and data collection, ground investigations, drainage surveys and flood modelling and feedback from landowners. Description and evaluation of the alternatives is provided in the Alternatives Discussion Paper (www.a5wtc.com).

4.2.2 Online widening of the existing A5 to dual carriageway standard was also considered as an alternative in certain discrete areas following stakeholder feedback. However this was not considered an appropriate solution for reasons outlined below and in the Preliminary Options Report (www.a5wtc.com).

- Significant property loss;
- Impacts on residents (noise, air quality and severance); and
- Impacts on the Sion Mills Heritage Identity Area.

4.2.3 Eleven of the thirty-one alternatives considered have been incorporated into the Proposed Scheme and are outlined below.

New Buildings to south of Strabane

Alternative 1 – New Buildings (Figure 4.8)

4.2.4 Following a series of landowner meetings, an alternative was considered to move the mainline closer to the River Foyle (whilst remaining outside the floodplain) near New Buildings in order to reduce severance of landholdings. Although there would be greater impact on the setting of the river and potentially an increased risk of a spillage/pollution event, the alternative was considered preferable to the preferred route as the impact could be readily mitigated and there would also be a potential reduction of visual, air quality and noise impacts to residential dwellings to the south of New Buildings.

Alternative 2 – Bready (Figure 4.9)

4.2.5 The preferred route crossed over the existing A5 at a high skew angle north of the Magherareagh community, swinging from the east to the west. During the development of the preferred route, the land parcel constraints around Magherareagh were reviewed and re-defined following landowner consultation. This resulted in a second crossing point of the existing A5 becoming viable, leading to the development of an alternative alignment which was supported by a number of local residents during landowner meetings.

4.2.6 The alternative would reduce the volume of earthworks and the number of side road diversions required, providing an overall saving in construction costs without incurring a reduction in economic benefit. There would be significant landscape and visual impacts to residential properties for both options but the alternative had greater potential for

mitigation. The alternative would also have lower potential for impacting wintering birds on Grange Foyle and would sever fewer land parcels.

Alternative 3 – McKean’s Moss (Figure 4.10)

- 4.2.7 The emerging preferred route would have had hydrological and air quality impacts on McKean’s Moss ASSI. Further ground investigation revealed that the section of the Preferred Route close to McKean’s Moss was less favourable from an engineering, cost and environmental perspective. An alternative was developed which avoided McKean’s Moss but required acquisition and demolition of three additional properties. Despite this, the alternative remained a cost effective option due to the high construction and maintenance costs of the original Preferred Route option. The alternative route avoided the ASSI and minimised the need for complicated drainage works. The alternative was adopted on the basis of cost savings and reduced hydrological and air quality impacts.

Alternative 4 - Ballymagorry (Figure 4.11)

- 4.2.8 An alternative route was developed west of the preferred route at Ballymagorry due to a review of the flood modelling and following consultation with landowners. The results of detailed traffic modelling also showed that connectivity to Woodend Road was required and that a junction at this location would provide greater scheme economic benefits. The alternative route would improve connectivity and journey reliability for local road users and is further away from the highest density of residential dwellings, although overall, the number of landowners affected increased. The alternative would also reduce the amount of displaced flood water. The alternative was considered preferable to the preferred route due to economic and connectivity benefits. Further information regarding this alternative is provided in the Choice of Route for the A5WTC at Ballymagorry Report (ref: 718736-0800-R-029).

Alternative 5 - Strabane (Figure 4.12)

- 4.2.9 An alternative route at the River Mourne crossing was developed as the preferred route alignment led to an over-complicated bridge over the Mourne. Altering the alignment reduced the complexity of the bridge and its associated costs, however there would be additional land take as a result. The alternative would also be further away from residential properties to the south of the Mourne. The alternative was considered preferable to the preferred route primarily due to reduced construction costs.

South of Strabane to south of Omagh

Alternative 6 – Newtownstewart (Figure 4.13)

- 4.2.10 Following consultation with the Northern Ireland Environment Agency (NIEA), concerns were expressed about potential impacts at Harry Avery’s Castle. An alternative to the preferred route which aligned the route further south of Harry Avery’s Castle was developed to reduce the potential heritage impacts. The alternative was chosen primarily to accommodate NIEA’s concern but it also had marginal cost and environmental benefits due to reduced earthworks and it eliminated the need to divert the Back Burn.

Alternative 7 - Omagh (Figure 4.14)

- 4.2.11 The ground investigation revealed that the woodland area close to Gillygooley Road would require complex and expensive engineering solutions due to the extent of soft ground. An alternative route was developed which avoided the area. The alternative route would sit lower in the valley, reducing the landscape and visual impact, and by avoiding the woodland, would minimise the ecological impact. The alternative was considered preferable to the preferred route due to reduced construction costs and reduced environmental impact.

South of Omagh to Aughnacloy*Alternative 8 - Doogary (Figure 4.15)*

- 4.2.12 During the public exhibitions in July 2009 there were some concerns raised about the alignment at Doogary, which crossed the existing A5 twice and passed through agricultural land in order to avoid an adjacent bog. An alternative was developed which runs alongside the bog, reducing the amount of land take and the number of bridges required. Avoiding the need to cross the existing A5 also improved safety by simplifying the traffic management needs and improved buildability. Although more complex ground engineering would be required to construct the road along the bog, the reduced number of bridges, shortened length and improvement in scheme economics, would result in a better cost: benefit option, compared to the preferred route. The alternative would result in an increased ecological impact but the landscape and visual impacts would be reduced. The alternative was considered preferable to the preferred route, primarily on the basis of reduced costs.

Alternative 9 - Newtownsaville (Figure 4.16)

- 4.2.13 During the public exhibitions in July 2009 and subsequent landowner meetings, there were some concerns about the route at Newtownsaville. The concerns were on the basis that the route crossed the existing Newtownsaville Road twice and passed through agricultural land and near dwellings in order to avoid an area of perceived poorer ground, including a bog located to the east of the existing Newtownsaville Road. An alternative was developed to address these issues. The cost of the alternative would be lower than the preferred route as it would be 150m shorter and have fewer crossings of existing side roads. The alternative would have lesser landscape and visual impacts and there would be improved integration due to reduced community severance with less impact on existing side roads.

Alternative 10 - Ballygawley (Figure 4.17)

- 4.2.14 A number of concerns about the preferred route at Ballygawley and the location of the proposed junction with the A4 were made by members of the public and landowners. Objections were due mainly to the potential impact on properties and land close to the A4. The combination of the development of the preferred route (in particular the junction type at this location) and landowner concerns led to alternative routes being considered. An alternative route was developed further west, away from Ballygawley, which resulted

in lower costs due to reduced earthworks and shortening of the route. By crossing the Ballygawley Water further south, the chosen alternative route also reduced the impact to the flood regime in the area.

Alternative 11 - Aughnacloy (Figure 4.18)

- 4.2.15 Following the preferred route announcement, a decision was made to incorporate a limited movement junction north of Aughnacloy. The junction location, at the crossing between the proposed A5WTC and existing A5, would provide access to and from Aughnacloy.
- 4.2.16 The preferred route approaching the proposed junction from Ballygawley went through a number of drumlins requiring significant earthworks. The chosen alternative would better align with Loughans Road thus improving safety. It would also result in lower costs compared to the preferred Route due to reduced earthworks and reduced land take. Landscape and visual impacts would also be reduced as the drumlins would be avoided. The alternative was therefore adopted.

4.3 Development of the Proposed Scheme (2013/14)

- 4.3.1 Following the public inquiries in 2011, a number of the inspectors' recommendations were accepted and incorporated into the scheme.

Lisnagirr Road, Mountjoy

- 4.3.2 The proposals promoted in 2010 provided for the stopping up of Lisnagirr Road rather than allowing for the introduction of a full headroom bridge over the local road. It was the Department's view that increasing the height of the proposed embankments supporting the dual carriageway to accommodate the bridge, would markedly increase an already large visual impact for property located east of the proposed dual carriageway. Following objections from local road users and responses at the public inquiries held in 2011, the inspectors recommended that a reduced headroom bridge should be considered at this location. The Department accepted the recommendation.
- 4.3.3 An alternative has been prepared and is included as part of the Proposed Scheme. The proposal allows for the raising of the dual carriageway by some 700mm above the level proposed in 2010 and the local lowering of Lisnagirr Road east of the dual carriageway to enable an underpass with 4.5m headroom to be provided on Lisnagirr Road. Some additional land has been included in the NIMVO for minor works to Lisnagirr Road and the provision of turning heads.

Retention of existing A4/A5 roundabout, Ballygawley

- 4.3.4 The proposals promoted in 2010 at Ballygawley provided for:
- extension of the A4 dual carriageway across the existing A4/A5 roundabout as far as Junction 15;

- a new overbridge carrying the existing A5 from Aughnacloy over the A4 dual carriageway; and
- realignment of Tullybryan Road from Ballygawley to the proposed Junction 15 to provide connectivity between the A4/A5 trunk road and the village of Ballygawley and its environs.

4.3.5 This arrangement was challenged at the public inquiries in 2011 and an alternative proposed that retained the existing A4/A5 roundabout, thus avoiding the requirement for the proposed Tullybryan Road realignment. The inspector's recommendation was that the proposals should be amended in line with the alternative. The recommendation was accepted and the amendment has been incorporated as part of the Proposed Scheme. Retaining the roundabout also enabled the design to incorporate a connection with Tullywinney Road to the south.

4.3.6 The Department has continued to review the Proposed Scheme which forms the subject of this ES to ensure that it adheres to current design standards and legislation and reflects the potential for phased construction in line with any budgetary requirements. This has resulted in the following changes to the scheme design.

Development of the drainage strategy

4.3.7 Since 2012 the drainage strategy has been modified. Previously the sustainable drainage systems for water quality treatment and flow attenuation were predominantly characterised by the use of dry ponds and wetlands. Following liaison with the NIEA, and in line with updated and emerging drainage design standards, the current drainage strategy predominantly consists of wet ponds. Further detail on the drainage strategy and design is provided in Chapter 6.

Alternative junction layouts to accommodate scheme phasing

4.3.8 The phased delivery programme for the scheme results in interim traffic movements between the existing A5 and proposed A5WTC which were not considered within the original single phase delivery programme. A review of the proposals at the phasing tie-ins has taken place with minor changes to the alignment being incorporated into the scheme to cater for the interim higher traffic flows at discreet locations. The tie-ins that required reviewing were;

Junction 3 (North of Strabane)

4.3.9 Phase 1 Proposals: These works include the main line carriageway north of the junction, the two north facing slip roads (northbound on slip and southbound off slip) the link road between the A5WTC and the ex A5; 2 roundabouts and a priority junction and the Woodend Road realignment.

4.3.10 Phase 2 Proposals: These works include the main line carriageway south of the junction; the south facing slip roads (northbound off slip and southbound on slip) and the Park Road link.

4.3.11 Changes in Traffic Flows: During Phase 1 A5 traffic will use the existing A5 south of the junction and the new A5WTC north of the junction. During Phase 1 the link road between these roads will carry the full traffic flow rather than the lower flow associated with the full junction being operational. Similarly the north facing slip roads will carry much higher flows during Phase 1.

4.3.12 Review of Design: The interim traffic patterns with increased flows on selected links required a review of the design for these links. The review identified that the slip roads and link road widths were adequate however the junction arrangements for the link road and slip roads were reviewed in light of their need to cater for both the Phase 1 and Phase 2 traffic patterns. As such, and also taking into account possible impacts on the flood plain in this area, the link road alignment was adjusted and the priority junction at the top of the southbound off slip road was replaced with a new roundabout.

Junction 13 (South of Omagh)

4.3.13 Phase 1 Proposals: These works include the main line carriageway south of the junction; the two south facing slip roads (northbound off slip and southbound on slip); the upgrade of Seskinore Road between the A5WTC and the ex A5 and 3 roundabouts.

4.3.14 Phase 2 Proposals: These works include the main line carriageway north of the junction and the north facing slip roads (northbound on slip and southbound off slip).

4.3.15 Changes in Traffic Flows: During Phase 1 A5 traffic will use the new A5WTC south of the junction and the existing A5 north of the junction. During Phase 1 the section of Seskinore Road between these roads will carry the full traffic flow rather than the lower flow associated with the full junction being operational. Similarly the south facing slip roads will carry much higher flows during Phase 1.

4.3.16 Review of the Design: The interim traffic patterns with increased flows on selected links required a review of the design for these links. The review identified that the slip road widths were adequate however the Seskinore Road width was increased to 7.3m to cater for the higher flows on the realigned section. The roundabout arrangements were reviewed in light of their need to cater for both the Phase 1 and Phase 2 traffic patterns and minor geometric adjustments were made to these to improve capacity for the Phase 1 traffic patterns.

Junction 15 (Ballygawley)

4.3.17 Phase 1 Proposals: These works include the main line carriageway north of the junction; the dualling of the A4 east to the existing Ballygawley Roundabout; Feddan Road realignment and the roundabout junction.

4.3.18 Phase 3 Proposals: These works include the main line carriageway south of the roundabout and connection into the new A4/A5 roundabout.

4.3.19 Changes in Traffic Flows: During Phase 1, A5 traffic will use the new A5WTC north of the junction, the A4 dualling section between the new and existing Ballygawley

roundabouts and the existing A5 south of the A4. During Phase 1 the new dualled section of the A4 will carry increased flows between the roundabouts.

- 4.3.20 Review of Design: The review of the design for the A4 dualling section has found that the proposed dual carriageway and roundabouts would have the capacity to carry the additional Phase 1 traffic and as such no further alternatives were considered.

5 THE EXISTING ENVIRONMENT

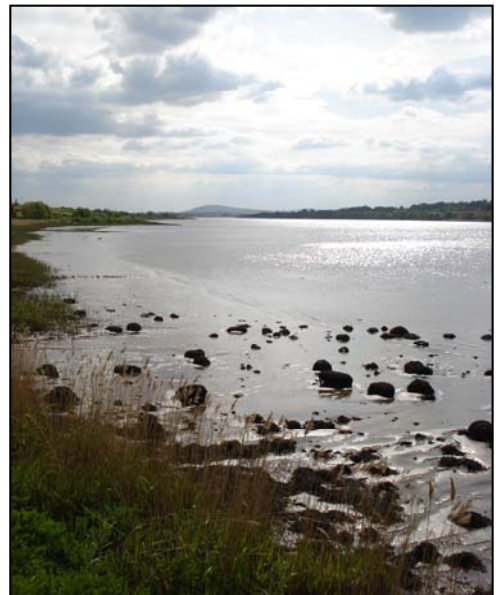
5.1 Context

5.1.1 Travelling from north to south, the physical and natural environment associated with the Proposed Scheme corridor (herewith referred to as the Proposed Scheme) is one of marked contrasts. The paragraphs below describe the existing environment, split into 3 sections for ease of reference.

5.2 New Buildings to South of Strabane

5.2.1 Between New Buildings and Strabane the Proposed Scheme would be located within the broad valley of the River Foyle. It is a large-scale and imposing landscape in which the wide valley floor flanking the river channel is framed by the prominent profile of the Sperrin Mountains to the east, the highest of the peaks being Slievekirk in the north and Owenreagh Hill to the east of Strabane. Beneath the profile of the mountains there is a series of foothills which form the transition from the high valley perimeter to the wide valley floor. Prominent foothills include Gortmonly Hill to the south of Magheramason and Knockavoe to the east of Strabane.

Plate 5.1 The River Foyle



5.2.2 There is a significant break in the foothills in the form of the valley of the east-west flowing Burn Dennet, a significant tributary of the River Foyle. The tributary valley fans out such that the middle third of this section crosses the wide mouth of the valley.

5.2.3 The Sperrins south of the Burn Dennet Valley mark the most northerly part of the Sperrin Area of Outstanding Natural Beauty (AONB).

5.2.4 A second, small tributary of the River Foyle, the Glenmornan River, joins the Foyle immediately south of the confluence with the Burn Dennet. The tributary's catchment extends to the south-east into the foothills and western margin of the Sperrins. The tributary valley becomes well-contained and intimate once it passes the northern limit of Ballymagorry and passes through Artigarvan.

5.2.5 The Foyle valley is flanked on its western side by a grouping of lower hills comprising of/the Dooish Mountain, Binnion Hill and Croaghan Hill. The tributary valleys of the Swilly Burn and Deelee River form a notable break between the hill crests north of Strabane on the western side of the Foyle.

- 5.2.6 Strabane town, the residential, administrative and commercial centre of Strabane District is the largest of the settlements associated with this part of the Proposed Scheme. Other smaller centres of population include New Buildings, Magheramason, Bready, Cloughcor and Ballymagorry.
- 5.2.7 Recognised ecological and nature conservation interests are represented in the form of:
- the River Foyle and Tributaries Special Area of Conservation (SAC) and Area of Special Scientific Interest (ASSI);
 - the River Finn SAC; and
 - McKean's Moss ASSI.
- 5.2.8 Historic buildings and sites of archaeological interest are located throughout the area, the most recognisable and extensive being the Strabane Canal, the line of which is readily evident between the northern outskirts of Strabane and its exit lock on to the River Foyle.
- 5.2.9 Where the Proposed Scheme would pass to the west of Strabane and along the immediate eastern margin of the River Finn, the principal environmental interests comprise the residential community that frames the urban edge of the town and the ecologically important River Finn SAC.

5.3 South of Strabane to South of Omagh

- 5.3.1 South of Strabane the Proposed Scheme would be located within the moderately incised valley of the Mourne River and enters the more deeply incised valley of the Strule River south of Newtown Stewart.
- 5.3.2 Sion Mills, a historically important settlement associated with an expanding linen industry in the mid C19th, marks a point of transition from the urban river valley through Strabane to one within the countryside. The valley is framed to the west by a series of rounded foothills that mark the western margins of the Sperrin AONB. Beyond the foothills the profiles of Conthem Hill and Meenashesk Hill mark the skyline. The lower valley slopes are sparsely settled, the one notable settlement being Douglas Bridge located on the Douglas Burn as it descends from the Sperrins.
- 5.3.3 The western valley side is defined by hills similar in form and scale to those east of the river, the most prominent being Glentimon Hill and Clady Hill. The valley slopes are moderately steep. The settlements of Sion Mills and Victoria Bridge occupy locations on the flatter margins alongside the river, whilst Glebe is located west of Sion Mills in an area where the mid slopes are relatively gentle. At the confluence with the River Derg there are views along the valley to the west towards Ardstraw.
- 5.3.4 There is a significant node in the landscape in this part of the Proposed Scheme at Newtown Stewart. The town sits to the west of the River Strule on slopes rising above a distinctive meander in the river which also marks its confluence with the Owenkillew River. The northern slopes of Bessy Bell provide an imposing backdrop to the town to

the south west. It is a composition which is well appreciated from the existing A5 as it crosses the meander in the river and bypasses the town to the north and east. It is also a composition which can be viewed from parts of the foothills and western Sperrins north of the River Strule. A windfarm located near to the elongated crest of Bessy Bell is a distinctive feature in some of these more distant views. Harry Avery's Castle is a prominent and important reminder of former times set on the lower slopes to the west of the town.

Plate 5.2 Harry Avery's Castle



5.3.5 Recognised ecological and nature conservation interests are represented in the form of:

- The River Foyle and Tributaries Special Area of Conservation (SAC) and Area of Special Scientific Interest (ASSI);
- Owenkillew River (SAC) and (ASSI); and
- Tully Bog (SAC) and (ASSI).

5.3.6 South of Newtownstewart the valley is deeply incised. Bessy Bell rises sharply to the west. Mary Gray and Deers Leap appear prominently to the east. The Proposed Scheme extends from the river, west across the existing road corridor and across the lower and mid slopes of Bessy Bell. The more elevated parts of the Proposed Scheme are open to view from the hills east of the river and appear in views from a complex network of local roads east of the river that extends as far as the Gortin Glen Forest Park.

Plate 5.3 Looking east from Bessy Bell to Deers Leap



5.3.7 As the Proposed Scheme emerges from the incised valley, the landscape opens out. There is an initial tract of undulating landform which gives way to the broad floodplain of the Fairy Water. At the western margins of the Proposed Scheme there are substantial blocks of woodland which frame a distinctive local area in the context of the open valley landscape.

5.3.8 South of the floodplain and west of Omagh there is a locally elevated area of drumlins. Stands of tree planting and boundary hedges combine with the intricate landform to frame an area composed of a series of intimate cells through which a complex network of local roads is threaded. It is a pattern which extends throughout the Proposed Scheme to the south of the town as the drumlin landform continues, albeit at a generally lower elevation than the area to the west.

5.4 South of Omagh to Aughnacloy

- 5.4.1 The landscape associated with the Proposed Scheme south of Omagh is characterised by extensive areas of drumlin lowland, enclosed and divided by a series of sandstone ridges and local hill forms. Immediately south of Omagh there is an area of intimate drumlin landscape through which the Drumragh River meanders in a shallow but well contained valley.
- 5.4.2 Near Gortaclare, the landform of Curr Mountain marks a change in landscape character as the rolling dip slope terrain of the Brougher ridgeline is encountered. The Proposed Scheme would move to the west of Garvaghy Big Hill passing Newtownsaville and Eskra before rising onto the Brougher Ridge west of Tycanny. As it crosses the ridge and begins to descend towards the Clogher Valley the Proposed Scheme is contained within a shallow elevated valley flanked by Beltany Hill, Birney's Hill and Tycanny Hill. Errigal Keerogue Church is a prominent and important ecclesiastical site, set on the higher slopes to the south of Tycanny.
- 5.4.3 The Clogher Valley lowlands are broadly confined between the Brougher Mountain and Slievemore ridges to the north and Slieve Beagh to the south. This is a distinctive part of the Proposed Scheme with a drumlin landform crossed by a network of rivers and streams. Between the drumlins are numerous local water courses, small raised bogs and numerous hedgerows.
- 5.4.4 The crossing of the A4 marks a transition as the influence of the Brougher Ridge is left behind. Black Hill, an outlying and conspicuous drumlin/moraine landform marks this point of transition between the higher, rolling terrain of Big Hill/Branny Hill to the east of the Proposed Scheme and the lower valley setting of the River Blackwater to the west.
- 5.4.5 Views from within and across this landscape are varied. The hill mass of Slieve Beagh is the primary backdrop to elevated views from the Proposed Scheme. There are filtered expansive vistas towards the rounded, wooded hills of Favour Royal Forest. At lower levels the landscape is markedly more intimate with views contained by the rounded drumlin landforms.
- 5.4.6 The settlement of Aughnacloy is located at the southern end of the Proposed Scheme on the River Blackwater where it leaves the Clogher Valley. Here, the surrounding landscape is one of visually appealing drumlin landform and riverside settings. The historic core of the town is located on a drumlin crest, set above the shallow river margin landscapes and drumlin landforms of the river. The town's churches are conspicuous features of the landscape setting, often visible through drumlin landforms and providing a strong sense of place.
- 5.4.7 West of the town there is a broad and low-lying marginal river landscape with widespread views to distinct and rounded drumlin landforms, with Slieve Beagh a distant backdrop. The influence of the town and of designed landscapes is marked, with extensive views to Ravellea across the "Thistle", an early C18th design laid out in a series of extensive

ditches and planted banks. The form of the Thistle is barely evident at ground level but can be noticed from the elevated prospect of the town.

5.4.8 To the east and north of the town, there is a more elevated and enclosed landscape of moraine deposits with restricted views and occasional prospects westwards. As the nature of the terrain rises towards neighbouring hills, the hummocky form and pattern of the drumlins varies, with slightly wider prospects through the river valley connecting Aughnacloy with Carnteel. To the south, the River Blackwater continues to influence the drumlin defined valley landscape across the border with ROI.

Plate 5.4 Looking east across the drumlin landscape from the Brougher Ridge



6 THE PROPOSED SCHEME

6.1 Introduction

- 6.1.1 The Proposed Scheme comprises an 85km long dual carriageway, running largely through an agricultural landscape between New Buildings and the border with the Republic of Ireland (ROI), immediately south of Aughnacloy. The design standards adopted, predicted traffic flows, alignment, principal components proposed, landscape measures, environmental mitigation and principal construction activities anticipated to be involved are described below. The alignment and principal design components are shown in Figures 6.1 - 6.17.
- 6.1.2 Subject to approval to proceed to implementation, it is possible modifications to the proposals could be identified during detailed design which may benefit the integration, operation, environmental implications or economics of the Proposed Scheme. Should this be the case, such modifications would be subject to approval by TransportNI, who would be required to ensure that those responsible for the detailed design demonstrate that such modifications would not detrimentally change the significance of the impacts described in this Environmental Statement.

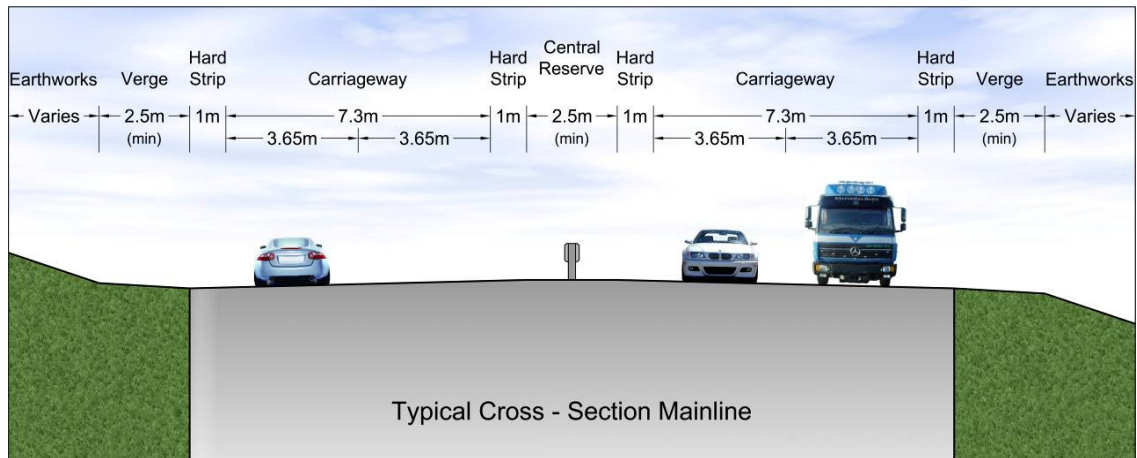
6.2 Design standards

- 6.2.1 The dual carriageway would be constructed as a Category 6 Dual Carriageway in accordance with the Design Manual for Roads and Bridges (DMRB) Volume 6, Section 1, Part 1 TD 9/93 Highway Link Design standards. Typical cross section dimensions for the dual carriageway are detailed in Table 6.1 and illustrated in Plate 6.1.

Table 6.1 Dual carriageway dimensions

Element	Dimension
Carriageways	2 x 7.3m
Hard Strips	4 x 1m
Central Reserve	2.5m (minimum)
Earthworks	Varies
Verges	2 x 2.5m (minimum)
Total Width	26.1m (minimum)

Plate 6.1 Typical cross section



6.2.2 The boundary fence would generally be a 1.2-1.5m high concrete post and chainlink fence.

6.3 Predicted traffic flows

6.3.1 A strategic traffic model has been developed in order to predict future traffic flows in the catchment area for the Proposed Scheme. The model has been designed to facilitate the testing of alternative scheme alignments, junction locations, design support, economic appraisal and to provide supporting information for environmental modelling.

6.3.2 The model has been based on the SATURN suite of software. Separate models were developed to cover the AM Peak hours (7.30 – 9.30 am), PM Peak hours (4.00 – 6.00 pm) and the average interpeak hour (9.30 am to 4 pm).

6.3.3 The traffic model and associated data collection has been undertaken in accordance with the Design Manual for Roads and Bridges Volume 12, Section 1, Part 1, The Application of Traffic Appraisal to Trunk Roads Schemes, and the Department for Transport (DfT) WebTAG Guidance.

6.3.4 Traffic forecasts have been developed using a bespoke version of TEMPRO¹ that has been adapted to local Northern Ireland forecasts of travel growth. This growth is applied at electoral ward level, an area consisting of approximately 1000 households, so that variations in travel growth can be replicated during traffic forecasting.

6.3.5 The traffic modelling has predicted the annual average daily traffic (AADT) flows in the anticipated opening year of 2028 and the future assessment year of 2041. Data has

¹ The TEMPRO software provides summaries of National Trip End Model (NTEM) forecast data for transport planning purposes. The forecasts include population, employment, households by car ownership and trip ends.

also been provided for the anticipated opening years for phases 1 and 2 of the proposed construction programme. The traffic forecasts have contributed to the selection and refinement of the route as well as providing the basis for the air quality, effects on all travellers, water quality and noise modelling assessments.

- 6.3.6 The predicted traffic flows vary across the scheme, Table 6.2 shows the two-way Annual Average Daily Traffic AADT for 4 key sections of the scheme for the anticipated opening year for the fully completed scheme (2028) and for the design year (2041) adopted for evaluating. The figures are rounded to the nearest 100 vehicles.

Table 6.2 Predicted traffic flows by section

Section	Year 2028 (AADT)*	Year 2041 (AADT)*
Londonderry to Strabane	17800 vehicles	19800 vehicles
Strabane to Omagh	20200 vehicles	22300 vehicles
Omagh to A4	17400 vehicles	20900 vehicles
A4 to Aughnacloy	6700 vehicles	7800 vehicles

- 6.3.7 DMRB Volume 5, Section 1, Part 3, TA46/97 Traffic Flow Ranges for Use in the Assessment of New Rural Roads recommends that a dual carriageway is appropriate for a range of Opening Year AADT flows between 11,000 and 39,000. These figures are considered to be a starting point for the economic assessment of new roads but it should be noted that other factors such as safety, consistency of standard and providing an integrated network are also considered when deciding on the final carriageway standard of the Proposed Scheme.
- 6.3.8 The traffic data used for the purposes of the assessments reported in this Environmental Statement is available in Appendix 6A.

6.4 Road alignment

New Buildings to south of Strabane (Figure 6.1 – 6.4)

- 6.4.1 The Proposed Scheme commences on the northern fringe of New Buildings where a new roundabout (junction J1) located adjacent to the existing A5 connects the Proposed Scheme and the existing A5. An initial 1.2km section of 2+1 single carriageway runs in a south-westerly direction from the roundabout west of the settlement and close to the eastern bank of the River Foyle through a part of the valley which is designated as being of high scenic value. There is a transition from wide single carriageway to dual carriageway at a second roundabout (junction J2) where an eastern spur off the roundabout provides for access between the existing A5 and the proposed A5WTC, approximately 0.5km south-west of the settlement.
- 6.4.2 Continuing south-west from J2, the proposed dual carriageway passes through a short section of deep cutting (maximum depth 13m) and then between Magheramason and the River Foyle, in the vicinity of the northern limit of the River Foyle and Tributaries Special Area of Conservation (SAC) and Area of Special Scientific Interest (ASSI). It

crosses Dunnalong Road immediately south of the village, the local road being realigned on embankment (maximum height 15.5m) to the south of its existing alignment to enable it to be bridged over the dual carriageway. The alignment continues in a south-westerly direction becoming more distant from the SAC and ASSI as the river follows a marked meander to the west. It crosses Meenagh Road which is raised on embankment (maximum height 9.5m) on-line to maintain access along the local road, and then follows a gentle curve to the south as it rises on high embankment (maximum height 9.5m) to enable the proposed dual carriageway to be bridged over the existing A5 Victoria Road, north of its junction with Cloghboy Road.

- 6.4.3 South of the new bridge, the alignment encroaches onto the lower western slopes of Gortmonly Hill where there is substantial cutting and re-grading of the slopes as they rise some 60m to the east of Bready.
- 6.4.4 The proposed dual carriageway emerges from the cutting and follows an alignment at-grade, east of, and roughly parallel with, the A5. The two roads are visually separated by a low, elongated rise in the local landform. It crosses Donagheady Road, which is realigned from its existing junction with the A5 Victoria Road to the south of its existing alignment over an approximate 500m length east of Victoria Road. The realigned section is raised on embankment (maximum height 10.5m) to provide clearance for a new bridge over the proposed dual carriageway.
- 6.4.5 The alignment then follows a gentle curve to the south-west, passing between Willow Farm and housing on the A5 Victoria Road. It crosses Willow Road in shallow cutting and rises on embankment (maximum height 12m) to enable it to be bridged over the A5 Victoria Road. Continued access from Victoria Road along Willow Road is provided for by the introduction of a new section of single carriageway road running adjacent to the eastern boundary of the proposed dual carriageway and tying into the existing A5 Victoria Road at a new T-junction south of the proposed bridge over the existing road.
- 6.4.6 The dual carriageway descends from the bridge to cross Ash Avenue on low embankment before rising again onto 8m high embankment and crossing Drumenny Road via a new bridge. This section of the Proposed Scheme requires the closure of Ash Avenue where the dual carriageway crosses the local road, and also results in the loss of land currently used by local sports teams, north of Drumenny Road. Continued access for property along Ash Avenue from the existing A5 is provided for off the A5 along Drumenny Road and along a new section of local road running adjacent to the dual carriageway boundary from Drumenny Road, west of the proposed bridge over the local road. The dual carriageway continues on embankment (maximum height 13m) between Drumenny Road and the Burn Dennet. A new 8m-high open-span bridge carries the road over the watercourse with the span allowing for agricultural access along both river banks.
- 6.4.7 Beyond the watercourse, the alignment curves from south to south-east to avoid encroachment into McKean's Moss ASSI. It initially descends from the Burn Dennet

crossing before rising on embankment (maximum height 10.2m) to cross over Ballydonagh Road and Moss Road. Existing access along Ballydonagh Road is stopped up. Access along Moss Road is maintained on-line beneath the dual carriageway via an underbridge which also caters for continued access to Ballydonagh Road by way of a new section of link road between Moss Road and Ballydonagh Road immediately west of the dual carriageway. As the proposed scheme travels east of McKean's Moss, it is in a sidelong cutting (maximum depth 12.2m) below the existing A5 before it emerges onto embankment (maximum height 7.8m) to access a new open-span bridge over the Glenmornan River. The proposed open-span bridge is of sufficient width to accommodate agricultural access beneath the dual carriageway on both sides of the watercourse.

- 6.4.8 South of the river, the dual carriageway remains on embankment (maximum height 10.8m) as it crosses Greenlaw Road and Park Road. Greenlaw Road is stopped up at the crossing. An underbridge provides for continued access on-line along Park Road and to Greenlaw Road. A footpath is provided between Park Road and Greenlaw Road, running adjacent to the boundary at the foot of the embankment and west of the dual carriageway. Continuing south, the dual carriageway approaches the location of an extended all-movements grade-separated junction (J3) south-west of Ballymagorry.
- 6.4.9 J3 comprises an extended arrangement with a new roundabout on the line of the existing A5 linked to J3 some 150m east of Park Road via a new 500m section of single carriageway road. J3 consists of a dumbbell roundabout arrangement. The western roundabout connects with the northbound exit and entry slip roads and also a link to Park Road. The southbound exit slip road connects with the east roundabout whilst southbound access from the local road network to the proposed A5WTC is provided for via an entry slip road off the new roundabout on the existing A5. The tie-in with Park Road for the link road comprises a simple T-Junction. Spruce Road is stopped up each side of the land take for the Proposed Scheme, access to property west of the land take being made available from the existing A5, the new link road, and south along Park Road.
- 6.4.10 South of J3, the dual carriageway is on embankment (maximum height 10m) as it curves to the south-west on an alignment between the A5 Victoria Road and the disused Strabane Canal. It passes to the rear of housing on Victoria Road before crossing the line of the disused canal and following an alignment adjacent to the existing A5 as it rises on embankment at its approach to a proposed bridge over the A38 Lifford Road and Mourne River.
- 6.4.11 A complex junction arrangement (J4, J5 and J6) provides for access and exit onto and off of the new dual carriageway and for continued access along Park Road and the A38. To the north of the river, J4 and J5 comprises an enlarged existing roundabout at the northern end of the existing Mourne Bridge, and two new roundabouts. Southbound access off the A5WTC is via a new slip road directly onto the existing roundabout. Northbound access from Strabane is available via the existing roundabout

and the A38 to a new roundabout on the line of the A38 beneath the two most northerly spans of the new bridge and a section of single carriageway road to a second new roundabout located to the west of the dual carriageway which provides for access to a slip road merging with the northbound carriageway of the dual carriageway. Northbound access from Lifford is provided for via the A38 to the roundabout beneath the dual carriageway and then via the new link road and roundabout providing for access to the A5WTC and Park Road.

- 6.4.12 Northbound access to Strabane and southbound access from Strabane onto the A5WTC is provided for via J6 where two new slip roads south of the river link the dual carriageway to the local road network via the existing roundabout located at the junction of the A5 Great Northern Link and Bradley Way.

South of Strabane to Newtownstewart (Figure 6.5 – 6.7)

- 6.4.13 South of J6, the dual carriageway follows a south-westerly alignment on 4-6m high embankment along a narrow corridor between the western edge of Strabane and the River Finn and close to the rear of property on Urney Road and Glenfinn Park.
- 6.4.14 A new junction (J7) comprising a large diameter roundabout on 13m-high embankment is located close to the river bank, some 200m south of Glenfinn Park. Continued access along the A5WTC is provided via a southerly orientated exit from the roundabout. Urney Road is locally realigned through the junction via a bridge beneath the dual carriageway as it exits the roundabout to the south. New T-junctions off the realigned road maintain access to Carrick Avenue.
- 6.4.15 A north-westerly orientated spur on the roundabout provides for future access to a proposed new bridge over the River Finn to cater for a link between the A5WTC and a proposed upgrading of the N14 / N15 in Donegal. The new bridge and works associated with the N14 / N15 have been the subject of separate statutory procedures and do not form part of the Proposed Scheme. The Irish government has committed to constructing the bridge at the same time as the A5WTC to ensure the road network is fully operational.
- 6.4.16 As the dual carriageway runs south from J7, it is in a 2km long cutting (maximum depth 20m) passing beneath Strahans Road and adjacent to a flooded disused quarry. It emerges from the cutting close to the rear boundary of property on Knockroe Road, crosses Bog Lane Road and Knockroe Road close to existing levels before returning to cutting (maximum depth 8.5m) as it passes beneath Orchard Road. Bog Lane Road and Knockroe Road are both to be stopped up at the crossing points. A proposed overbridge carries Orchard Road over the dual carriageway maintaining access along the local road network. A new T-junction west of the dual carriageway connects with a 300m realigned section of Knockroe Road providing continued access between sections of Bog Lane Road and Knockroe Road either side of the dual carriageway.
- 6.4.17 The cutting south of Orchard Road reduces in depth as the dual carriageway follows a marked curve and emerges from the cutting to pass through a proposed compact

grade-separated junction (J8) north of Sion Mills. Access onto and exit from the A5WTC comprises compact slip roads with each of the two carriageways feeding onto a link road which ties into the existing A5 by way of a new roundabout. The link road is raised on 11m high embankments and bridged over the dual carriageway to provide for access to the existing A5 from the northbound carriageway.

- 6.4.18 The dual carriageway continues to curve south from J8, crossing Peacock Road as it enters a short, asymmetric cutting (maximum depth 16m), the deeper of the cutting slopes being east of the carriageways. It emerges briefly from the cutting and then enters a second asymmetric cutting (maximum depth 20m), with the principal cutting slope on the west side of the carriageways as it runs between the settlements of Sion Mills and Glebe. Peacock Road is stopped up either side of the dual carriageway, access to fields and property being via the existing T-junction between the local road and the existing A5 and from the A5 along Primrose Park to its existing junction with Peacock Road. A proposed bridge over the cutting between the two settlements maintains access along Primrose Park.
- 6.4.19 South of Sion Mills and Glebe, the dual carriageway is in shallow, sidelong cutting along the east facing valley slopes of the Mourne River. It crosses beneath Bells Park Road at its existing junction with Garden Road and then High Road as it curves to the south-east and approaches and crosses Seein Road in shallow cutting. Garden Road and Bells Park Road are both locally realigned east of the dual carriageway and linked via a new T-junction. Bells Park Road is raised on low embankment to provide the required clearance over the dual carriageway. High Road is stopped up. Seein Road is realigned to the north and rear of property fronting onto the local road to enable it to be raised on embankment and bridged over the dual carriageway.
- 6.4.20 The dual carriageway then moves onto a series of high embankments (maximum heights 9-15m) as it descends and crosses two small tributary valleys of the Mourne River and is bridged over Concess Road and Fyfin Road. There is a proposed compact grade-separated junction (J9) on Fyfin Road which provides for access to Victoria Bridge and the existing A5 to the east and Castlederg to the west. Compact slip roads with each of the two carriageways and short link roads with T-junctions cater for access onto the local road.
- 6.4.21 South of J9, the dual carriageway enters a deep cutting (maximum depth 15m) as it rises out of the tributary valley and curves to the south along the eastern slopes of the Mourne Valley via a sequence of shallow cuttings and low embankments. Stone Road is bridged over the deep cutting. Urbalreagh Road is stopped up where it is crossed by the cutting, with continued access being provided for via the new bridge on Stone Road and a short section of new single carriageway road linking the two local roads.
- 6.4.22 The dual carriageway then descends the wide slopes of the Derg River valley, that frame the landscape at the confluence of the Derg River and Mourne River, via a sequence of asymmetric cuttings (maximum depths 8-10m). The cutting is shallow as it crosses Derg Road, which would be realigned for some 500m from its junction with Old

Bridge Road, and raised on embankment to the north of its current alignment to enable it to be bridged over the dual carriageway. A proposed low, open-span bridge carries the dual carriageway over the Derg River. South of the river, there is a short section of cutting (maximum depth 10m). The B164 Deerpark Road is raised on low embankment on its existing alignment to provide the required clearance between the dual carriageway and local road where it crosses the southern end of the cutting.

6.4.23 Continuing south, the dual carriageway follows a gentle curve to the south-east close to existing ground levels. It crosses Milltown Road which is to be stopped up and then rises on embankment (maximum height 7.5m) to enable it be bridged over Magheracoltan Road. A proposed compact grade-separated junction (J10) provides for access to Newtownstewart west of Wood Hills and the existing junction between Drumlegagh Road North and the B84 Baronscourt Road. Some 500m of the B84 Baronscourt Road is realigned and raised on embankment to the north of its existing alignment and west of its existing junction with Drumlegagh Road North to enable it to be bridged over the dual carriageway. Access onto and exit from the dual carriageway is provided for via compact slip roads with each of the two carriageways and short sections of single carriageway road tying into a new roundabout on the realigned Baronscourt Road east of the dual carriageway and into the realigned B-road via a T-junction west of the dual carriageway. Access along Drumlegagh Road North towards Newtownstewart is catered for by way of a T-junction on the new section of link road providing access to the northbound carriageway of the dual carriageway. Golf Course Road is stopped up.

6.4.24 South of J10, the dual carriageway climbs towards Oldcastle Road passing close to and south of Harry Avery's Castle in a short, deep cutting (maximum depth 18m). A new bridge over the cutting maintains access along Oldcastle Road.

Newtownstewart to north of Omagh

6.4.25 South of Newtownstewart the dual carriageway follows a defined descent through a number of cuttings (maximum depth 11m) crossing Honeyford Lane, Glen Road, Gortgranagh Road, Castletown Road and Grange Road as it curves to the south to follow an alignment along the lower eastern slopes of the Strule Valley below Bessy Bell. Honeyford Lane is stopped up on the north side of the dual carriageway. Glen Road and Gortgranagh Road are stopped up where the dual carriageway crosses them. Continued access for both roads is provided for via a new bridge on a realigned section of Gortgranagh Road and short sections of single carriageway each side of the dual carriageway between Glenn Road and the realigned Gortgranagh Road. Where the dual carriageway crosses Castletown Road and Grange Road, Castletown Road is realigned to the west of the existing road and bridged over the cutting housing the dual carriageway. Grange Road is stopped up. A short section of new single carriageway road provides for continued access to Grange Road off the realigned Castletown Road east of the dual carriageway.

- 6.4.26 As the dual carriageway descends the slopes, it curves south-west and is bridged over West Road. It then enters a short 30m-deep sidelong cutting and a sequence of sidelong cuttings (8-10m deep) and embankments (10-20m high), some 100-150m west of the existing A5 Beltany Road. Hamiltons Road is realigned to the north to improve the gradient on this narrow road and bridged over the dual carriageway. Joel's Lane (also known as McCormacks Road) is also realigned to the north to improve the gradient on the narrow road and accommodate an underbridge to maintain access between Castletown Road and the existing A5.
- 6.4.27 Approximately 500m south of Joel's Lane, the alignment takes a marked curve to the south-west and away from the existing A5 as it enters a 1km-long cutting (maximum depth 13.5m). Killynure Road is realigned south of its existing alignment to accommodate a new bridge carrying the local road over the cutting. The dual carriageway emerges from the cutting onto embankment prior to being bridged over Castletown Road and curving south to pass west of Mountjoy. A minor road, McDermotts Road, is realigned to connect to Castletown Road north of the bridge. The dual carriageway enters a 1km-long cutting (maximum depth 12.5m) as it approaches and passes beneath Dunteige Road some 400m west of Mountjoy. The local road is raised on low embankment and bridged over the cutting on its existing line.
- 6.4.28 Continuing south, the dual carriageway rises on embankment before being bridged over Lisnagirr Road and returning to existing ground levels as it crosses Rash Road. Rash Road is realigned over a 300m length and raised on embankment (maximum height 9m) be bridged over the proposed dual carriageway. Access north along Tully Road is maintained by the introduction of a new section of single carriageway road east of the proposed dual carriageway with a new T-junction onto Rash Road where a disused railway line crosses the local road. Access south from Rash Road along Tully Road continues as far as the stop up point as it crosses the dual carriageway. On the east side of the dual carriageway, the southern section of Tully Road is stopped up with access to the west side via the existing A5 and Rash Road.
- 6.4.29 South of Rash Road, the alignment enters a 1km-long cutting (maximum depth 10m) as it follows the alignment of the disused railway line between the Tully Bog SAC and ASSI, and the A5 Beltany Road. At its nearest, the proposed dual carriageway is some 200m east of the SAC / ASSI.
- 6.4.30 It emerges from the cutting and returns to grade as it passes through a proposed all-movements grade-separated junction (J11) north of Omagh. The junction comprises a dumbbell of roundabouts and linking bridge raised on embankments. Slip roads off each roundabout and new sections of link road tie Drumlegagh Road South into the western roundabout and the A5 Beltany Road into the eastern roundabout. Continued access to property along the southernmost section of Drumlegagh Road South is maintained via a T-junction off the new section of link road running west from the junction and new access road linking Todds Road and the southern end of Drumlegagh Road South. Todds Road is stopped up each side of the dual carriageway.

- 6.4.31 As the proposed scheme runs south from J11, it curves to the south-west rising onto embankment (maximum height 9.5m) to enable it to be bridged over the Fairy Water some 400m west of its confluence with the River Strule. A series of flood connectivity culverts through the embankment provide for flood water flows.
- 6.4.32 South of the Fairy Water, the dual carriageway follows an alignment broadly reflecting that of the western edge of Omagh, varying in distance between 0.5km and 1.5km from the settlement boundary. Initially at-grade or on low embankment, it crosses the low lying floodplain of the Fairy Water. Mellon Park Drive and Gillygooley Road are both stopped up where they are crossed by the dual carriageway. Continued access along Mellon Park Drive is provided for by way of a realignment of the existing southern arm of the drive which is bridged over the dual carriageway. Continued access along Gillygooley Road is provided for by way of a new 800m-long section of road aligned to the south of the existing road. The realigned road is raised on embankment and bridged over the proposed dual carriageway. A new T-junction off the realigned road east of the proposed dual carriageway maintains access along Mullaghmena Road.
- 6.4.33 The proposed dual carriageway then follows a southerly alignment through a local woodland before entering a cutting (maximum depth 15m) as it crosses beneath Aghnamoyle Road. Aghnamoyle Road is raised on low embankment on-line and bridged over the cutting. A short section of new single carriageway road provides a link between Aghnamoyle Road and Botera Road to maintain access along Botera Road which is stopped up where it is crossed by the dual carriageway.
- 6.4.34 The dual carriageway passes through an area of low, densely aggregated drumlins west of Omagh via a series of short, asymmetric cuttings (maximum depths 8-14m). Tamlaght Road is raised on embankment east of the dual carriageway to enable it to be bridged over one of the cuttings. Further south, Brookmount Road is locally lowered on-line and the proposed dual carriageway is elevated on embankment (maximum height 9m) and bridged over the local road.
- 6.4.35 An all-movements grade-separated junction (J12) on the line of the A32 Clanabogan Road provides for access to and from the western part of Omagh and for access onto the proposed dual carriageway from areas to the west including Dromore and Enniskillen. The junction comprises an elongated gyratory with on and off slip roads and a pair of bridges carrying the dual carriageway over the gyratory below.
- 6.4.36 South of J12 the alignment continues on a south-easterly alignment and then curves to the east as it negotiates a sequence of embankments (maximum heights 10-12m) and short, deep cuttings (maximum depths 21m) through the drumlins that frame the south-western parts of Omagh. Loughmuck Road is realigned to the north to enable it to be continued beneath the dual carriageway where the south-east facing slip roads at J12 merge with the main carriageway. Beagh Road is realigned and raised on embankment (maximum height 11.5m) to enable the local road to be bridged over the dual carriageway. At Ballynahatty Road the dual carriageway is in cutting (maximum depth 11m) and the local road is raised on embankment to the east of the dual carriageway to

enable it be bridged over the dual carriageway. Emerging from the cutting beneath Ballynahatty Road the dual carriageway is on low embankment as it crosses the narrow Drumragh River valley and floodplain. An open-span bridge carries the dual carriageway over the watercourse and connectivity culverts through the embankment south of the bridge provide for movement of flood waters.

- 6.4.37 The dual carriageway crosses Blackfort Road and Drumragh Road south of the existing junction of the two roads. Access along the roads is maintained via a bridge over the dual carriageway along Blackfort Road, which is realigned from its junction with Drumragh Road, and a short section of new single carriageway road which links the two local roads south of the proposed dual carriageway.
- 6.4.38 The dual carriageway gradually curves south-east as it approaches a full grade-separated junction where it crosses the B83 Seskinore Road south of Omagh (J13). Seskinore Road is realigned to the north to accommodate dumbbell roundabouts linked by a bridge over the dual carriageway, which is in cutting (maximum depth 15m) through the junction. A link between the new A5WTC and existing A5 is established where the realigned Seskinore Road continues north from the roundabout on the north side of the dual carriageway to a new roundabout on a locally realigned section of the A5 Doogary Road.

South of Omagh to the A4 west of Ballygawley

- 6.4.39 South of J13, the dual carriageway follows the eastern margin of the Doogary Bog west of the existing A5 Doogary Road and close to existing ground levels. It crosses Tattykeel Road requiring the stopping up of the local road each side of the dual carriageway and the introduction of a short section of new single carriageway road which is bridged over the dual carriageway to maintain access between the A5 Doogary Road and Tattykeel Road. A kilometre further south, the dual carriageway crosses Tattykeel Road for a second time. In this location the local road is stopped up on both sides of the dual carriageway.
- 6.4.40 As the dual carriageway continues to follow a south-easterly alignment it diverges from the existing A5. It passes through a series of deep cuttings (maximum depth 12-20m) to maintain an appropriate vertical profile through the dispersed low drumlins that typify the farmland landscape south of Omagh. Drumconnelly Road is stopped up where the dual carriageway crosses the local road. A new section of single carriageway road is introduced to the south of the existing road. This is raised on embankment (maximum height 10.5m) to enable it to be bridged over the dual carriageway to maintain access between the local road and the A5 Doogary Road. A 1km-long section of the dual carriageway is on embankment (maximum height 8m) where it approaches, is bridged over, and descends from Tullyrush Road. It then enters a short deep cutting (maximum depth 20m) and emerges to cross Rarone Road close to existing ground levels. Rarone Road is realigned slightly and raised on embankment to the north of its existing alignment to enable it to be bridged over the dual carriageway.

- 6.4.41 The dual carriageway continues south-east towards Moylagh and crosses a second road named Drumconnelly Road. In this location the local road is stopped up on each side of the dual carriageway. It enters a cutting (maximum depth 18m) before emerging onto a short section of embankment where it passes through a compact grade-separated junction (J14) at Moylagh. Northbound and southbound access on and off the dual carriageway is catered for by way of two short sections of link road onto a realigned section of the B46 Moylagh Road south of its existing alignment. The new section of the B46 is aligned beneath the dual carriageway. A new roundabout to the south of the dual carriageway caters for continued access between the B-road and Augher Point Road. South of Moylagh there is a long cutting (maximum depth 15m) where the dual carriageway is aligned along the southwest facing slopes of a large distinctive drumlin south of the settlement.
- 6.4.42 The dual carriageway then generally runs close to existing ground levels, on low embankment or in shallow cutting as it gently curves towards the south in the direction of Newtownsaville. It crosses Killadroy Road and Greenmount Road on embankment east of the existing junction of the two roads. An underbridge caters for continued access along Greenmount Road which is locally realigned and lowered into shallow cutting to provide the required clearance. Killadroy Road is stopped up on both sides of the dual carriageway and a new section of single carriageway road links the local road east of the dual carriageway with the realigned Greenmount Road.
- 6.4.43 Some 500m further south, the dual carriageway crosses the Routing Burn via a three-span bridge over the incised valley which houses the watercourse. The channel of the watercourse is accommodated through the central span. Routing Burn Road, to the south of the watercourse is stopped up on both sides of the dual carriageway.
- 6.4.44 As the dual carriageway passes east of Newtownsaville it is raised on embankment. An underbridge is provided to cater for continued access along Springhill Road to Newtownsaville Road. The embankment then merges into sidelong cutting and embankment as the dual carriageway runs between Newtownsaville Road and Tullanafoile Road. It crosses Cormore Road, which is stopped up on both sides of the dual carriageway, and rises to the south-east on embankment (maximum height 12m) to enable it to be bridged over Tullanafoile Road. It then crosses Tullycorker Road where the local road is raised on embankment south of the dual carriageway to enable sufficient clearance to be provided for a new bridge over the asymmetric cutting (maximum depth 8.5m) which accommodates it in this location.
- 6.4.45 The dual carriageway curves to the east as it skirts the lower south facing slopes of Tycanny Hill resulting in the establishment of a deep, asymmetric cutting some 36m deep. It then descends the prominent scarp slope of the Brougher Ridge. Existing access along the southern end of Tycanny Road to its junction with Newtownsaville Road is stopped up and a new section of single carriageway road links Tycanny Road east of the proposed dual carriageway with Rarogan Road. Access along Rarogan

Road is maintained beneath the dual carriageway via an underbridge and a 200m-long realignment of the local road to a new T-junction on Newtownsaville Road.

- 6.4.46 There is a sequence of high, sidelong cuttings (maximum depths 12-35m) as the dual carriageway descends the Brougher ridge. It emerges from the last of these cuttings (maximum depth 35m) west of and below Errigal Keerogue Churchyard and passes through an area of moraines that mark the transition from the ridge to the Clogher Valley.
- 6.4.47 South of the churchyard it crosses Glenhoy Road. The local road is realigned to the north of its existing alignment to enable the local road to be raised on embankment and bridged over the dual carriageway.
- 6.4.48 The dual carriageway continues through the moraines via a series of cuttings (maximum depths 8-13m) and embankments (maximum heights 10-18m). It crosses Ballynasaggart Road close to existing ground levels, the local road being raised on embankment (maximum height 10.5m) on line and bridged over the dual carriageway.
- 6.4.49 A new at-grade roundabout (J15) provides for all-movements access between the dual carriageway and the A4, Annaghilla Road. The section of the A4 which runs north-east to the existing A4 / A5 Annaghilla Road would be upgraded to dual carriageway between these roundabouts, utilising the existing single carriageway for the proposed eastbound carriageway, while the proposed westbound carriageway would be constructed offline. The existing junction between Feddan Road and the A4, Annaghilla Road is stopped up, continued access being provided for by the diversion of Feddan Road into a fifth arm on the new roundabout.
- 6.4.50 As the dual carriageway exits south from J15 it passes through a short cutting (maximum depth 16m), emerging onto an approach embankment and three-span bridge over the Ballygawley Water. The central span accommodates the watercourse and the two side spans access tracks. South of the bridge the dual carriageway is in a sidelong cutting (maximum depth 17m) as it passes north of housing on Tullywinney Road. It continues onto embankment as it crosses Tullywinney Road, the local road being maintained on-line via an underbridge.
- 6.4.51 The dual carriageway crosses the rolling farmland which extends across a landscape of irregular low drumlins and moraines to the south via a number of cuttings (maximum depth 10-21m) and embankments (maximum height 7m). Lisginny Road is realigned on embankment (maximum height 8m) to the north of the existing road and bridged over the dual carriageway, which would be close to existing ground levels. Old Chapel Road is realigned on embankment (maximum height 12m) to the west of the existing road and bridged over the dual carriageway.
- 6.4.52 On the approach to the A5 Tullyvar Road and a partial grade-separated junction (J16) there is sidelong cutting (maximum depth 12.5m) along the northern margin of the proposed dual carriageway. At the junction, movement between the existing road and proposed dual carriageway is limited to northbound access and southbound exit via a

pair of north facing slip roads with dumbbell roundabouts and a new bridge. The section of the existing A5 south of the junction is raised on embankment (maximum height 9m) to provide for the elevated dumbbell roundabout at the southern end of the proposed bridge. An arm off the northern roundabout provides for continuation of the link between the existing A5 and Loughans Road.

- 6.4.53 The dual carriageway follows a broad sweep around the eastern side of Aughnacloy terminating where it meets the A28 Caledon Road south-east of the village. There are a number of cuttings (maximum depth 10-20m) and embankments (maximum height 7-10m) in this section. One of the sidelong cuttings east of Loughans Road is 32m deep. This section also crosses the B35, Carnteel Road and the B128, Rehaghy Road. The B35 is realigned on embankment and bridged over the dual carriageway to the south of its existing alignment, whilst a very minor road, Glack Lane, is realigned to connect to Carnteel Road east of the dual carriageway. At the B128 Rehaghy Road, the dual carriageway is on embankment (maximum height 10m) as it crosses the local road, which is continued via an underbridge on its existing alignment.
- 6.4.54 An at-grade roundabout (J17) on the A28, Caledon Road marks the southern end of the dual carriageway
- 6.4.55 The final section of the proposed scheme comprises a 1.2km length of single carriageway road linking J17 and the merge with the A5, Monaghan Road south of the town. In the middle of this section another minor road, Douglas Road, is crossed with two at-grade accesses being provided.

6.5 Junctions

- 6.5.1 Fifteen junctions are proposed, one of which, the Strabane West junction, comprises a composite of three components which provide for fully grade-separated access onto and exit from the dual carriageway at the Mourne River. The junctions, their type and location are scheduled in Table 6.3

Table 6.3 Proposed junctions

Proposed junction	Type and location
J1 - New Buildings North	At-grade roundabout linking to the existing A5 Victoria Road at the northern end of the 2+1 carriageway New Buildings Bypass
J2 - New Buildings South	At-grade roundabout linking to the existing A5 Victoria Road at the southern end of the 2+1 carriageway New Buildings Bypass
J3 - Ballymagorry	Full grade-separated junction linking to the existing A5 Victoria Road and Woodend Road north of Strabane and south west of Ballymagorry

Proposed junction		Type and location
Junctions 4, 5 and 6 combine to form the fully grade-separated Strabane West Junction	J4 - Strabane Lifford Road	Two roundabout junction accommodating the A38 Lifford Road, the existing A5 and Park Road and the northbound entry slip road to the proposed dual carriageway north of the Mourne River scheme.
	J5 - Strabane Railway Street	At-grade roundabout accommodating the southbound exit slip road from the proposed dual carriageway to the existing A5, Railway Street and the A38 Lifford Road north of the Mourne River.
	J6 - Strabane Bradley Way	At-grade roundabout accommodating the south facing slip roads (northbound exit and southbound entry) linking the proposed dual carriageway and the existing A5 and Bradley Way south of the Mourne River.
J7 - Strabane N14/N15	At-grade roundabout to accommodate the proposed N14/N15 Link south west of Strabane.	
J8 - Strabane South	Compact grade-separated junction linking to the existing A5 Melmount Road south of Strabane and north west of Sion Mills.	
J9 - Victoria Bridge	Compact grade-separated junction connecting to the B72 Fyfin Road west of Victoria Bridge.	
J10 - Newtownstewart	Compact grade-separated junction linking to the B84 Baronscourt Road and Drumlegagh Road North west of Newtownstewart	
J11 - Omagh North	Full grade-separated junction linking with the A5 Beltany Road and Drumlegagh Road South northwest of Omagh.	
J12 - Omagh West	Full grade-separated junction with the A32 Clanabogan Road Southwest of Omagh.	
J13 - Omagh South	Full grade-separated junction linking to the B83 Seskinore Road and the existing A5 south of Omagh.	
J14 - Moylagh	Compact grade-separated junction linking to the B46 Moylagh Road and Augher Point Road at Moylagh.	
J15 - Ballygawley Roundabout	At-grade roundabout with the A4 Annaghilla Road southwest of Ballygawley	
J16 - Aughnacloy North	Partial grade-separated junction with west facing slip roads only linking to the A5 Tullyvar Road and Loughans Road north of Aughnacloy.	
J17- East Aughnacloy	At-grade roundabout with the A28 Caledon Road southeast of Aughnacloy.	

6.6 Side roads

6.6.1 The Proposed Scheme involves the stopping up of existing roads where they are severed by the dual carriageway. In many instances provision is made for continued access along the roads by way of localised realignment of the severed road and/or the introduction of sections of new single carriageway road to maintain access via other local roads in the existing network. Detailed information relating to affected side roads and whether provision has been made for diversion is provided in Appendix 6B.

6.6.2 There are 17 locations where side roads would be permanently stopped up:

- Meenagh Road (connectivity maintained for private access);
- Greenlaw Road
- Bog Lane Road;
- Peacock Road.
- High Road;
- Milltown Road;
- Golf Course Road;
- Tully Road (at Ch. 48450);
- Todds Road.
- Tattykeel Road (at Ch. 63900);
- Drumconnelly Road (at Ch. 67930);
- Routingburn Road;
- Cormore Road;
- Crew Road (connectivity maintained for private access);
- Tullybryan Road would be stopped-up at the tie-in with the A4 Annaghilla Road;
- Ballynany Road would be stopped up at the tie-in with the A4 Annaghilla Road;
and
- Monaghan Road would be stopped-up at the southern tie-in to the scheme.

6.7 Structures

Overbridges

Thirty-nine proposed overbridges would carry existing roads over the proposed dual carriageway. They would either be two-span structures, with a central reserve support, or single-span structures. Typical designs for the two forms of structure are illustrated in Plates 6.2 and 6.3.

Plate 6.2 Typical two-span overbridge



Plate 6.3 Typical single-span overbridge



Underbridges

- 6.7.1 Twenty-four underbridges would carry the proposed dual carriageway over existing roads. These would generally be single-span structures. A typical design for these is illustrated in Plate 6.4.

Plate 6.4 Typical Underbridge



Bridges over watercourses

- 6.7.2 There would be 10 bridges carrying the proposed dual carriageway over watercourses. All have been designed to ensure there would be no intermediate piers located within the channel of the watercourses.

Burn Dennet

- 6.7.3 The bridge over the Burn Dennet would be a three-span symmetrical structure, approximately 77m long. The central span accommodating the channel of the watercourse would be approximately 33m. The two side spans provide for continued access for landowners on both sides of the dual carriageway.

Glenmornan River

- 6.7.4 The bridge over the River Glenmornan would be a three-span symmetrical structure, approximately 51m long. The central span accommodating the channel of the watercourse would be approximately 23m. The two side spans provide for continued access for landowners on both sides of the dual carriageway.

Mourne River

- 6.7.5 The bridge over the Mourne River would be a four-span asymmetrical structure, 263m long. The four spans would be approximately 50m, 64m, 85m and 64m. The first two spans would carry the dual carriageway over the Lifford Road Roundabout. The third span would accommodate the channel of the Mourne River below the dual carriageway. The fourth span would carry the dual carriageway over the northbound off-slip on the south side of the river. The proposed superstructure would have a curved soffit for the three main spans.

River Derg

- 6.7.6 The bridge over the Derg River would be a two-span asymmetrical structure, approximately 92m long. The two spans would be approximately 31m and 61m, the first providing for floodplain connectivity and the second accommodating the channel of the river below the dual carriageway.

Coolgahy Burn

- 6.7.7 The bridge over the Coolgahy Burn would comprise a relatively short 12m span bridge with two adjacent connectivity culverts

Fairy Water

- 6.7.8 The bridge over the Fairy Water would be a single-span structure, approximately 46m long.

Drumragh River

- 6.7.9 The bridge over the Drumragh River would be a single-span structure, approximately 34m long.

Routing Burn

- 6.7.10 The bridge over the Routing Burn would be a three-span symmetrical structure, approximately 30m long. The central span accommodating the channel of the watercourse would be approximately 15m. The two side spans provide for continued access for landowners on both sides of the dual carriageway.

Ballygawley Water (A5)

- 6.7.11 The bridge over the Ballygawley Water, where the proposed A5 dual carriageway crosses the watercourse, would be a three-span symmetrical structure, approximately 51m long. The central span accommodating the channel of the watercourse would be approximately 23m. The two side spans provide for continued access for landowners either to both sides of the dual carriageway.

Ballygawley Water (A4)

- 6.7.12 The bridge over the Ballygawley Water where the A4, would be upgraded to dual carriageway, would be a single-span structure located adjacent to the existing river bridge and carrying the westbound carriageway of the new dual carriageway.

Flood relief connectivity culverts

- 6.7.13 A total of 155 connectivity culverts would cater for continued connectivity across established floodplains. They comprise large-diameter pipe culverts and box culverts which would be built embankments where the dual carriageway is aligned across floodplains. Detailed information relating to their location, type and size is provided in Appendix 6C.

Watercourse culverts

- 6.7.14 A total of 104 culverts provide for the continuity of watercourses severed by the Proposed Scheme other than where bridges have been proposed. Many are piped culverts of 1.5 or 1.8 m diameter. The remainder are box culverts varying in size from 1.2 x 2.1m to 4.5 x 5.1m. Detailed information relating to their location, type and size and environmental requirements which have been incorporated into their design is provided in Appendix 6D.

6.8 Flood compensation areas

- 6.8.1 Land take for the Proposed Scheme includes areas which compensate for the loss of floodplain capacity where the dual carriageway and its associated junctions and side roads would be located within existing floodplains. The compensation areas provide for controlled displacement of capacity to avoid displacement that may otherwise place property at risk. Lost volume will be replaced as a minimum within the compensatory storage areas. The location of the proposed flood compensation areas is shown in Figures 6.1 – 6.17. Detail relating to the floodplains affected, the length of the Proposed Scheme affecting them, loss in floodplain capacity and the areas provided for compensation is available in Appendix 6C.
- 6.8.2 At specific locations, for example the Foyle floodplain, it is envisaged that compensatory storage would not be appropriate as the flood risk is influenced by tidal movements/surges and therefore the influence of storage is reduced.

6.9 Watercourse diversions

- 6.9.1 There are 107 sections of existing watercourse which would be diverted where the dual carriageway and associated junctions and side roads sever them or diversion has avoided the need for otherwise overly long culverts through embankments. Information relating to their location and length is provided in Appendix 6E.

6.10 Deposition areas

- 6.10.1 There are proposals in 29 locations for the acquisition of land for the purpose of depositing surplus material (deposition areas) arising from excavated areas as provided for in the Roads (Northern Ireland) Order 1993. The land would be reinstated to an agreed standard for future use, the intention being that it should be returned to the existing landowner or other parties should the existing owner not wish to take the land back.
- 6.10.2 The proposed deposition areas are shown on Figures 6.1 – 6.17. A schedule of the areas attached in Appendix 6F details the anticipated volumes of material it is anticipated would be deposited in each area and the current land use.

6.11 Drainage

6.11.1 The drainage proposals make provision for:

- the collection and discharge of road-related run-off from the dual carriageway, sections of existing roads which are to be modified or realigned and sections of new local road required to maintain access where there is severance of existing roads;
- control of waterborne pollutants associated with carriageway run-off to protect receiving watercourses and groundwater from potential contamination.
- sub-surface drainage to protect the integrity of the road pavement and sub grade material;
- prevention of erosion of cutting and embankment slopes;
- interception of boundary drains and overland flow;

Road related run-off and associated pollutants

6.11.2 The road drainage system has been designed for the 1 year, 5 minute duration, return period storm event. In addition, a 20% allowance has been made for climate change.

6.11.3 The proposals provide for the discharge of all road related run-off to existing surface watercourses. They include Sustainable Drainage Systems (SuDS) design measures to ensure that potential impacts on receiving surface waters relating to run-off flow rates and traffic related pollutants carried by run-off would be avoided / mitigated. The collection and conveyance of water from the carriageways involves a combination of concrete lined channels, swales² and grassed channels within the roadside verge or central reserve, which is then piped to outfalls. In most instances, wet retention ponds and/or dry detention ponds have been introduced prior to discharge via the proposed outfalls.

6.11.4 The swales, grassed channels, wet retention ponds, and dry detention ponds serve to intercept suspended solids and sediment-bound pollutants in run-off. The swales, grassed channel and wet retention ponds also serve to intercept dissolved copper and zinc. An indication of the efficiency of each is provided in Appendix 16B.

6.11.5 The locations of the proposed wet retention ponds, dry detention ponds and drainage outfalls are shown in Figures 6.1 - 6.17.

² Swales are shallow linear depressions integrated into landform which collect and direct the flow of surface water run-off.

- 6.11.6 Drainage of road related run-off for the mainline and slip roads at junctions has been sub-divided into 91 separate catchments. Seventy-one of the catchments would be drained via concrete channels in the roadside verge which is then piped to wet retention ponds prior to discharge to an existing watercourse.
- 6.11.7 The run-off for one of the drainage catchments, that discharges via outfall S1-OF-34, would be similarly captured and conveyed, but would be passed via a wet retention pond and dry detention pond prior to discharge.
- 6.11.8 The run-off for 3 of the drainage catchments, those discharging via outfalls S1-OF-37, S1-OF-41 and S3-OF-29, would be captured in swales in the roadside verge or central reserve and conveyed by pipe via a catchpit at the end of the swale to the outfalls.
- 6.11.9 The run-off for 9 of the drainage catchments would be captured in swales in the roadside verge or central reserve and conveyed by pipe via a catchpit at the end of the swale to a wet retention pond prior to discharge to the outfalls. The 9 outfalls comprise S1-OF-05.1, S1-OF-42, S1-OF-33, S1-OF-38, S2-OF-03, S2-OF-09, S3-OF-06, S3-OF-13, and S3-OF-16.
- 6.11.10 The run-off for one of the drainage catchments, that discharges via outfall S3-OF-02, would be captured and conveyed via concrete channel and pipe to a dry detention pond prior to discharge.
- 6.11.11 The run-off for 3 of the drainage catchments, those discharging via outfalls S1-OF-23.1, S1-OF-04 and S3-OF-21, would be captured and conveyed via concrete channel and pipe to a wet retention pond prior to discharge.
- 6.11.12 Headwalls, sidewalls and aprons to outfalls would be of concrete construction. Headwalls would be constructed such that no part of the structure protrudes beyond the line of the watercourse bank.
- 6.11.13 Outfall pipes would be installed to minimise the height between the pipe and watercourse bed, thus minimising erosion, but high enough to ensure the pipe remains clear of any sediment build-up and that high water levels within the watercourse do not back up into the road drainage system. Where there is a risk of backflow up the outfall pipe during high river flows a flap valve may be fitted.
- 6.11.14 Erosion protection in the form of stilling basins, erosion protection aprons, stone rip-rap or geotextiles would be provided where high velocity discharges may result in scour.
- 6.11.15 Pollution control valves would be installed in all drainage networks to facilitate isolation of the drainage network from the relevant receiving watercourse following a spillage incident and pending completion of appropriate clean-up procedures.

Side road drainage

- 6.11.16 There would be 154 side road outfalls associated with the Proposed Scheme. These would be discharged directly to existing watercourses or into the existing piped drainage network as documented in Appendix 6E. Discharge flows will be of a similar

order to what currently discharges from the side road network into the receiving watercourses.

Earthworks drainage

6.11.17 Pre Earthworks Drainage (PED) would be provided at the top of cuttings and the toe of embankments. These drains would have sufficient capacity to transfer flows from the surrounding topography and proposed slopes to suitable watercourses/drains. The PED would have two main functions;

- intercept flows from the surrounding natural topography away from the proposed carriageway; this would also reduce the potential for erosion of cutting slopes; and
- intercept flows from the proposed embankment slopes to prevent flooding of adjacent lands.

6.11.18 PED flows would be transferred to the receiving watercourse via filter drain / ditch.

6.12 Lighting

6.12.1 Road lighting would be limited to proposed junctions and approach sections of the dual carriageway, single carriageway sections and side roads.

6.12.2 Typically, lighting columns on sections of dual carriageway approaching and passing through junctions would be 15m tall and would incorporate LED luminaires with a wattage of up to 150W and a light output of up to 24klm. Columns would be spaced at approximately 50m centres.

6.12.3 Typically, lighting columns on the single carriageway sections would be 10m tall and would incorporate LED luminaires with a wattage of up to 110W and a light output of up to 17klm. Columns would be spaced at approximately 40m centres.

6.13 Works to existing utilities

Electricity

6.13.1 Northern Ireland Electricity distribution apparatus would be affected approximately 120 times by the Proposed Scheme. The majority of this apparatus is overhead High and Medium voltage cable supported on single wooden poles. Where this apparatus is affected it would be moved, and if necessary raised, to provide sufficient ground clearance to the proposed carriageway. If this is not possible then some cables would need to be diverted in ducts under the mainline or under re-aligned side roads.

6.13.2 Northern Ireland Electricity transmission apparatus is crossed by the Proposed Scheme's mainline 7 times and by associated side road works a further 4 times. These conductors are supported on a mixture of wooden portal poles, steel pylons and steel towers.

6.13.3 To the north and south of Killinure Road diversionary works would be required to transmission apparatus for around 2km in total. This diversion would include re-alignment, raising of portal poles and the construction of new angle towers and pylons.

- 6.13.4 At the remaining locations where the Proposed Scheme crosses transmission apparatus there is a preference for it to remain in its existing location and be raised as required to provide the necessary ground clearances. The Proposed Scheme would aim to minimise the impact to this apparatus, however, in some locations portal poles, steel pylons and steel towers would need to be raised, and possibly moved.

Water mains and sewers

- 6.13.5 Northern Ireland Water apparatus would be affected by the Proposed Scheme at around 150 locations. A variety of solutions would be required to protect, move and re-lay this infrastructure, and would include temporary diversions in order to maintain services.
- 6.13.6 Around 120 small to medium diameter (80-200mm) water distribution mains would be affected. These are mainly laid in the existing road network and would either be protected and left in their current positions or relocated in the Proposed Scheme's realigned road network.
- 6.13.7 Trunk water mains would be affected 9 times. These are generally medium diameter (200-300mm). Some larger diameter trunk mains would also be affected; to the west of Victoria Bridge (380mm dia.), in Gillygooly Road (400mm dia.), and in Glenhoy Road (450mm dia.). It is likely that wherever possible they would remain in their existing locations and be re-laid under the mainline of the Proposed Scheme.
- 6.13.8 The Proposed Scheme affects the public sewerage network at a limited number of locations, where apparatus associated with treatment works or pumping stations is crossed by the mainline. A total of 17 gravity foul sewers would be affected which flow to; a sewage pumping station at New Buildings, Magheramason Wastewater Treatment Works (WWTW), Strabane WWTW and Sion Mills WWTW. Furthermore, 2 pumped foul sewers from pumping stations in New Buildings and Strabane would be affected. Where possible these sewers would be protected and maintained in their existing locations.

Telecommunications

- 6.13.9 BT overhead and underground apparatus would be affected approximately 125 times by the Proposed Scheme. Most of this apparatus is located along or in side roads, and in the existing A5. Generally, where the Proposed Scheme impacts overhead apparatus it would be re-laid in new ducts in the realigned road network. In some instances pole heights would need to be raised to allow cables to cross the Proposed Scheme with sufficient clearance. Affected underground apparatus would be protected or moved within the carriageway cross-section.
- 6.13.10 Virgin Media, Eircom and Bytel have trunk fibre optic apparatus contained in a 4-way duct, laid in a common trench between New Buildings and Ballygawley. This apparatus is generally laid adjacent to the existing A5, except for a section immediately south of New Buildings where it takes a more rural route. It would be affected approximately 11 times, requiring changes to its position and alignment.

- 6.13.11 Cable and Wireless underground fibre optic apparatus would be affected by the mainline of the Proposed Scheme to the south and south-east of Aughnacloy. It would need to be protected or re-laid in the verge of the proposed works.
- 6.13.12 An Orange self contained cellular base station located on Park Road northwest of Strabane may require temporary relocation during the road works. However, in the longer term it would remain in its existing location.

6.14 Land Use Requirements

- 6.14.1 Some 1150 hectares of land would be required for the construction of the Proposed Scheme. Approximately 250 hectares would be required temporarily during the construction phase with the remainder remaining within the permanent highway boundary.
- 6.14.2 No work would be allowed outside of the Vesting Order (VO) boundary other than where the contractor has sought and received approval from TransportNI, the landowner and other relevant statutory bodies.

Buildings

- 6.14.3 Construction of the Proposed Scheme would result in a number of buildings being demolished as the land on which they are situated would be required for construction of the scheme. They are as follows:
- 6.14.4 Residential:
- Farmhouse at Ch. 3300.
 - 3 dwellings and a double garage/office at Ch. 11600.
 - Castletown House (flats) at Ch. 19000.
 - 1 dwelling at Ch. 37300.
 - 1 dwelling on Baronscourt Road at Ch. 37400.
- 6.14.5 Other:
- 4 farm buildings Ch. 3300.
 - 1 Barn at Ch. 7000.
 - 1 Barn at Ch. 16400.
 - 1 Commercial Property (Garage) at Ch. 17000.
 - 2 farm buildings at Ch. 29100.
 - Chicken Shed at Ch. 76600.
 - Farm Buildings at Ch. 91800.

Permission to Enter Process

- 6.14.6 Further to representations made at the previous scheme raft Orders stage (November 2010) and as indicated in the Public Inquiry Inspector's report in February 2012, The Department proposed an alternative mechanism for areas of land required temporarily for the construction of the scheme. Such areas include deposition areas, flood compensatory storage areas, temporary access routes, surface water drainage systems, outfalls and watercourse diversions.
- 6.14.7 Subject to the landowner entering into a Permission to Enter agreement with the Department prior to the making of any Order, the land would be removed from the made Vesting Order at that time and the land would be made available to the Department and the contractor for the duration of the construction period. A permanent fenceline boundary would be agreed with the landowner along with reinstatement specifications for the land.
- 6.14.8 Two types of PTE are proposed:
- PTE 1 for proposed temporary works
 - PTE 2 for permanent works on land to be acquired temporarily
- 6.14.9 The PTE form would clarify the nature of the works to be carried out on the land, any operational maintenance requirements (access to drainage headwalls, etc) and the reinstatement specification.

6.15 Landscape proposals and environmental mitigation

- 6.15.1 Landscape proposals are illustrated in Figures 6.18. - 6.44.
- 6.15.2 They comprise a combination of landscape earthworks and ground modelling planting of woodland, scrub, groups of trees, hedgerows, various grassland types and marginal and aquatic habitats and screen fencing.
- 6.15.3 The objective has been to integrate the the dual carriageway and its traffic within the differing landscapes associated with the Proposed Scheme and to introduce appropriate mitigation measures where sensitive visual receptors would potentially be subject to high levels of visual impact.

Earthworks and ground modelling

- 6.15.4 Earthworks and ground modelling proposals include:
- profiling of major cutting and embankment slopes to mitigate the severity of certain of the engineering works required to achieve the vertical and horizontal profiles required for a road of the standard proposed;
 - screen mounding to mitigate specific views from sensitive visual receptors;
 - grading of deposition areas to reflect local landform and massing.

- 6.15.5 There are five locations where preliminary engineering profiles for cutting slopes have been modified to reflect the importance of the existing landform in the context of the local or wider landscape.
- 6.15.6 There are 18 locations where screen mounding has been introduced to mitigate impacts on sensitive visual receptors. In all instances the mounding has been used in combination with woodland or shrub planting to provide the required screening. Mounding would typically be 2m high with 1 in 2.5 side slopes graded out to cutting slopes or embankment profiles at either end.
- 6.15.7 Where deposition areas are proposed, the following approach has been adopted:
- grading to complement forms and slopes of existing landform;
 - merging of the graded areas into the dual carriageway verge to establish a continuity of profile from road to the newly profiled landform; and
 - reintroduction of current field patterns where practicable and subject to potential landowner agreement.

Planting

- 6.15.8 The planting proposals comprise a combination of woodland and woodland edge (LE 2.1, 2.2), linear belts of trees and shrubs (LE 2.4), shrubs with intermittent trees (LE 2.5) and areas of scrub (LE 2.8).
- 6.15.9 Proposed tree and shrub planting has been proposed with a view to:
- replace or compensate for the loss of existing planting;
 - integration with existing vegetation;
 - conserving the setting of local river and stream corridors;
 - integration of design components that may otherwise have a greater influence on landscape character (for example junction settings, over-bridges, accommodation routes and extensive embankment lengths); and
 - ecological objectives.
- 6.15.10 The proposals also indicate areas of existing tree and scrub planting and lengths of hedgerow which it is proposed should be protected and retained within the land take for the Proposed Scheme. Specific engineering and design measures have been adopted in three of the locations where planting would be retained. The first location is at Gortmonly Hill east of Bready where the large-scale cutting into the western slopes of the hill have been graded to reduce loss of existing mature woodland at the southern exit to the cutting. The second is at Ch. 33200 where a short section of low retaining wall would be provided along the north-eastern roadside boundary to reduce otherwise more extensive encroachment into a distinctive copse on the western valley slopes of the Mourne River. The third is at Ch 63880 – 64080 where a retaining wall has been introduced to enable as much of a small area of mature tree planting to be kept.

Woodland and scrub planting

- 6.15.11 Woodland and scrub planting would comprise mixes of native species comprising ash, oak and wet woodland types as described in Tables 6.4 to 6.6. Planting of ash would be subject to the timing of the construction phases and the availability of disease free planting stock, in relation to the current Ash Chalara die-back outbreak and restrictions imposed.
- 6.15.12 Amenity tree and shrub planting (LE 3.1) would be restricted to primary road junctions and settings near urban centres.

Table 6.4 Ash Woodland Planting Species Mix

Latin Name	Common Name
<i>Alnus glutinosa</i>	Alder
<i>Betula pendula</i>	Silver Birch
<i>Betula pubescens</i>	Downy Birch
<i>Corylus avellana</i>	Hazel
<i>Crataegus monogyna</i>	Hawthorn
<i>Fraxinus excelsior</i>	Ash
<i>Ilex aquifolium</i>	Holly
<i>Prunus spinosa</i>	Blackthorn
<i>Quercus petrea</i>	Sessile Oak
<i>Quercus robur</i>	Pedunculate Oak
<i>Salix caprea</i>	Goat Willow
<i>Salix cinerea</i>	Grey Willow
<i>Sorbus aucuparia</i>	Rowan

Table 6.5 Oak Woodland Planting Species Mix

Latin Name	Common Name
<i>Betula pendula</i>	Silver Birch
<i>Corylus avellana</i>	Hazel
<i>Fraxinus excelsior</i>	Ash
<i>Quercus petrea</i>	Sessile Oak
<i>Quercus robur</i>	Pedunculate Oak
<i>Salix aurita</i>	Eared Willow
<i>Sambucus nigra</i>	Elder
<i>Sorbus aucuparia</i>	Rowan

Table 6.6 Wet Woodland Planting Species Mix

Latin Name	Common Name
<i>Alnus glutinosa</i>	Alder
<i>Betula pubescens</i>	Downy Birch
<i>Fraxinus excelsior</i>	Ash
<i>Prunus spinosa</i>	Blackthorn
<i>Salix cinerea</i>	Grey Willow

Hedgerows and Hedges

6.15.13 Hedgerows or hedges would comprise native species hedges (DMRB HA 88/01 Landscape Element LE 4.2), native species hedgerows (LE 4.3) and native hedgerows with trees (LE 4.4). Typical hedge species mixes are described in Tables 6.7 to 6.9.

Table 6.7 Species Rich Hedgerow Planting Species Mix

Latin Name	Common Name
<i>Acer pseudoplatanus</i>	Sycamore
<i>Corylus avellana</i>	Hazel
<i>Crataegus monogyna</i>	Hawthorn
<i>Fagus sylvatica</i>	Beech
<i>Fraxinus excelsior</i>	Ash
<i>Ilex aquifolium</i>	Holly
<i>Lonicera periclymenum</i>	Honeysuckle
<i>Prunus spinosa</i>	Blackthorn
<i>Rosa canina</i>	Dog Rose
<i>Salix alba</i>	White Willow
<i>Salix fragilis</i>	Crack Willow
<i>Sambucus nigra</i>	Elder
<i>Sorbus aucuparia</i>	Rowan
<i>Ulex europaeus</i>	Gorse

Table 6.8 Bessy Bell Hedgerow Planting Species Mix

Latin Name	Common Name
<i>Corylus avellana</i>	Hazel
<i>Crataegus monogyna</i>	Hawthorn
<i>Fraxinus excelsior</i>	Ash
<i>Ilex aquifolium</i>	Holly
<i>Sambucus nigra</i>	Elder

<i>Sorbus aucuparia</i>	Rowan
<i>Ulex europaeus</i>	Gorse

Table 6.9 Conifer Hedgerow Planting Species Mix

Latin Name	Common Name
<i>Crataegus monogyna</i>	Hawthorn
<i>Ilex aquifolium</i>	Holly
<i>Larix decidua</i>	Larch
<i>Pinus sylvestris</i>	Scott's pine
<i>Ulex europaeus</i>	Gorse
<i>Picea abies</i>	Norway spruce

Grassland

6.15.14 Areas of species rich grassland are proposed at a number of locations throughout the Proposed Scheme. Typical species mixes are described in Tables 6.10 to 6.12.

Table 6.10 Conservation Grassland Planting Species Mix

Latin Name	Common Name
<i>Achillea millefolium</i>	Yarrow
<i>Agrostis capillaris</i>	Common Bent
<i>Agrostis stolonifera</i>	Creeping Bent
<i>Ajuga reptans</i>	Bugle
<i>Alopecurus geniculatus</i>	Marsh Foxtail
<i>Anthoxanthum odoratum</i>	Sweet Vernal Grass
<i>Cardamine pratensis</i>	Cuckoo Flower
<i>Carex disticha</i>	Brown Sedge
<i>Carex hirta</i>	Hairy Sedge
<i>Carex leporina</i>	Oval Sedge
<i>Centaurea nigra</i>	Common Knapweed
<i>Cynosurus cristatus</i>	Crested Dog's-tail
<i>Festuca rubra</i>	Red Fescue
<i>Hypochaeris radicata</i>	Cat's-ear
<i>Lathyrus pratensis</i>	Meadow Vetchling
<i>Leontodon autumnalis</i>	Autumn Hawkbit
<i>Lotus corniculatus</i>	Common Bird's-foot-trefoil
<i>Lotus pedunculatus</i>	Greater Bird's-foot-trefoil
<i>Plantago lanceolata</i>	Ribwort Plantain
<i>Prunella vulgaris</i>	Selfheal

Latin Name	Common Name
<i>Ranunculus acris</i>	Meadow Buttercup
<i>Rumex acetosa</i>	Common Sorrel
<i>Succisa pratensis</i>	Devil's-bit Scabious
<i>Veronica chamaedrys</i>	Germander Speedwell
<i>Vicia sepium</i>	Bush Vetch

Table 6.11 Rush Pasture / Marshy Grassland Planting Species Mix

Latin Name	Common Name
<i>Agrostris canina</i>	Velvet Bent
<i>Agrostis capillaris</i>	Common Bent
<i>Agrostris stolonifera</i>	Creeping Bent
<i>Alopecurus geniculatus</i>	Marsh Foxtail
<i>Angelica sylvestris</i>	Wild Angelica
<i>Anthoxanthum odoratum</i>	Sweet Vernal Grass
<i>Cardamine flexuosa</i>	Wavy Bitter-cress
<i>Cardamine pratensis</i>	Cuckooflower
<i>Carex disticha</i>	Brown Sedge
<i>Carex echinata</i>	Star Sedge
<i>Carex flacca</i>	Glaucous Sedge
<i>Carex hirta</i>	Hairy Sedge
<i>Carex leporina</i>	Oval Sedge
<i>Carex nigra</i>	Common Sedge
<i>Carex panicea</i>	Carnation Sedge
<i>Carex remota</i>	Remote Sedge
<i>Cirsium palustre</i>	Marsh Thistle
<i>Epilobium montanum</i>	Broad-leaved Willowherb
<i>Epilobium parviflorum</i>	Hoary Willowherb
<i>Equisetum arvense</i>	Field Horse-tail
<i>Equisetum fluviatile</i>	Water Horsetail
<i>Filipendula ulmaria</i>	Meadowsweet
<i>Galium palustre</i>	Marsh Bedstraw
<i>Glyceria fluitans</i>	Floating Sweet-grass
<i>Juncus effusus</i>	Soft Rush
<i>Lathyrus pratensis</i>	Meadow Vetchling
<i>Lotus pedunculatus</i>	Greater Bird's-foot-trefoil
<i>Lychnis flos-cuculi</i>	Ragged Robin

Latin Name	Common Name
<i>Mentha aquatica</i>	Water Mint
<i>Ranunculus acris</i>	Meadow Buttercup
<i>Ranunculus flammula</i>	Lesser Spearwort
<i>Senecio aquaticus</i>	Marsh Ragwort
<i>Stellaria alsine</i>	Bog Stitchwort
<i>Trifolium dubium</i>	Lesser Trefoil
<i>Veronica beccabunga</i>	Brooklime
<i>Vicia sepium</i>	Bush Vetch

Table 6.12 General Verge Grassland Species Mix

Latin Name	Common Name
<i>Agrostris capillaris</i>	Common Bent
<i>Agrostris stolonifera</i>	Creeping Bent
<i>Anthoxanthum odoratum</i>	Sweet Vernal Grass
<i>Arrhenatherum elatius</i>	False oatgrass
<i>Cardamine pratensis</i>	Cuckoo Flower
<i>Centaurea nigra</i>	Common Knapweed
<i>Cynosurus cristatus</i>	Crested Dog's-tail
<i>Dactylis glomerata</i>	Cocks foot
<i>Festuca rubra</i>	Red Fescue
<i>Hypochaeris radicata</i>	Cat's-ear
<i>Leontodon autumnalis</i>	Autumn Hawkbit
<i>Lotus pedunculatus</i>	Greater Bird's-foot-trefoil
<i>Plantago lanceolata</i>	Ribwort Plantain
<i>Prunella vulgaris</i>	Selfheal
<i>Ranunculus acris</i>	Meadow Buttercup
<i>Succisa pratensis</i>	Devil's-bit Scabious
<i>Vicia sepium</i>	Bush Vetch

Planting strategy and specific proposals

- 6.15.15 The landscape proposals are shown in Figures 6.18 - 6.45 and are outlined below for sections of the Proposed Scheme.

New Buildings to Strabane

- 6.15.16 Where the Proposed Scheme runs close to the river edge and within the Area of High Scenic Value, existing marginal vegetation would form the primary foil to the road. Proposals provide for the planting of hedges and targeted pockets of planting at junctions and side road crossings. South of Bready, areas of low scrub would be

introduced onto embankments and cutting slopes to reflect the existing planting within the area. Shrub and tree planting would provide screening at points of higher visual sensitivity. The extent of shrub and tree planting would increase south of Ballymagorry in the form of linear belts of planting, reflecting the existing vegetation pattern of the neighbouring disused Strabane Canal and as a screen for properties that would overlook the Proposed Scheme.

- 6.15.17 To the west of Strabane and north of the River Mourne, existing mature planting would be retained as far as possible and enhanced to establish a strong framework of vegetation to the dual carriageway. Where the Proposed Scheme passes alongside the River Finn, west of housing off Urney Road, planting would increase in density and extent in the form of belts of trees with a shrubby understorey. .
- 6.15.18 Planting in support of the proposed profiling of the cutting slope would involve the introduction of scrub planting at the interface of cut slope and natural slope at the northern end of the cutting. Existing woodland at the southern end of the cutting would be partially retained, with a new margin of woodland planting established on the point of transition into cutting. The slopes would otherwise be sparsely planted and predominantly grassed to replicate the current form and relationship of the hill to the surrounding area.
- 6.15.19 Within this section of the Proposed Scheme land has been taken on the east side of the dual carriageway for the specific purpose of accommodating screen planting between Ch 9800 and Ch 10050 at Maghereagh (Figures 6.20 – 6.21).
- 6.15.20 The proposals also make provision for the introduction of larger planting stock and / or greater planting densities in the following locations:
- between Ch 14300 and Ch 14550 along the west side of the dual carriageway where the Proposed Scheme runs close to a property on Park Road (Figure 6.22);
 - on the east facing embankments between Ch 16100 and Ch 16500 where the Proposed Scheme runs west of housing on Derry Road (Figure 6.22); and
 - on the south-east margin of the dual carriageway between Ch 18670 and Ch 19250 where the Proposed Scheme runs close to housing on Urney Road / Glenfinn Park (Figure 6.23).

South of Strabane to north of Omagh

- 6.15.21 Where the Proposed Scheme runs south of Omagh as far as the Derg valley, the strategy relative to the Southern Lifford Hills would be focused on the replacement of hedgerows and targeted woodland planting to compensate for areas lost to the Proposed Scheme and to screen nearby receptors. A framework of tree planting with a dense under storey would also be proposed at the Peacock Road intersection.
- 6.15.22 The strategy would provide for woodland and tree planting with a dense understorey on down-slope embankments and at side road and valley crossings. The objective would

be to break the line of the route along the valley side, mask the modifications to hillside slopes and replicate tree groupings on the slopes and in the tributary valleys.

- 6.15.23 Linear belts of tree planting with a dense shrub understorey to each side of the valley and low scrub planting within the open central section of the valley floor would form the focus of the strategy for this section of the Proposed Scheme as it follows an alignment close to the existing A5. The objective would be to soften the impacts of side road crossings, whilst maintaining the natural spatial flow between the Newtownstewart floodplain to the east and the heart of the Derg Valley to the west.
- 6.15.24 Where the Proposed Scheme would be in cutting below the northern slopes of Bessy Bell, scrub planting would be introduced in dispersed areas towards the top of the slopes to soften the line at their crest and complement locally extensive areas of scrub vegetation.
- 6.15.25 As the dual carriageway would follow a line along the western slopes of the river valley above the existing A5 corridor, woodland planting and tree planting with a dense shrub under storey would be planted on down-slope embankments, establishing a sequence of woodland areas which reflect existing groups found on the hillsides within the valley. In a similar manner to LCZ4 (Chapter 10), the objective would be to break the line of the route along the valley side, mask the modifications to hillside slopes and replicate tree groupings on the slopes.
- 6.15.26 Within this section of the Proposed Scheme land has been taken on the west side of the dual carriageway for the specific purpose of accommodating screen planting between Ch 20900 and Ch 21100 (Figure 6.24) where the Proposed Scheme runs close to 3 properties on Knockroe Road.
- 6.15.27 The proposals also make provision for the introduction of larger planting stock and / or greater planting densities between Ch 49250 and Ch 49650 (Figure 6.31) west of the northbound off-slip at J11 where the junction is close to property on Drumlegagh Road South.

Omagh to the A4

- 6.15.28 Frameworks of enclosing dense woodland and tree planting with a dense understorey would be proposed at junctions, side road crossings and near to small settlements. Remnant field margins that would be unlikely to prove viable if returned to agriculture would be utilised to incorporate small pockets of woodland in keeping with such planting forms within the existing landscape. At the southern end of the zone scrub planting would be proposed east of Newtownsaville where there is a distinctive local area of wet woodland scrub associated with a local watercourse.
- 6.15.29 The extensive rock cutting across Tycanny Hill would be infilled and suitably graded at lower levels. Scrub woodland planting, extending to the upper reaches of this backfill slope would provide some sense of a foil to the upper, exposed rock cutting, with denser planting at entry and exit points to mask the transition from engineered to natural slope.

- 6.15.30 Proposals within the deep cutting at Errigal would include extensive scrub planting towards the crest and along entry / exit points to soften profiles and mask the transition from engineered to natural slope. The severed plot of land above the cutting and in proximity to Errigal church would be extensively planted as woodland to serve as a foil to the culturally significant setting.
- 6.15.31 Large areas of woodland planting would frame the road corridor and complement existing areas of riverside planting that are a valuable component of this distinctive and attractive ridge landscape. Areas of tree planting with a dense understorey would be used on embankment slopes as the Proposed Scheme crosses the low moraines below the ridgeline into the Clogher Valley.
- 6.15.32 The strategy would limit areas of shrub and tree planting mainly to the junction with the A4, its modified alignment earthworks and the surrounding re-aligned link roads. Dense blocks of woodland planting would be introduced at this point to help integrate and screen a complex of roads and earthworks. Avoidance of planting to the north of the junction would ensure that the line of the road across the open valley floor from Ballynasaggart along the valley is not overtly emphasised.
- 6.15.33 Within this section of the Proposed Scheme land has been taken in the following locations for the specific purpose of accommodating screen planting:
- on embankment between Ch 63670 and Ch 64140 north-east of the dual carriageway where it is close to two properties on Tattykeel Road (Figure 6.34);
 - between Ch 65500 and Ch 65880 north-east of the dual carriageway where it is close to properties north of Tullyrush Road (Figure 6.35);
 - between Ch 70680 and Ch 70940 north-east of the dual carriageway where it is close to property on Killadroy Road (Figure 6.36);
 - between Ch 73730 and Ch 73760 south-west of the dual carriageway where it is close to property at Newtownsaville (Figure 6.37); and
 - between Ch 76080 and Ch 76400 north-east of the dual carriageway where it is close to property off Tycanny Road (Figure 6.38).
- 6.15.34 The proposals also make provision for the introduction of larger planting stock and / or greater planting densities in the following locations:
- between Ch 63900 and Ch 64100 north-east of the dual carriageway where it is close to properties north of Tullyrush Road (Figure 6.34); and
 - between Ch 80020 and 80200 south of the dual carriageway where it runs north of a property on Glenhoy Road (Figure 6.39).

The A4 to Aughnacloy

- 6.15.35 Large blocks and belts of woodland and tree planting with a dense shrub understorey would be used within this relatively well-wooded drumlin landscape to frame the junction with the existing A5, mask side road crossings and soften embankments.

Areas of scrub would be introduced onto larger cutting slopes in order to break the transition from engineered to natural slope and mask the transition at entry and exit points to the cuttings.

- 6.15.36 The proposals also make provision for the introduction of larger planting stock and / or greater planting densities between Ch 85900 and Ch 86200 (Figure 6.41) south of the dual carriageway where it runs north of a property in an elevated position on Lisginny Road.

Screen fencing

- 6.15.37 One section of 2m high screen fencing has been proposed between Ch 14350 and Ch 14560 (Figure 6.22) where the dual carriageway and northbound on-slip at J3 would be located close to 55a Park Road such that there would be insufficient room to provide effective screen planting between the property and Proposed Scheme.

Environmental barriers

- 6.15.38 There are 9 locations where 2m high, environmental barriers would be installed along the mainline roadside to mitigate impacts associated with traffic related noise:

Table 6.13: Environmental barriers

Location	Description	Chainage/Figure Ref.
Bready	On eastern side of properties to east of existing A5 (Victoria Rd). On western (NB) boundary of WTC.	7160 – 7410, Fig. 6.2
Cloughcor	On western side of properties to west of existing A5. On eastern (SB) boundary of WTC.	10910 – 11200, Fig. 6.21
Park Road, Strabane	Barrier proposed to the North of junction 4, on the western side of WTC.	14300 – 14600, Fig. 6.22
Derry Road, Strabane	North Strabane. Between junctions 3 and 4 on Eastern (SB) carriageway of WTC. Protects Western side of properties which are 'sandwiched' between existing A5 and WTC.	Ch. 15880 – 16310 North of Strabane (south of J3), Fig. 6.22
Glenfinn Park & Urney Road	Between junctions 6 and 7. Western side of Strabane. On Eastern (SB) carriageway of WTC on approach to J7.	18630 – 19260, Fig. 6.23
Tattykeel	South of junction 13. 2 isolated properties. On Eastern boundary of WTC. These properties are 'sandwiched' between existing A5 to E and WTC to W.	63870 – 64070, Fig. 6.34
Tullyrush	A number of farms/properties on Tullyrush Road in rural location	65480 – 65940, Fig. 6.35

Location	Description	Chainage/Figure Ref.
	between junctions 13 and 14. Barrier is on Western side of WTC.	
Routing Burn	This barrier is an addition to an existing bund to fill in a gap on the overbridge over Routing Burn. Location is south of junction 14 on western side of WTC. Protects 2 isolated properties (Both are newly built).	71620 – 71750, Fig. 6.37
Lisginny Road	South of junction 15. Proposed on landscape/visual grounds. Does not pass full criteria for 3 dB reduction, see notes below.	86160 – 86420, Fig. 6.41

Ecological mitigation

- 6.15.39 The planting proposals shown in Figures 6.18 - 6.45 and described above serve the added purpose of compensating and offsetting loss of existing habitats associated with the introduction of the Proposed Scheme into the landscape.
- 6.15.40 New sections of boundary hedgerow planted throughout the substantial length of the Proposed Scheme would result in the introduction of species rich hedgerows.

6.16 Construction

Plant and activities

- 6.16.1 Plant and equipment used during construction would include mechanical excavators, scrapers, graders and dump trucks, generators, HGV-delivery vehicles, ready-mix concrete vehicles, bowsers, road rollers and compaction plant, pumps, hand tools and site staff vehicles.

Excavation, filling and earthworks balance

The Proposed Scheme would involve substantial earthworks particularly where there would be a requirement for significant sections of cutting and embankment. Where practicable, excavated material would be deposited along the route in areas of proposed fill and within the deposition areas.

- 6.16.2 Initial assessments indicate that cuttings would generate approximately 16 million m³ of material, of which 12 million m³ is likely to be suitable for re-use as general or structural fill or utilised in landscaping requirements and environmental enhancement. The initial assessment also indicates there would be a requirement to import approximately 3.25 million m³ of material

- 6.16.3 The works would generate around 4 million m³ of surplus material which it is intended would be deposited wherever possible within deposition areas specifically vested for the deposition of material.
- 6.16.4 Wherever possible, site derived materials for re-use in structural or landscape earthworks would be directly transferred from areas of cut to areas of fill. Should there be a requirement for temporary stockpiling of materials they would be stored away from sensitive locations such as marshy areas, watercourses, flood areas, or close to property, where dust during dry periods could be disruptive to local residents.
- 6.16.5 Where import and export of materials is required, haulage routes would be subject to agreement under the required project Traffic Management Plan. Specific consideration would be given to the potential sensitivity of communities located along potential haul routes.

Protection of Topsoil

- 6.16.6 The contractor would be required to prepare and implement a Topsoil Management Plan as part of the CEMP. This would address issues of stripping, handling, storage and resoiling to ensure that impacts on soil condition and ecology would be minimised.

Contamination

- 6.16.7 The Geotechnical Investigation (GI) has identified 26 areas of potentially contaminated ground distributed throughout the Proposed Scheme corridor (see Chapter 12). It is considered unlikely that other areas of contaminated ground, not identified during the GI, would be encountered during site clearance and excavation. However, any potentially contaminated material would be separated from other excavated material, tested and either treated, or assessed as inert, non-hazardous or hazardous and disposed of to an appropriately licensed location.

Hot spots

- 6.16.8 There are locations where construction activity would be most intense and of relatively long duration (construction hot spots), such that there would be potential for higher orders of environmental impact, comprise proposed junctions, large earthworks, bridges and site compounds.
- 6.16.9 Outline descriptions of the nature of the construction activity at each of the four hot spot categories is provided below.

Junction example - Junction 3 and works within flood plain (Ch. 12300 – 17500)

- 6.16.10 Pre-earthworks drainage would be excavated to intercept any site run off which would then pass through temporary sediment ponds prior to being discharged into the local watercourses. In areas of soft ground, a working platform would be constructed, band drains would be installed and the load transfer platform constructed. The embankment would then be constructed in a number of stages with defined settlement periods between loading cycles. A temporary surcharge would be placed on the embankment which would later be removed and deposited elsewhere. Earthworks side slopes would

be graded, topsoiled and seeded in conjunction with bulk earthworks to allow early establishment of vegetation. The permanent drainage would then be installed along with the attenuation / treatment ponds and other outfall works. The pavement would be constructed at the first available opportunity.

Large Earthworks example - Bready Cut (Ch. 6500 – 7200)

- 6.16.11 Pre-earthworks drainage would be excavated along the eastern site boundary, this would prevent any land run-off from the east entering the site. Temporary Pre-earthworks drainage would be excavated along the western site boundary to intercept any site run off which would then pass through temporary sediment ponds prior to being discharged into the local watercourses. Bulk earthwork operations would then take place with the excavated spoil being hauled south to available embankment deposition areas. Earthworks side slopes would be graded, topsoiled and seeded in conjunction with bulk earthworks to allow early establishment of vegetation. The permanent drainage would then be installed along with the attenuation / treatment ponds and other outfall works. The pavement would be constructed at the first available opportunity.

Bridge example - Junction 6 – Mourne Bridge, Strabane (Ch. 18050)

- 6.16.12 Prior to commencement of works temporary environmental bunds would be constructed along the river banks. Sheet piled walls would be required in the vicinity of the main piers during the installation of piled foundations and the construction of the main pier pile caps to isolate the works from the river. Temporary piling platforms would be constructed at abutment and pier locations prior to commencing piling works. Arisings from the piling works would be controlled and transported to suitable site deposition areas. Once piling works have been completed, the intermediate and main pier pile caps would be constructed. The abutment works would also run in parallel. A pair of form travellers with enclosed soffit form work would be erected on each of the pier heads, balanced superstructure segments would then be cast alternate sides of the pier. Abutment segments and stitch pours would be cast to complete the superstructure. The bridge finishing works (parapet beams, waterproofing, bridge deck drainage units, footpaths, public lighting, parapet railings and surfacing) would then take place. All temporary works would then be removed and the affected areas reinstated prior to removing the environmental bunds.

Main site compounds

- 6.16.13 The Contractor's main construction compounds would be located at central locations along each section. They would have good main road access and be away from built-up areas.
- 6.16.14 Access roads, parking areas, stores areas and workshops etc. would be paved and would drain to a sealed system discharging to an approved temporary discharge area. Temporary lined earthworks would create shallow ponds required for water handling. All construction material for access routes and other hardened areas would be laid on

top of the existing ground with a separation geotextile membrane laid on the topsoil. At the completion of the project the imported materials would be removed and the entire area reinstated to its original condition. Normal depth ploughing would relieve compaction of the topsoil.

- 6.16.15 Where possible foul water would be connected to mains sewage. Otherwise collection and treatment tanks would be required and this would involve setting the tanks below ground level.
- 6.16.16 The main site compound might accommodate a concrete batching plant that would produce all concrete needed for the works. The plant consists of a batcher, aggregate bins, cement silo, cement replacement material silo and water tanks. When siting the plant local environmental risks and constraints would be identified and considered.
- 6.16.17 Particular consideration would be given to the areas designated for fuel and oils storage, storage of materials subject to Control of Substances Hazardous to Health (COSHH) assessments, generator sites, liquid waste storage and hazardous waste storage. Methods of containment and specifics of control measures would be adopted in accordance with Northern Ireland Environment Agency guidelines and construction industry standards.
- 6.16.18 Activities in the main compound could be expected to generate movements in and out of around 1,000 vehicles per day.

Working hours

- 6.16.19 Working hours for normal site activities would typically be from 7:00am to 7:00pm Monday to Friday and from 7:00am to 4:30pm on Saturday. Working hours would reduce through the winter season and would typically be from 8.00am to 5.00pm Monday to Friday.
- 6.16.20 During the earthworks season (April to October) the working hours would typically be 7.00am to 9.00pm Monday to Friday and from 7:00am to 4:30pm on Saturday. There would be no normal working on Sundays or bank holidays.
- 6.16.21 Where construction works could have a significant impact on neighbouring properties, businesses and buildings (for example piling or night time working), the affected parties would be advised of these works prior to their occurrence. In addition, the Contractor's Public Liaison Officer would liaise closely with members of the public and businesses to inform them of measures to minimise the disruption and impacts of construction.

Temporary lighting during construction

- 6.16.22 The need for temporary lighting has been identified at:
- traffic management intersection locations and plant crossings when operational.
 - tie-ins to the existing road network, any street lighting would be maintained where possible and augmented where necessary with additional temporary lighting installed to suit the revised traffic layout. Mobile lighting towers would be used to

fill in light where installed lighting columns are inadequate. All mobile lighting towers would have drip trays placed underneath to catch leaks.

- The extent of lighting at plant crossings would be limited to any hours of darkness when the plant crossings are in use. At worst, lighting at the plant crossings would be required an hour and a half after 7:00am and three hours before 7:00pm in the winter months. Plant crossings, where possible, would be lit using mains electricity. Floodlights would be mounted on lattice towers or scaffold towers high enough to allow the floods to be mounted pointing downward. When mains power supply is not available power would be supplied from silenced generators set up on bunded bases. Short term lighting requirements would be provided by mobile self-contained lighting towers; these are silenced. Care would be exercised in all lighting locations to ensure the lights do not dazzle drivers of approaching vehicles or shed excessive light on to adjacent properties.

Main and satellite compounds

6.16.23 Anticipated locations for main and satellite construction compounds are scheduled in Table 6.14. Locations may be subject to variation.

Table 6.14 Potential Locations for Site Compounds

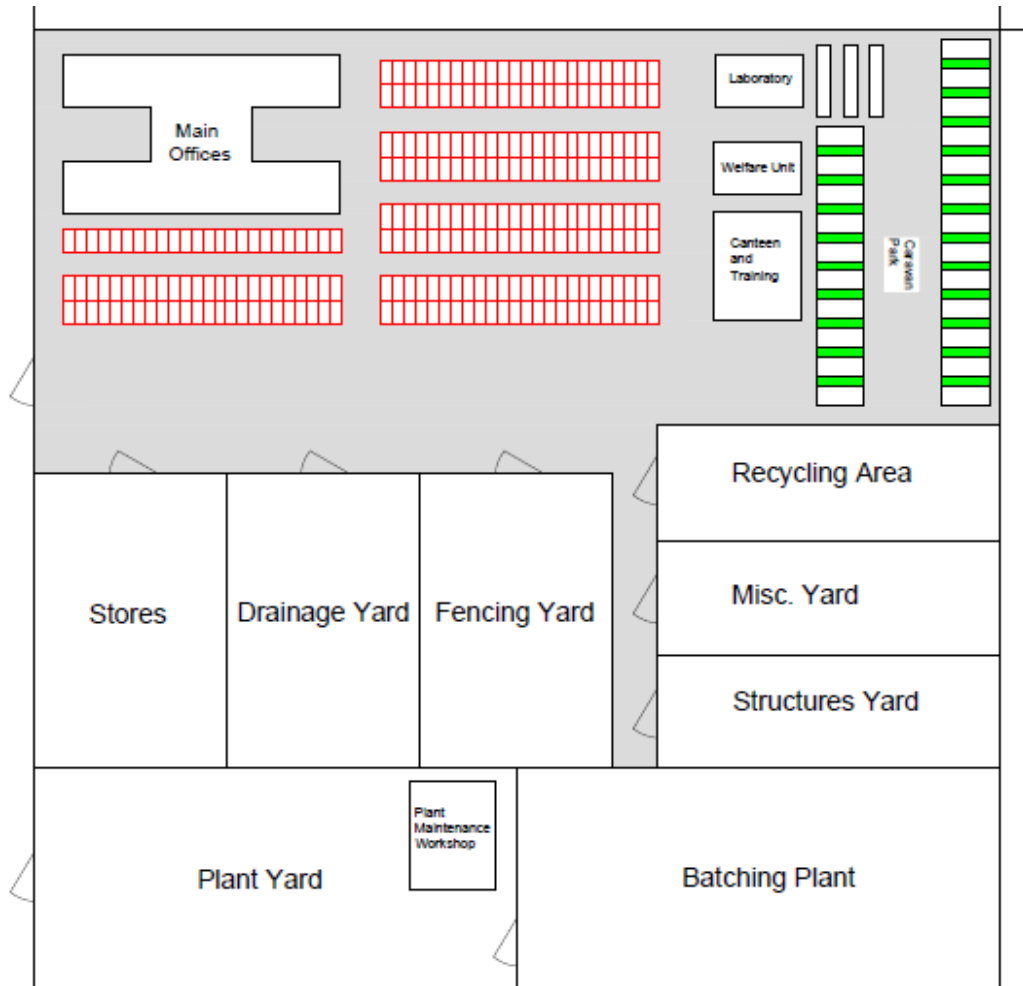
Main Compound (approx 10 acres)	Satellite Compounds (approx 4 acres)
Section 1	
Ballymagorry area Ch. 12000 – Ch. 14500	Bready Ch. 6000 – Ch. 7500 Mourne River Ch. 18000 – Ch. 18700
Section 2	
Strule to Omagh North Area Ch. 42000 – Ch. 48000	At each of the mainline Junctions: Ch. 31000 – Ch. 32500 Ch. 48500 – Ch. 51500 Ch. 36000 – Ch. 37500 Ch. 53500 – Ch. 54500
Section 3	
Ballygawley area Ch. 81000 – Ch. 84000	At each of the mainline Junctions: Ch. 61100 – Ch. 63100 Ch. 85500 – Ch. 87500 Ch. 67700 – Ch. 69700 Ch. 87300 – Ch. 89300 Ch. 72800 – Ch. 74800 Ch. 90900 – Ch. 92900

6.16.24 Figure 6.13 shows a typical main compound layout. These compounds would be outside of the vesting line and would be agreed with the appropriate authorities as the scheme progresses.

6.16.25 Main site compounds would typically contain the main site offices, site laboratory, canteen, welfare facilities, materials storage areas, accommodation park, car parking, waste management area, vehicle washing facilities and a batching plant. The satellite compounds would typically contain a number of offices, stores, welfare facilities and provide material storage and car parking areas.

- 6.16.26 There may be other smaller compounds required based on programme and/or remoteness from the nearest satellite compound. They would consist of short term limited accommodation and facilities compounds. They would be accommodated within the lands made available.

Figure 6.13 Typical Site Compound Layout (200m x 200m)



- 6.16.27 Small satellite compounds would be set up temporarily during the construction period to suit the location of construction, the works programme and environmental considerations. Planning of these compounds would be subject to the CEMP in common with all site works. The size of each establishment would be commensurate with the numbers using the facility.
- 6.16.28 Welfare facilities would be provided at these smaller compounds and some facilities for storage. These establishments would be powered by generator (tanked bunding surround) and water tanks provided for welfare. All appropriate environmental considerations would be adopted for dealing with waste and storage.
- 6.16.29 These satellite establishments would be in use during site working hours only, except for security presence if required.

Construction Environmental Management

- 6.16.30 The contractors appointed to implement the Proposed Scheme would be required to prepare a Construction Environmental Management Plan (CEMP) and Silt Management Plan (SMP) prior to commencement of the proposed works. The draft CEMP (Appendix 6G) and SMP (Appendix 6I) provide a summary of the generic principles and minimum standards that each contractor would comply with. They set out how the environmental impacts of the construction activities would be managed and minimised through the implementation of best practice.
- 6.16.31 As part of the contract, and prior to commencement of the works, the contractor would be required to prepare, and gain approval, of a detailed construction environmental management plan (CEMP) and silt management plan (SMP). Key parts of the CEMP would include:
- an identification of environmental aspects and potential environmental risks associated with the works;
 - statutory requirements;
 - good practice measures to be observed and adopted; and the production of method statements for key activities including measures/procedures to be adopted to ensure statutory and contractual conformity. The measures included would address management of construction related traffic, noise and dust suppression, working margins and methods related to historic features, sensitive habitats, species and watercourses.
- 6.16.32 The contractor would be required to provide a detailed programme prior to commencement of the works. This would set out:
- the overall programme of construction;
 - programming of the key elements and phases of construction (to take account of seasonal restrictions and works at sensitive locations); and
 - the duration of each element and phase.
- 6.16.33 The programme would be regularly updated to reflect any changes in programmed activities and would provide the basis for notification to residents and local communities where sensitive activities would be likely to involve temporary disturbance to access or non routine events such as blasting of rock.
- 6.16.34 Waste and materials would be managed on site through a Site Waste Management Plan (SWMP).

Traffic Management

- 6.16.35 Traffic flows would be maintained on the existing principal roads where the existing road remains at grade and requires no upgrade works. Where there would be disruption to the local road network during construction works the following measures would be required:

- one way traffic management on some local roads to construct the tie-ins;
- short duration closures to some local roads to construct tie-ins;
- various local temporary diversions;
- traffic management during bridge construction works; and
- night time closures required for bridge beams lift.

- 6.16.36 Detailed road closure/diversion information is provided in Appendix 6D. The contractor would be required to develop and agree a Traffic Management Plan with TransportNI for the duration of the contract. The plan would identify proposals for the principal phases of the works and individual construction activities which would potentially involve disruption to existing vehicular and pedestrian access in specific locations along the construction corridor.
- 6.16.37 It would be a requirement that the traffic management complies with Chapter 8 of the Traffic Signs Manual, as published by the Department of Transport. It would be a further requirement that the plan stipulates measures agreed with TransportNI which would address such issues and ensure continued and safe access throughout the contract period.
- 6.16.38 Some temporary road closures may be unavoidable during construction to allow for realignments of the road and/or bridge construction. These would only be allowed if it is agreed by TransportNI that other traffic management options are impractical. Road users would be given advance warning of any closures and diversion routes agreed with TransportNI and appropriately signed.
- 6.16.39 Haulage routes through the site would be permitted to cross side roads within the site boundaries. Access would be permitted at all side roads for the construction of realigned side roads and accesses and any associated structural works. Similarly, access would be allowed at these locations for site workers to access the site going to / from work. Haulage routes along the local road network would be agreed with TransportNI and suitable signage would be installed to control the use of the local road network by construction traffic.
- 6.16.40 It would be a requirement that vehicles using the local road network comply with the gross vehicle weights prescribed in the Motor Vehicles (Construction and Use) Regulations (Northern Ireland) 1999 (as amended).
- 6.16.41 The use of tracked vehicles outside of the site boundary would not be permitted without approval from TransportNI and the adoption of adequate road protection measures.
- 6.16.42 The Contractors would be responsible for any construction related damage to roads or paths in the vicinity of the works and would be required to carry out any repairs or reinstatement, as deemed necessary, with the approval of TransportNI.

7 SCOPING AND INTRODUCTION TO THE ASSESSMENT

7.1 Scoping of potential impacts

7.1.1 Volume 11 of the Design Manual for Roads and Bridges (DMRB) provides a framework for identifying and considering potential impacts associated with major road projects based on a number of environmental aspects. These are scheduled below and have been used as the basis for examining and establishing the scope of the assessments which are reported in this Environmental Statement.

- Air quality.
- Cultural heritage.
- Landscape.
- Nature conservation.
- Geology and soils.
- Noise and vibration
- Effects on all travellers.
- Community and private assets.
- Road drainage and the water environment

7.1.2 The DMRB makes reference to materials as an aspect which should be considered. In the context of the Proposed Scheme, implications related to materials have been addressed to the extent that consideration has been given to potential impacts associated with the transport of materials that would be sourced at distance from the Proposed Scheme corridor and to potential impacts that could arise by virtue of severance or loss of areas identified in development plans as future resources. The first of the issues has been addressed within relevant assessment chapters in terms of construction related impacts. The second has been addressed under Community and Private Assets (Chapter 15).

7.1.3 The environmental assessment team for the Proposed Scheme prepared a scoping report identifying studies and assessments to be included in the project specific ES for the Proposed Scheme. A copy of the scoping report is provided in Appendix 7A.

7.1.4 The report, which was prepared following discussions with statutory consultees, was issued to statutory consultees in September 2014 with an invitation for further

response. No further responses have been received. The report was also placed on the project website in order that other parties including members of the public would have the opportunity to comment. No comments have been received.

- 7.1.5 The studies and assessments reported in chapters 8 – 16 of this ES reflect those identified in the scoping report. Modifications have been made to one of the methods of assessment indicated in the report. One assessment has also not been implemented following further review of the likelihood that the Proposed Scheme could have a significant effect on the environmental issue under consideration.
- 7.1.6 The modification to the method of assessment relates to the assessment of construction related noise as reported in chapter 13. The assessment which has not been proceeded with relates to the view from the road in chapter 14. Further review of the assessment reported in the A5WTC Environmental Statement 2010 demonstrated there would be no likelihood of the views from the existing A5 or the currently proposed A5WTC having a significant environmental effect on users of either road. It was accordingly concluded that further assessment should not be undertaken.

7.2 Format for the assessment chapters

- 7.2.1 A common format has been adopted for the reporting of the assessments undertaken for each of the environmental aspects investigated.

Scope of the assessments

- 7.2.2 This section describes the potential impacts identified during scoping, specific to the aspect reported in the chapter. It explains the nature of the potential impacts, the specific assessments considered appropriate, the extent of the study area for each of the assessments and the timescales considered.

Study areas

- 7.2.3 The extent of the study area for the assessments varies according to the environmental aspect being considered. These have been determined in light of an initial review of the relationship of the Proposed Scheme to sensitive receptors (people, environmental features or fauna) and the likelihood of consequential impacts. For some aspects, the area is identified as being relatively localised to the proposed alignment. For others it may extend out to the surrounding road network, along watercourses or include more distant communities and environmentally sensitive areas. The extent of the study area for each aspect is described in each assessment chapter.

Timescales

- 7.2.4 Similarly, the timescales adopted for the assessments vary according to the environmental aspect being considered. For many environmental aspects, the DMRB

guidance calls for an assessment based on predicted changes during construction, as the scheme would be opened to use (the Opening Year) and 15 years subsequent to the Opening Year (the Design Year). The latter point represents the period generally adopted for forecasting the volumes of traffic using the road and within parts of the wider road network as the basis for designing the Proposed Scheme. The specific timescale for each aspect is described in each assessment chapter. The adopted Opening and Design Years for the Proposed Scheme are 2028 and 2041 respectively.

Resources and receptors

7.2.5 Environmental resources are defined as those aspects of the environment that support and are essential to natural or human systems. These include areas or elements of population, ecosystems, soil, water, air and climatic factors, material assets, landscape, watercourses, community facilities etc.

7.2.6 Environmental receptors are defined as people (occupiers of dwellings and users of recreational areas, places of employment and community facilities) and elements within the environment (flora and fauna), that rely on resources.

Statutory and planning context

7.2.7 This section outlines statutes, guidance, policies and plans relevant to the environmental interests forming the focus of the assessment reported in the chapter.

Methods of assessment

7.2.8 This section details the methods adopted for the various assessments. It explains the nature of the data relied on and the surveys, models and calculations used and undertaken to validate:

- the baseline environment with particular reference to environmental resources and receptors; and
- predicted impacts associated with the introduction of the Proposed Scheme into the baseline environment.

7.2.9 There is an explanation of the quantitative and qualitative criteria adopted to evaluate impacts and determine the order of beneficial and adverse impacts.

Baseline environment

7.2.10 This section includes a description of the key components and characteristics of the baseline environment and the status of the environment.

Predicted impacts and mitigation

- 7.2.11 This section describes the predicted impacts and evaluates their significance in accordance with the criteria detailed in the methods of assessment. The assessment considers impacts during construction and once the Proposed Scheme is open to use.
- 7.2.12 Impacts comprise identifiable changes in the existing environment (the baseline environment) which would occur or be likely to occur as a consequence of implementation of the Proposed Scheme (e.g. the loss of a habitat or the pollution of a watercourse).
- 7.2.13 Impacts may be referred to either prior to or following mitigation. Each of the assessments evaluates and describes the nature of impacts predicted to result from the construction and operation of the Proposed Scheme. Each defines ratings (thresholds) appropriate to the nature of the environmental aspect and in accordance with accepted terminology where standardised methodologies are used.
- 7.2.14 Impacts may be direct (e.g. the loss of woodland to accommodate the road) or indirect (e.g. pollution downstream arising from silt deposition during earthworks). They may be short-term/temporary (e.g. dust associated with construction) medium-term (e.g. cutting back of planting subsequently allowed to regenerate) or long-term/permanent (e.g. improvement in local air quality). They may be beneficial (e.g. screening of an existing eyesore) or adverse (e.g. loss of an attractive landscape component).
- 7.2.15 The prediction of impacts has been based on:
- the known or likely presence of environmental receptors / resources;
 - the environmental value of the resources / receptors, as determined through their designated status along with qualitative criteria such as rarity, status and condition;
 - the vulnerability or sensitivity of affected resources;
 - the number and sensitivity of affected receptors;
 - the extent, nature and duration of physical change resulting from the construction or operation of the Proposed Scheme;
 - the ability of the resource / receptor to respond to change; and
 - the adaptability, and thus effectiveness, of the resource / receptor to control change (i.e. mitigation).

7.2.16 All of the assessments are based on comparisons between the environment immediately prior to the assumed construction of the Proposed Scheme and the predicted environment, assuming the proposed road is built.

7.2.17 This section describes the mitigation measures which have been identified in light of the evaluation of predicted impacts.

Conclusions and effects

7.2.18 This section summarises the order of the predicted impacts associated with the Proposed Scheme taking into account the effectiveness of proposed mitigation measures and the significance of the resultant effects on the environmental aspects forming the subject of the chapter.

8 AIR QUALITY

8.1 Executive Summary

8.1.1 The air quality assessment has examined the potential impacts of the Proposed Scheme on air quality at a local and regional level. This included possible air quality impacts during the construction phase and operation phase of the Proposed Scheme. The aim was to determine whether the Proposed Scheme would result in the exceedance of air pollutants above specified significance thresholds.

8.1.2 The air quality assessment demonstrates that due to the strategic diversion of traffic to the A5 WTC, the level of key air pollutants decreases positively benefitting the local population when compared to a scenario without the Proposed Scheme. In addition, the majority of designated ecological sites are predicted to experience a decrease in the deposition of Nitrogen on the operation of the Proposed Scheme. However, regional emissions would increase from existing levels as a result of the Proposed Scheme.

8.2 Scope of the assessments

8.2.1 The assessments relating to air quality have been focused on:

- impacts on sensitive receptors associated with construction related dust;
- impacts on local air quality associated with construction traffic;
- local air quality relative to sensitive receptors associated with parts of the road network where changes in traffic volumes and performance would be affected by the introduction of the Proposed Scheme into the network; and
- changes in greenhouse gas emissions (regional emissions) attributable to the introduction of the Proposed Scheme into the local road network.

8.2.2 Sensitive receptors considered comprise; residences, schools, care homes, hospitals, collectively referred to as public exposure receptors, and sites designated by virtue of their nature conservation value.

8.2.3 The assessment for sites designated by virtue of their nature conservation value has been focused on the calculation of NO_x and nitrogen deposition rates which it is anticipated would result with and without the Proposed Scheme. The results have been taken into account by the ecological assessment team as part of its assessment for the relevant designated sites as reported in Chapter 11.

Construction-related dust

- 8.2.4 The assessment has been focused on sensitive receptors located within 200m¹ of the working areas required for construction of the Proposed Scheme.

Emissions and construction traffic

- 8.2.5 The assessment of construction-related impacts, specific to traffic-related emissions (NO₂ and PM₁₀), has been focused on sections of existing road and haul routes which would be extensively used by construction vehicles and on areas of concentrated construction activity such as site compounds and storage areas which are located within defined centres of population.
- 8.2.6 While the number and movement of construction traffic is not certain at the time of preparation of this report, estimates of the number of Heavy Goods Vehicles (HGVs) movements and their locations has been provided (Appendix 8G).
- 8.2.7 Estimates of the potential impact of HGV construction was undertaken as described in the DMRB local air quality assessment described above.

Local air quality relative to sensitive receptors

- 8.2.8 The assessments have involved an evaluation of changes in concentrations of specific pollutants at sensitive receptors associated with parts of the road network where it is predicted criteria detailed in the DMRB would apply (affected roads). Existing concentrations and trends of the specified pollutants as well as the location of Air Quality Management Areas (AQMAs) relative to the Proposed Scheme have been investigated. The significance of impacts has been described in terms of receptor locations where increases or reductions in concentrations of the specified pollutants have been identified and in relation to concentration levels detailed in The Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland and The Environment (Northern Ireland) Order 2002.
- 8.2.9 The pollutants considered in relation to public exposure receptors comprise NO₂ and particulates (PM₁₀). The pollutants considered in relation to ecologically sensitive receptors comprise oxides of nitrogen (NO_x) and nitrogen deposition.
- 8.2.10 Sensitive receptors comprise:
- people living within 200m of the relevant sections of the existing road network and the proposed new road identified in accordance with parameters detailed in the DMRB;

¹ Monitoring undertaken as part of research into PM₁₀ emissions from a construction site indicated no discernible difference beyond 200m downwind of construction works.

- locations were significant numbers of the public and more vulnerable members of the public (sensitive receptors) regularly congregate (these include hospitals, schools, care homes etc); and
- areas of sensitive habitat comprising nationally or internationally designated sites. The following four sites have been subject to assessment: McKean's Moss ASSI, Grange Wood ASSI, Tully Bog ASSI and SAC and Strabane Glen ASSI.

8.2.11 The parameters determining which parts of the existing road network have been included in the study area for the assessments comprise sections of road (affected roads) which it is predicted would be subject to:

- a change in alignment of 5m or more; or
- a change in daily traffic flows of 1,000 Annual Average Daily Traffic (AADT) or more; or
- a change in heavy duty vehicle Heavy Duty Vehicles (HDVs) flows of 200 AADT or more; or
- a change in daily average speed by 10 km/hr or more; or
- a change in peak hour speed of 20 km/hr or more.

8.2.12 In relation to timescales, the assessments for public exposure receptors have been focused on prediction of changes in concentrations of the specified pollutants in the opening year for the fully completed scheme (2028) prior to and following opening of the Proposed Scheme to use. Assessments have also been undertaken for 2019 and 2023 to represent impacts associated with the opening of phases 1 and 2 to determine if there would be likely to be any significant effects associated with the phased implementation of the Proposed Scheme.

Regional emissions

8.2.13 The assessments for impacts related to regional emissions has involved a comparison of annual emissions of specified pollutants emitted by traffic associated with the road network in the study area.

8.2.14 The specified pollutants comprise carbon dioxide (CO₂) hydrocarbons (HC) particulate matter (PM₁₀) and oxides of nitrogen (NO_x).

8.2.15 A DMRB regional traffic screening has been undertaken to identify those affected by DMRB regional screening criteria:

- a change of more than 10% in AADT; or
- a change of more than 10% to the number of HDVs; or
- a change in daily average speed of more than 20 km/hr.

- 8.2.16 In relation to timescales, the assessments have been focused on comparison of emissions with and without the Proposed Scheme in the opening year for the fully completed scheme (2028) and in the future assessment year (2041).

8.3 Statutory and planning context

- 8.3.1 The legislative requirements, policies and technical guidance taken into consideration during the air quality assessment are presented below and in Volume 3, Appendix 8A.

European Clean Air for Europe programme (CAFE) Directive and UK 2010 Regulations

- 8.3.2 The Directive details air quality limit values, target values, and critical levels for a number of air pollutants established by the European Parliament and Council for the protection of human health, vegetation and ecosystems. and was made law in England through the Air Quality Standards Regulations (2010).

Air Quality Standards Regulations (2010)

- 8.3.3 The Regulations impose requirements on the Secretary of State to draw up air quality plans in relation to limit values and target values and short-term action plans in relation to alert thresholds.

The Environment (Northern Ireland) Order 2002

- 8.3.4 Part III The Environment (Northern Ireland) Order 2002 provides Northern Ireland legislation for protecting air quality and for local air quality management, whereby all local authorities are required to assess air quality within their area. If a likely exceedence of an objective is identified, then the authority must declare an Air Quality Management Area (AQMA) and prepare an Action Plan with the aim of improving air quality in that area.

United Nations Economic Commission for Europe (UNECE) Critical Loads

- 8.3.5 This document describes the critical load adopted by the United Nations Economic Commission for Europe (UNECE) defined as "a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on sensitive elements of the environment do not occur according to present knowledge".

The Environmental Protection Act 1990 (EPA)

- 8.3.6 This Act contains a definition of what constitutes a 'statutory nuisance' with regards to dust, and places a duty on Local Authorities to take action if they believe a statutory nuisance is occurring within their area and to serve an abatement notice requiring the

abatement or prevention of such nuisances if they believe a nuisance is likely to occur or recur.

8.4 Methods of assessment

8.4.1 Officers of the Environmental Health Departments at Derry City Council (DCC), Strabane District Council (SDC), Dungannon and South Tyrone Borough Council (DSTC) and Omagh District Council (ODC) have been consulted in relation to:

- protocols and methodologies pertinent to the assessments; and
- the identification of data related to existing concentrations of pollutants and air quality and trends more generally.

Assessment guidelines

8.4.2 The assessments have been informed by the following guidance:

- Section 3, Part 1 – HA207/07 Air Quality of Volume 11 of the DMRB;
- Local Air Quality Management Technical Guidance (LAQM.TG(09));
- IAN 170/12(v3) - Updated air quality advice on the assessment of future NO_x and NO₂ projections for users of HA207/07. The IAN provides updated advice on long term trends (LTT) for NO₂;
- IAN 174/13 - Updated air quality advice on the application of the test for evaluating significant effects; for users of HA207/07;
- Minerals Policy Statement 2: Controlling and mitigating the environmental effects of mineral extraction in England;
- Annex 1: Dust and Control of Dust Emissions from Construction Activities, The Greater London Authority (GLA); and
- London Councils Best Practice Guidance on Control of Dust Emissions from Construction Activities.

Construction-related dust

8.4.3 The assessment has involved:

- establishment of 0-50m, 50-100m, and 100-200m bands around the required working areas for construction of the Proposed Scheme;
- identification of the numbers of receptors located within each band;
- identification of higher risk receptors, comprising those located within 50m of the working areas and downwind of the prevailing winds; and
- identification of proposed mitigation measures.

Emissions and construction traffic

8.4.4 The assessment has involved calculation of predicted changes in concentrations of NO₂ and PM₁₀ on sections of road which it is anticipated would be used for the delivery and disposal of materials to three principal site access points: at the proposed Junction 3, off the A5 at the approach to the proposed crossing of the Mourne River (Ch16700 – 17900) and at Strahans Road. The three locations were chosen to be representative of routes and access points following an initial appraisal of identified routes and access points which demonstrated they would be subject to the highest anticipated volumes of construction related traffic and would be likely to result in the highest concentrations of NO₂ and PM₁₀. The calculation of predicted concentrations has involved application of the method described below for local air quality relative to sensitive receptors.

Local air quality relative to sensitive receptors

8.4.5 The assessment has involved:

- establishment of the local air quality study area based on the parameters described in 8.2.11;
- establishment of baseline conditions in relation to existing and newly collected air quality monitoring data, results of local authority air quality modelling exercises, published air quality background levels of the pollutants of interest within the study area and location, extent and status of AQMAs associated with the study area;
- identification of relevant sensitive receptors within the assessment study area;
- calculation of predicted concentrations of NO₂ and PM₁₀ for the Do-Minimum (DM) and Do-Something (DS) scenarios as described in 8.2.12.; and
- evaluation of the results against Air Quality Standards (AQS) to determine the significance of changes in concentrations of the pollutants.

Background and baseline data

8.4.6 Background data for NO_x, NO₂ and PM₁₀ has been obtained from Defra 1x1km background maps, of pollutant concentrations (published 2014). As the background NO_x and PM₁₀ maps provide data for individual pollutant sectors (e.g. motorway, trunk A-roads, primary A-roads, minor roads and industry), the components relating to road traffic that were explicitly modelled have been removed, to avoid double counting of road emissions.

Local and project specific monitoring data

8.4.7 No local authority monitoring data was available post 2009. Consequently, a project specific monitoring study was undertaken using a network of passive diffusion tubes between November 2013 and May 2014. NO₂ diffusion tube sites with >75% data capture and representative locations within the study area were used to inform the air

quality assessment and verify the dispersion modelling results. Where data capture was considered adequate, the measured concentration was annualised to be representative of an annual mean concentration. The locations of the monitoring sites used are presented in Appendix 8B.

AQMAs

- 8.4.8 Information relating to AQMAs has been obtained from the Local Air Quality Management review and assessment documentation prepared and published by the four local authorities consulted.

Identification of receptors

- 8.4.9 Public exposure receptors have been identified using the Pointer address database for Northern Ireland (maintained by Land & Property Services²).

Prediction of concentrations

- 8.4.10 The prediction of concentrations of the pollutants included in the assessment has involved the use of ADMS Roads (3.2.4), an advanced dispersion modelling programme. Detailed explanation of the modelling process, input data and verification and adjustment procedures is available in Appendix 8D.
- 8.4.11 Data inputs to the model have been road geometries, road emissions, metrological data and advanced site dispersion parameters.

Road geometries

- 8.4.12 All road links were set at ground level with receptors set at 1.5m above ground level. Variations in dispersion associated with the road link locations such as road elevations, road cuttings and local topography were considered in the verification exercise to improve performance of the model under these circumstances (Appendix 8D).

Road emissions

- 8.4.13 Data relating to emissions for the modelled roads within the assessment study area has involved consideration of emissions for each hour throughout the year for each section of modelled road (links). It has involved use of DEFRA's Emissions Factors Toolkit (Version 6.01) to calculate vehicle emissions for four periods throughout a weekday; the morning peak (7.30 – 9.30), the evening peak (1600 – 1800), the inter peak (9.30 – 16.00) and off peak (18.00 – 7.30). The EFT takes into account traffic flows, fleet composition, traffic speeds and road type. The calculated values have been applied to all seven days of the week in accordance with Defra guidance.
- 8.4.14 The model combines the emissions profiles representing the four periods in a day with the hourly meteorological data and other parameters to calculate annual average concentrations of the pollutants throughout the assessment study area.

- 8.4.15 In accordance with LAQM.TG(09) paragraph 2.27, all modelled road-based concentrations of NO_x have been converted to annual mean NO₂ using the 'NO_x to NO₂' calculator (Defra, Version v4.1, 19).

Meteorological data

- 8.4.16 Hourly meteorological data for 2013 has been obtained from Castlederg, County Tyrone.

Model verification

- 8.4.17 Verification of the model has been undertaken in accordance with LAQM TG (09) Annex 3. Details of the verification process are provided in Appendix 8D.

- 8.4.18 The model was initially used to predict Baseline Year (2013) concentrations of NO₂ and PM₁₀ using established traffic data. The concentrations were then combined with background concentrations to arrive at predicted concentrations in the baseline year. These were checked against concentrations obtained during monitoring for the baseline year to establish the appropriateness of the model and establish model verification factors to be applied to the predicted concentrations for the assessment scenarios.

- 8.4.19 In the absence of any PM₁₀ monitoring data for verification, the NO_x verification factors have been applied to the modelled outputs for PM₁₀.

Long term nitrogen dioxide trends

- 8.4.20 The modelled outputs have been modified to take into account current advice from Defra² that previously anticipated rates of reduction in vehicle NO₂ emissions predicted in LAQM.TG(09) have not been achieved and that emission factors for the future should accordingly reflect a less optimistic outcome. This has involved application of the procedures in IAN 170/12(v3) - Updated air quality advice on the assessment of future NO_x and NO₂ projections for users of HA207/07 which are detailed in Appendix 8E.

Evaluation of results and significance of effects

- 8.4.21 Adjusted modelled NO₂ and PM₁₀ concentrations at the identified receptors have been evaluated against the UK AQS Objectives set out in Table 8.1 for each of the assessment scenarios.

- 8.4.22 Annual mean NO₂ concentrations in excess 60 µg/m³ have been used as an indicator of potential exceedences of the 1 hour mean NO₂ Objective.

² Note on projecting NO₂ Concentrations, Bureau Veritas. April 2012

8.4.23 Annual mean PM₁₀ concentrations in excess of 32 µg/m³ were used as an indicator of potential exceedences of the 24 hour mean PM₁₀ Objective.

Table 8.1 Objectives for NO₂ and PM₁₀

Pollutant	Objective	Measured as	To be achieved by and maintained thereafter	
			AQS	2008/50/EC
NO ₂	200 µg/m ³ Not to be exceeded more than 18 times per year	1 Hour Mean	31 December 2005	1 January 2010
	<i>(60 µg/m³ – Indicator of Potential Exceedences of Short Term NO₂ Objective)</i>			
	40 µg/m ³	Annual Mean	31 December 2005	1 January 2010
PM ₁₀	50 µg/m ³ Not to be exceeded more than 35 times per year	24 Hour Mean	31 December 2004	1 January 2005
	<i>(32 µg/m³ – Indicator of Potential Exceedences of Short Term PM₁₀ Objective)</i>			
	40 µg/m ³	Annual Mean	31 December 2004	1 January 2005

8.4.24 IAN 174/13 - Updated air quality advice on the application of the test for evaluating significant effects; for users of HA207/07 provides advice on the use of an evaluation process to inform the consideration of any significant air quality effects that may be attributable to a proposed major road scheme.

8.4.25 The approach focuses on receptors already in, or with the potential to be in exceedence of air quality standards, likely to be affected by the scheme. The methodology requires the assessor to determine whether the scheme results in improvements; no change; or worsening of any existing exceedences, how many receptors would be affected, the magnitude of change and the number of properties constituting a significant effect. The methodology then requires a professional judgement to be made as to whether the impact of the Proposed Scheme is significant.

8.4.26 For the A5 scheme where the vast majority of receptors are not already in, or with the potential to be in exceedence of air quality standards, significance has also been assessed in accordance with guidance provided by Environmental Protection UK

(EPUK)³. The magnitude of change in air pollutant concentration descriptors is presented in Appendix 8F.

Regional emissions

- 8.4.27 The DMRB regional assessment uses the traffic characteristics and road length for each link in the traffic network area to calculate the contribution of the scheme to the total annual emissions of Hydrocarbons (HC), NO_x, PM₁₀ and carbon dioxide (CO₂) in the study area.
- 8.4.28 The assessment uses the traffic characteristics and road length for each link in the traffic network area. Total annual emissions for the Base Year (2013), DM and DS scenarios for the Opening Year scenarios (2019, 2023, and 2028) and Design Year (2041) are determined.

8.5 Baseline environment

Traffic conditions

- 8.5.1 Existing roads are single carriageway roads and carry up to 35,000 vehicles per day. The Proposed Scheme would consist of newly constructed roads, built and operated in three distinct phases, across primarily existing agricultural land. HGVs generally constitute up to 9% of the total traffic flow.

Background concentrations

- 8.5.2 Annual mean background concentrations for NO_x, NO₂ and PM₁₀ derived from the Defra LAQM toolkit⁴ issued in June 2014 are presented in Table 8.2.

Table 8.2 Annual mean background pollutant concentrations

1km ² grid	Pollutant	Background pollutant concentration (µg.m ⁻³)			
		2013	2019	2023	2028
Max	NO _x	12.9	9.6	8.8	8.6
	NO ₂	9.8	7.5	6.9	6.7
	PM ₁₀	12.3	11.5	11.4	11.5
Min	NO _x	3.6	2.8	2.5	2.4
	NO ₂	2.8	2.2	2.0	1.9
	PM ₁₀	7.5	7.2	7.1	7.0
Average	NO _x	4.7	3.5	3.1	3.0

³ Development Control: Planning For Air Quality (2010 Update), Environmental Protection UK, April 2010.

⁴ <http://laqm.defra.gov.uk/review-and-assessment/tools/tools.html>

1km ² grid	Pollutant	Background pollutant concentration (µg.m ⁻³)			
	NO₂	3.7	2.8	2.5	2.4
	PM₁₀	8.3	8.0	7.8	7.8

Local air quality monitored concentrations

8.5.3 No air quality monitoring is currently being undertaken in the study area.

Project specific monitoring

8.5.4 The results of the project specific NO₂ diffusion tube monitoring are presented in Appendix 8B. They demonstrate that of the 87 roadside and kerbside sites, four monitoring sites, MCHL 1 in Londonderry, MCHL 13 and MCHL 70 in Strabane and MCHL 79 in Omagh exceeded the annual mean NO₂ objective. All four monitoring locations represent roadside locations in the immediate vicinity of the emission source and at distance from sensitive receptors such that the concentrations are not indicative of exceedences relative to sensitive receptors in these areas.

AQMAs

8.5.5 There are two declared AQMAs in close proximity to the existing A5 and Proposed Scheme (see Figure 1). Strabane AQMA encompasses most of Strabane south of Railway Street/Newtown Street. Newtown Stewart AQMA encompasses the majority of Newtown Stewart south-west of the River Strule. Both have been declared on the basis that they would exceed the PM₁₀ national air quality objectives in 2010.

Wind

8.5.6 The wind rose obtained from the 2013 meteorological data is presented in Appendix 8C. The predominant wind direction is from the west to south-west.

Ecologically sensitive receptors

8.5.7 The location of the 4 sites designated by virtue of their nature conservation value which have been considered in the context of impacts relative to sensitive receptors is indicated in Figure 8.8. Detailed information relating to the sites and their status is provided in Chapter 11.

McKean's Moss ASSI

8.5.8 McKean's Moss is an area of lowland raised bog located approximately 5km north of Strabane on the east bank of the River Foyle. Background levels of NO_x based on data for 2013 are 3.9µg.m⁻³. Background levels for nitrogen deposition are 18.45 kg N ha⁻¹ yr⁻¹. The UNCE critical load for the habitat type relative to nitrogen deposition is 5-10 kg N ha⁻¹ yr⁻¹.

Strabane Glen ASSI

- 8.5.9 Strabane Glen is an area of ash woodland located approximately 1.5km east of Strabane. Background levels of NO_x based on data for 2013 are 5.3µg-m⁻³. Background levels for nitrogen deposition are 43.5 kg N ha⁻¹ yr⁻¹. The UNCE critical load for the habitat type is 10-15 kg N ha⁻¹ yr⁻¹.

Grange Wood ASSI

- 8.5.10 Grange Wood is an area of oak / ash woodland located approximately 1km south-east of Newtownstewart immediately adjacent to the existing A5. Background levels of NO_x based on data for 2013 are 3.8µg-m⁻³. Background levels for nitrogen deposition are 30.8 kg N ha⁻¹ yr⁻¹. The UNCE critical load for the habitat type is 10-15 kg N ha⁻¹ yr⁻¹

Tully Bog SAC and ASSI

- 8.5.11 Tully Bog is an area of lowland raised bog located approximately 3.5km north-west of Omagh. Background levels of NO_x based on data for 2013 are 4.6µg-m⁻³. Background levels for nitrogen deposition are 22.9 kg N ha⁻¹ yr⁻¹. The UNCE critical load for the habitat type relative to nitrogen deposition is 5-10 kg N ha⁻¹ yr⁻¹.
- 8.5.12 The data demonstrates that background NO_x concentrations at the 4 designated sites are well below the EU limit value of 30 µg.m⁻³ and that nitrogen deposition rates at all 4 sites exceed the UNECE critical limits for the habitats which constitute the basis for their designation.

8.6 Predicted impacts and mitigation

Construction-related dust

- 8.6.1 The numbers of receptors located within 50m, 50-100m and 100-200m of the working areas required for construction of the Proposed Scheme are scheduled in Table 8.3.
- 8.6.2 Those within 50m of the principal dust generating activities (site clearance, topsoil strip; cutting and filling, handling and placing of road base materials and aggregates and landscaping) and downwind of the prevailing westerly and south-easterly winds would be those at greatest risk of nuisance associated with construction-related dust.
- 8.6.3 High risk locations would accordingly be north of New Buildings, the western fringe of Magheramason, west of the existing A5 north of Strabane, Urney Road and Glenfinn Park and the western fringe of Moylagh.

Table 8.3 Sensitive Receptors within 200m of Proposed Construction boundary (Phase One, Phase Two and Phase Three)

Banding	Total No. of Receptors	Residential	Health Care	Educational	Others / Unclassified
0 – 50m	326	272	3	0	51
50 – 100m	395	353	0	2	40
100 – 150m	509	459	0	2	48
150 – 200m	605	544	0	1	60

Mitigation

8.6.4 Proposed mitigation comprises:

- monitoring and cleaning of roads and accesses;
- mixing of grout or cement-based materials using a process suitable for the prevention of dust emissions;
- minimisation of stockpile heights for fine materials;
- minimisation of dust generating activities (e.g. cutting, grinding and sawing);
- location of plant away from site boundaries close to residential areas where possible;
- damping down during dry weather and/or periods of strong wind;
- minimisation of drop heights from excavators to crushing plant;
- distances from crushing plant to stockpiles would be kept to the minimum that is practicable to control dust generation associated with the fall of materials;
- covering / sheeting of skips and delivery vehicles;
- completion of soiling, seeding, planting or sealing of completed earthworks as soon as reasonably practicable following completion of earthworks;
- use of wheel wash facilities at major site exits;
- material would not be burnt on site;
- switching off of engines when not in operation;
- notification procedures where potentially significant dust generating activities are required;
- method statements for the control of dust in such locations and complaint receipt; and

- management procedures to ensure issues are addressed should they be raised by the public.

8.6.5 These are measures which will both reduce the magnitude and duration of dust deposition for all receptors.

Construction-related traffic emissions

8.6.6 The maximum changes in concentrations of NO₂ and PM₁₀ associated with construction-related traffic for the three access points and associated routes which have been assessed are scheduled in Table 8.4. The results indicate the maximum impact relative to NO₂ would involve an increase of 4.2µg.m⁻³ and a predicted concentration of 35.1µg.m⁻³ a level which is below the air quality objective. The results indicate the maximum impact relative to PM₁₀ would involve an increase of 0.4µg.m⁻³ and a predicted concentration of 14.6µg.m⁻³ a level which is below the air quality objective.

8.6.7 Taking into consideration the short term nature of the construction work and the predicted increase in NO₂ and PM₁₀ emissions as a result of the additional vehicle movements, the construction traffic is not predicted to have a significant impact on local air quality. There are no new predicted exceedences of the annual or short term air quality objective for NO₂ or PM₁₀ as a result of the construction vehicle movements.

Table 8.4 Change in Annual Mean NO₂ and PM₁₀ Concentrations as a Result of Construction Traffic

Worst affected Receptor	Site Entrance	Chainage	XY Co-Ordinates	Change in NO ₂ (µg/m ³)	Change in PM ₁₀ (µg/m ³)
1	Junction 3	14700	235900.70 400145.38	+3.5	+0.4
2	Existing A5	16700 - 17900	233584.20 397321.78	+4.2	+0.3
3	Strahans Road	20400	232781.62 396014.53	+2.2	+0.3

Local air quality relative to public exposure receptors

8.6.8 A summary of the modelled annual mean NO₂ and PM₁₀ concentrations across the assessment study area upon opening of the fully completed scheme is provided in Table 8.5.

Table 8.5: Summary of Annual Mean NO₂ and PM₁₀ Concentrations for Phase Three DM and DS in the Study Area (2028).

Phase Three				LTT - NO ₂		PM ₁₀
				40 µg.m ⁻³		
Number of properties greater than 40 µg.m ⁻³	DM Exceedence			13		0
	DS Exceedence			3		0
	New Exceedence			0		0
	Removal of Exceedence			10		0
Total number of properties	Improvement in Concentration			7385		7518
	Deterioration in Concentration			2759		1167
	No Change in Concentration			119		1578
DS-DM Annual Mean Change (µg.m ⁻³)	Maximum Worsening			12.2		3.1
	Maximum Benefit			-23.0		-4.3
Maximum	Receptor	X	Y	DM	DS	Change
Worsening	185671881	249200	365560	2.7	14.9	12.2
Benefit	185484748	241171	412638	37.7	14.7	-23.0

- 8.6.9 The assessment has demonstrated there would be 13 exceedences of the annual mean NO₂ objective without the Proposed Scheme and 3 exceedences should the Proposed Scheme be implemented. It has also demonstrated there would be no exceedence of the annual mean PM₁₀ objective with or without the Proposed Scheme.
- 8.6.10 The maximum reduction would be 23µg.m⁻³ and the maximum increase would be 12.2µg.m⁻³. Despite this increase, the receptor remained below the annual average NO₂ objective with the scheme.
- 8.6.11 It is predicted there would be one exceedence of the 1-hour mean NO₂ AQS Objective with and without the Proposed Scheme, but with a beneficial effect.
- 8.6.12 There would be no exceedences of the annual mean or 24-hour mean PM10 AQS Objective with or without the Proposed Scheme.
- 8.6.13 Graphical representations of annual average NO₂ concentrations are presented in Figure 8.24 and Figure 8.25 respectively. Changes in predicted annual average NO₂ concentrations are shown in Figure 8.26. Graphical representations of annual average PM10 concentrations are presented in Figure 8.27 to Figure 8.30 respectively. Changes in predicted annual average NO₂ concentrations are shown in Figure 8.31 & 32.
- 8.6.14 Using EPUK Impact descriptors, the majority (99.5%) of the modelled properties are predicted to experience a slight beneficial to negligible impact on annual mean NO₂

concentrations. For annual mean and short-term mean PM₁₀, the majority (99.9%) of the properties are predicted to experience a negligible impact. Overall it is concluded that the impact on air quality is negligible to slight beneficial with the Proposed Scheme. Graphical representations of significance impact on annual average NO₂ and PM₁₀ concentrations are presented in Figure 8.45 to Figure 8.48 respectively.

8.6.15 Further breakdown of the predicted NO₂ and PM₁₀ annual mean concentrations for Phase 3 with and without the Proposed Scheme in Appendix 8I. Details of significance impacts associated with Phase 3 are presented in Appendix 8J. Predicted NO₂ and PM₁₀ annual mean concentrations for Phase 3 with and without the Proposed Scheme and at each modelled receptor are presented in Appendix 8K and Appendix 8L respectively.

Impacts associated with phasing

8.6.16 Summaries of the modelled annual mean NO₂ and PM₁₀ concentrations across the assessment study area upon opening of phases 1 and 2 of the phased implementation programme is provided in Tables 8.6 and 8.7.

Table 8.6: Summary of annual mean NO₂ and PM₁₀ concentration - phase one

Phase One				LTT - NO ₂		PM ₁₀
				40 µg.m ⁻³		
Number of properties greater than 40 µg.m ⁻³	DM Exceedence			1		0
	DS Exceedence			0		0
	New Exceedence			0		0
	Removal of Exceedence			1		0
Total number of properties	Improvement			1305		1131
	Deterioration			368		209
	No Change			7		340
DS-DM Annual Mean Change (µg.m ⁻³)	Maximum worsening			7.4		0.9
	Maximum benefit			-26.8		-3.3
Maximum	Receptor	X	Y	DN	DS	Change
Worsening	185852279	237104	403207	7.8	15.2	7.4
Benefit	185484748	241172	412638	41.4	14.6	-26.8

Table 8.7: Summary of annual mean NO₂ and PM₁₀ concentrations - phase two

Phase Two		LTT - NO ₂		PM ₁₀
		40 µg.m ⁻³		
Number of properties greater than	DM Exceedence	15		0

40 $\mu\text{g.m}^{-3}$		DS Exceedence		4	0	
		New Exceedence		0	0	
		Removal of Exceedence		11	0	
Total number of properties		Improvement		6677	6581	
		Deterioration		2329	1159	
		No Change		76	1342	
DS-DM Annual Mean Change ($\mu\text{g.m}^{-3}$)		Maximum worsening		14.7	2.4	
		Maximum benefit		-16.9	-4.2	
Maximum	Receptor	X	Y	DN	DS	Change
Worsening	185671881	249200	365560	2.9	17.6	14.7
Benefit	187143853	245203	372297	86.7	69.9	-16.9

8.6.17 The results demonstrate there would be no new exceedences of AQS Objectives for NO_2 or PM_{10} by virtue of the proposed phased implementation of the Proposed Scheme.

8.6.18 Further breakdown of NO_2 and PM_{10} annual mean concentrations for Phase 1 and 2 with and without the Proposed Schemes are presented respectively in Appendix 8I, Details of significance impacts associated with Phase 1 and 2 are presented respectively in Appendix 8J. Predicted NO_2 and PM_{10} annual mean concentrations for Phase 1 and 2 with and without the Proposed Schemes at each modelled receptor are presented respectively in Appendix 8K and 8L respectively.

Ecologically sensitive receptors

8.6.19 The modelled receptor points for each of the four designated nature conservation sites which have been subject to assessment are presented in Figure 8.8. The predicted annual mean NO_x concentrations for the designated sites with and without the fully completed scheme in 2028 are presented in Figures 8.33 – 8.36. The changes in predicted concentrations are presented in Figure 8.37 – 38. The predicted nitrogen deposition rates for the designated sites with and without the fully completed scheme in 2028 are presented in Figures 8.39 – 8.42. The changes in predicted rates are presented in Figure 8. 43 – 8.44

NO_x concentrations and nitrogen deposition at McKean's Moss ASSI

8.6.20 Predicted NO_x concentrations following opening of each of the anticipated construction phases are shown in Tables 8H.1 to 8H.3 in Appendix 8H. In all three instances

concentrations would be well below the EU limit value of $30\mu\text{g.m}^{-3}$, the maximum predicted concentration being $5.98\mu\text{g.m}^{-3}$ following opening of phase one to use.

- 8.6.21 Predicted annual mean nitrogen deposition rates following opening of each of the three anticipated construction phases are shown in Table 8H.12 in Appendix 8H. The results indicate rates would be higher with the Proposed Scheme following opening of each of the phases than without the Proposed Scheme. The increases would be 0.56kg N ha^{-1} , $0.64\text{kg N ha}^{-1}\text{yr}^{-1}$ and $0.51\text{kg N ha}^{-1}\text{yr}^{-1}$ for phases 1, 2 and 3 respectively. Predicted rates, at $19.80\text{kg N ha}^{-1}\text{yr}^{-1}$, $18.22\text{kg N ha}^{-1}\text{yr}^{-1}$ and $16.51\text{kg N ha}^{-1}\text{yr}^{-1}$ would exceed the UNECE critical load of 5 - $10\text{kg N ha}^{-1}\text{yr}^{-1}$ for a lowland raised bog. They would also be lower than the base year rate of $22.72\text{kg N ha}^{-1}\text{yr}^{-1}$.

NO_x Concentrations and nitrogen deposition at Grange Wood ASSI

- 8.6.22 Predicted NO_x concentrations following opening of phase 2 and phase 3 of the anticipated construction phases are shown in Tables 8H.4 and 8H.5 in Appendix 8H. It is predicted concentrations would reduce once phase two is open to use and reduce further once phase three is open to use as a result of the transfer of traffic away from the site boundary. The maximum predicted concentration $16.24\mu\text{g.m}^{-3}$ following opening of phase 2 is well below the EU limit value of $30\mu\text{g.m}^{-3}$.
- 8.6.23 Predicted annual mean nitrogen deposition rates following opening of phase 2 and phase 3 of the anticipated construction phases are shown in Tables 8H.13. The results indicate rates would be lower with the Proposed Scheme following opening of each of the phases than without the Proposed Scheme. The reductions would be 2.16kg N ha^{-1} and $1.69\text{kg N ha}^{-1}\text{yr}^{-1}$ for phases 2 and 3 respectively. Predicted rates, at $28.65\text{kg N ha}^{-1}\text{yr}^{-1}$ and $25.93\text{kg N ha}^{-1}\text{yr}^{-1}$ would exceed the UNECE critical load of 5 - $15\text{kg N ha}^{-1}\text{yr}^{-1}$ for broadleaved and mixed woodlands. They would also be lower than the base year rate of $44.69\text{kg N ha}^{-1}\text{yr}^{-1}$.

NO_x Concentrations and nitrogen deposition at Tully Bog ASSI / SAC

- 8.6.24 Predicted NO_x concentrations in the base year (2013) and following opening of phase 2 and phase 3 of the anticipated construction phases are shown in Tables 8H.6 and 8H.7 in Appendix 8H. It is predicted concentrations would reduce following opening of phase 2 and reduce further following completion of phase 3. The maximum predicted concentration $7.83\mu\text{g.m}^{-3}$ following opening of phase 2 is well below the EU limit value of $30\mu\text{g.m}^{-3}$.
- 8.6.25 Predicted annual mean nitrogen deposition rates following opening of phase 2 and phase 3 of the anticipated construction phases are shown in Tables 8H.14. The results indicate rates would be higher with the Proposed Scheme following opening of each of the phases than without the Proposed Scheme. The increases would be 0.21kg N ha^{-1} and $0.20\text{kg N ha}^{-1}\text{yr}^{-1}$ for phases 2 and 3 respectively. Predicted rates, at $21.50\text{kg N ha}^{-1}\text{yr}^{-1}$ and $20.4\text{kg N ha}^{-1}\text{yr}^{-1}$ would exceed the UNECE critical load of 5 - $10\text{kg N ha}^{-1}\text{yr}^{-1}$.

ha-1 yr-1 for broadleaved and mixed woodlands. They would also be lower than the base year rate of 30.14kg N ha-1yr-1.

NOx Concentrations at Strabane Glen ASSI

- 8.6.26 Predicted NOx concentrations in the base year (2013) and following opening of phase 2 are shown in Table 8H.11 in Appendix 8H. At 5.41µg.m-3 the predicted concentration would be well below the EU limit value of 30µg.m-3.
- 8.6.27 Predicted annual mean nitrogen deposition rates following opening of phase 2 and phase 3 of the anticipated construction phases are shown in Tables 8H.16. The results indicate rates would be lower with the Proposed Scheme following opening of phase 2 and higher following the opening of the fully completed scheme than without the Proposed Scheme. The changes would be an increase of 0.04g N ha-1 and increase of 0.03kg N ha-1 yr-1 for phases 2 and 3 respectively. Predicted rates, at 38.96kg N ha-1yr-1 and 35.36kg N ha-1yr-1 would exceed the UNECE critical load of 5 - 15kg N ha-1 yr-1 for broadleaved and mixed woodlands. They would also be lower than the base year rate of 48.81kg N ha-1yr-1.

Evaluation of changes in NO_x and nitrogen deposition relative to designated sites

- 8.6.28 Guidance in IAN 174/13 - Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 (HA207/07), indicates that where predicted NOx concentrations at ecologically sensitive sites are below the EU limit value for vegetation of 30µg-m-3 a significant effect is unlikely; this is the case for the 4 sites considered. Notwithstanding the guidance, and in light of information obtained relating to background nitrogen deposition rates at the sites considered, predicted rates have been calculated as detailed above and referred to the ecological assessment team for evaluation of the likely significance or otherwise in terms of the integrity and conservation status of the sites. The findings of that assessment are reported in Chapter 11.

Regional emissions

- 8.6.29 Emissions of HC, NO_x, PM₁₀ and CO₂ associated with the roads constituting the assessment study area, are scheduled in Table 8.8. Comparison of the total emissions of CO₂ with and without the Proposed Scheme indicates emissions would be greater by some 28,263 tonnes in the opening year for the fully completed scheme with the Proposed Scheme. A like comparison for the future assessment year (2041) indicates emissions would be greater by some 36,525 tonnes.
- 8.6.30 The assessment has demonstrated that the Proposed Scheme would result in an increase in total regional emissions of NO_x, PM₁₀, hydrocarbons and CO₂, ranging from 14% to 28% in the opening year for the fully completed scheme

Table 8.8: Regional emissions

Total Emissions (tonne/year)	HC	NO _x	PM ₁₀	CO ₂
Base Year (2013)	24	452	30	145,857
DM Opening Year (2028)	15	144	28	146,006
DS Opening Year (2028)	17	181	32	174,269
DM Design Year (2041)*	17	159	32	162,313
DS Design Year (2041)*	20	203	37	198,838
Change from DM to DS Opening Year (2028)	+2	+37	+4	+28,263
Change from DM to DS Design Year (2041)	+3	+44	+5	+36,525
Percentage Change (%) (DS-DM 2028)	+16	+25	+14	+19
Percentage Change (%) (DS-DM 2041)	+18	+28	+17	+23

*2030 emission factors from EFT V6.0.1 were applied for 2041 Design Year

8.7 Conclusions and effects

Construction-related dust

- 8.7.1 The assessment has investigated locations where dust generating construction activities would be most likely to result in higher levels of dust deposition. Mitigation measures have been identified and included in the environmental commitments for the Proposed Scheme which would be a mandatory requirement under the contracts for implementation of the works. These include measures focused on the control of dust and channels for registering concern should there be periods when dust is perceived as a nuisance by receptors in the vicinity of the working area.
- 8.7.2 It has been concluded that construction-related dust would not constitute a significant environmental effect.

Emissions and construction traffic

- 8.7.3 The assessment has investigated three locations where construction-related traffic volumes on roads which would be used to gain access to the working areas and supporting compounds and storage areas would be highest, and combined flows with traffic which would already be using such routes would be the highest within the Proposed Scheme corridor. The investigations have demonstrated that concentrations of NO₂ and PM₁₀ at receptors closest to these routes would be below the annual mean

and short term exceedence values. They are also concentrations where the contribution from traffic associated with the construction of the Proposed Scheme would be temporary.

- 8.7.4 It has been concluded that emissions associated with construction traffic would not constitute a significant environmental effect.

Local air quality and public exposure receptors

- 8.7.5 The assessments have demonstrated there would be no exceedences relative to PM₁₀ with or without the Proposed Scheme. They have also demonstrated that implementation of the Proposed Scheme would not result in any new exceedences for individual receptors or groups of receptors relative to emissions of NO₂ and that a greater number of receptors (13) would be removed from exceedence with compared to without the Proposed Scheme (3).
- 8.7.6 The assessments have further demonstrated that three times and six times as many receptors would experience an improvement in concentrations of NO₂ and PM₁₀ respectively when compared to without the Proposed Scheme.
- 8.7.7 It has been concluded that the impacts would be generally beneficial but that this would not constitute a significant environmental effect.

Local air quality and ecologically sensitive sites

- 8.7.8 Concentrations of NO_x and nitrogen deposition rates have been calculated for McKean's Moss ASSI, Grange Wood ASSI, Tully Bog ASSI and SAC and Strabane Glen ASSI. The results have been taken into account by the ecological assessment team and are reported in Chapter 11.

Regional emissions

- 8.7.9 The assessment has demonstrated that emissions of hydrocarbons, nitrous oxides, particulates (PM₁₀) and carbon dioxide would all be greater with compared to without the Proposed Scheme in the opening year for the fully completed scheme (2028) and in the future assessment year (2041). They predicate greater emissions for CO₂ of 28,263 tonnes in the opening year and 36,525 in the future assessment year.
- 8.7.10 It has been concluded that the impacts associated with CO₂ would constitute a significant environmental effect in the context of the regional road network which has formed the focus of the assessment.

9 CULTURAL HERITAGE

9.1 Executive Summary

- 9.1.1 The cultural heritage assessment has considered the potential effects of the Proposed Scheme on archaeological and built heritage assets and their settings, as well as impacts on the wider historic landscape. The Proposed Scheme would result in the demolition of a single Listed Building and two Industrial Heritage Records. Additionally, there would be direct physical impacts on two scheduled monuments and impacts on the setting of various other heritage assets along the Proposed Scheme. This includes large adverse impacts on the setting of Errigal Keerogue and Harry Avery's Castle which are State of Care Monuments.
- 9.1.2 The route would fragment existing field patterns and sever dispersed rural settlement patterns although not to the extent that it would affect the legibility of the Historic Landscape form over the extensive route corridor area.

9.2 Scope of the assessment

- 9.2.1 The assessments relating to cultural heritage have been focused on archaeological remains, historic buildings and historic landscapes.
- 9.2.2 In relation to archaeological remains and historic buildings, the assessments have generally been focused on known sites, features, buildings and structures and on sites and areas identified as having archaeological potential within a 600m-wide study area centred on the Proposed Scheme alignment. Consideration has also been given to a number of known sites and features close to but outside of the 600m-wide study area, where it has been recognised the introduction of the Proposed Scheme and its associated traffic could potentially have wider impacts on the setting of such assets.
- 9.2.3 In relation to historic landscapes, the assessment has been focused on historic landscape types and historic landscape units within the assessment study area where social and economic activity has served to shape landscapes in which there is a discernible awareness of their evolution. Historic landscape types are distinctive areas of the landscape which contain a number of historic landscape units which are linked together by a consistent overarching theme such as 'woodland' or 'enclosed land'. Historic landscape units are subdivisions within historic landscape types which take account of variations such as morphology, location and time depth such as long-established woodland and commercial forestry. The study area for the assessment has been a corridor 1.5km either side of the land take for the Proposed Scheme.

9.3 Statutory and planning context

- 9.3.1 Reference has been made to the following statutes, policies and plans. A detailed explanation of each and their specific relevance to the assessments is provided in Volume 3, Appendix 9A.

The Historic Monuments and Archaeological Objects (Northern Ireland) Order 1995

- 9.3.2 PART II of the Order makes provision for the scheduling of historic monuments and archaeological objects (Scheduled Monuments) and applications relating to the demolition of, or modification to, Scheduled Monuments.

The Planning (Northern Ireland) Order 1991 (Articles 42 and 44)

- 9.3.3 Part V of the Order makes provision for the listing of buildings and applications relating to the demolition of or modification to listed buildings.

Planning Policy Statement 6 (PPS6): Planning, Archaeology and the Built Heritage

- 9.3.4 PPS 6 sets out government policy for the protection and conservation of archaeological remains and features of the built heritage and provides advice on the treatment of these issues in development plans.

Local Area Plans

- 9.3.5 The Derry Area Plan 2011, Dungannon and South Tyrone Area Plan 2010, Omagh Area Plan 1987-2001 and Strabane Area Plan 1986-2001 all include policies addressing the conservation of cultural heritage assets.

9.4 Methods of assessment

- 9.4.1 The assessments have been informed by the guidance detailed in Volume 11, Section 3, Part 2, HA 208/07 (Cultural Heritage) of the DMRB. Reference has also been made to professional standards set by the Institute of Archaeologists of Ireland and the National Inventory of Architectural Heritage.

- 9.4.2 They have involved the following tasks:

- establishment of the baseline environment relative to archaeological remains, historic buildings and historic landscapes;
- identification and description of the predicted impacts on identified assets and resources;
- identification of mitigation; and
- evaluation of the predicted effects on the identified assets and resources taking mitigation into account.

Establishment of the baseline environment

9.4.3 Identification and description of the baseline environment has involved a combination of desk-based review of plans, maps, records and other documents, consultation with statutory consultees and the public and non-intrusive and intrusive site surveys.

Desk Based Review

9.4.4 Data sources referred to during the desk-based review comprise:

- Monuments and Buildings Record (MBR) held by the Northern Ireland Environment Agency (NIEA);
- specialist aerial photograph collections at NIEA;
- literary resources at Belfast Central Library and Queen's University Library;
- historic maps at the Public Record Office of Northern Ireland;
- aerial photographs of the study area taken in 2008;
- 1st and 4th Edition and modern OSNI maps;
- national Monuments Service Monument Database (Republic of Ireland); and the A5WTC Environmental Statement 2010.

Consultation

9.4.5 Consultees who have provided information relating to the baseline environment include:

- NIEA Built Heritage (Historic Monuments Unit and Historic Buildings Unit);
- National Museums of Northern Ireland; and
- local historical groups including the Aughnacloy Historical Society and New Buildings Archaeological and Historical Society.

Site surveys

9.4.6 Site surveys undertaken comprise:

- windscreen surveys carried out between March 2008 and June 2008 (archaeological remains, historic buildings and historic landscape). The surveys were undertaken within a preliminary study area to identify key recorded cultural heritage constraints during the preliminary options phase of assessment;
- walkover surveys carried out between December 2008 and March 2009 focused on archaeological remains and historic buildings within the preferred corridor as part of the appraisal of route options, to verify recorded sites identified from desk based sources and to make a record of new/potential sites identified in the field;
- walkover surveys carried out between September 2009 and December 2009 focused on archaeological remains and historic buildings within the 600m-wide study area adopted for the detailed assessment of the Proposed Scheme ; and

- monitoring of boreholes and trial pits forming part of the geotechnical investigations for the project in September 2009 and April 2010 by two fully qualified archaeologists. Borehole cores and open pits were inspected and profiles reviewed to establish the presence of archaeological indicators related to soil profiles.

Geophysical Survey

- A programme of geophysical survey was undertaken by Archaeological Services University of Durham in 2012. In total 351 sites along the route were subject to geophysical survey, covering c.167 hectares or c.70% of the Proposed Scheme. A number of possible archaeological features were identified and these areas were used as the basis for designing a programme of archaeological trial trenching¹.

Trial Trenching/Excavation

- Between March and June 2013 archaeological trial trenches and strip map areas were excavated within the New Buildings to South of Strabane section and South of Omagh to Aughnacloy section of the Proposed Scheme by Rubicon Heritage Services (A5WTC Section 1. Report on Phase 1 Evaluation of the Proposed Route. Cotswold Rubicon 2013, A5WTC Section 3. Report on Phase 1 Evaluation of the Proposed Route. Cotswold Rubicon 2013¹). The trenches and strip areas were positioned to investigate geophysical survey anomalies, areas previously identified as being of archaeological potential and apparent blank areas. In total 80 trench areas/strip map areas were excavated as part of the Phase 1 archaeological works. A further 68 trench areas/strip map areas were not excavated due to work on the scheme being suspended in mid-2013.

The 80 excavated trench areas/strip map areas identified 18 potential archaeological sites, 2 of these sites (SMA015 & SMA018) were fully excavated during the Phase 1 site works as they only consisted of one or two discrete archaeological features. Below is a summary of the sites investigated during the Phase 1 works;

- **Magherareagh A-C** (TT027 & TT030) – Trial trenches at this site located a number of features including a possible charcoal production site, possible prehistoric pottery kilns and a burnt mound.
- **Drumenny Little/Grange Foyle A-D** (TT031) – Trial trenches at this site located eight archaeological features comprising burnt spreads, pits, and a ditch. Sherds

¹ A CD with the reports for the geophysical survey and trial trenching is available on request from Seamus Keenan, TransportNI Western Division, County Hall, Drumragh Avenue, Omagh, BT79 7AF.

of pottery recovered from the hearth have been provisionally dated to the mid-Neolithic to early Bronze Age.

- **Ballydonaghy A-D** (TT037) – Trial trenches at this site located nine archaeological features comprising pits, a ditch, a burnt spread, stake holes and a hearth.
- **Desert A & B** (TT050) – Trial trenches at this site located pits, stake holes and hearths of an unknown date.
- **Gort/Errigal A** (SMA 024) – Full excavation was undertaken which investigated most of this site, and preliminary results suggest that 278 archaeological features were present comprising a burnt mound, burnt spreads, occupation/habitation layers, pits, linear features, post holes and stake holes. Further analysis of the site is ongoing, but a late Neolithic/early Bronze Age date has been suggested. The majority of this site has been fully excavated, however, features were observed to be continuing under the spoil heap which were never investigated at the time.
- **Tycanny A** (TT097) – Trial trenching at this site located a burnt mound spread.
- **SMA015** – The area was subject to a strip, map and sample exercise. An isolated pit was located which contained evidence of burning.
- **SMA018** – This area was subject to a strip, map and sample exercise. An isolated pit was located.

Nine of the sites identified by the Phase 1 works were subject to full archaeological excavation as part of advanced Phase 2 works immediately prior to the scheme being suspended in mid 2013. A summary of the results of these excavations is presented below:

- **Cloghcor** (SMA 011) – Preliminary findings from the archaeological excavation suggests this to be a Bronze Age site which included a burnt mound, a hearth, associated stake holes and a pit. No trough was located within the area of the excavation and it is possible that this may be located outside of the roadtake.
- **Sollus A** (SMA 009) – Full excavation was undertaken at this site and at least three phases of archaeological activity were identified. The earliest identified phases comprised a possible enclosure or henge monument with northern and southern ditch and two entrances (one on the eastern side and one on the western side). A number of stake/post holes were associated with the monument, one of which contained a worked timber post, Pottery dating to the late Neolithic and later was found within the ditch fills of the monument. The next identified phase comprised a burnt mound within (but postdating) the henge monument. The burnt mound contained two types of wood lined troughs, a burnt spread which included pottery dating to the middle and late Bronze Age. A considerable amount of palaeo-environmental material was recovered from this site, including

waterlogged worked wood. A final, much later phase of activity was represented by a post-medieval trackway.

- **Feddán/Drumcorke A-D** (TT 115 & TT116) – Full excavation was undertaken at this site, and preliminary results suggest that 70 archaeological features were present comprising remnants of a possible round house, several hearths, two ring ditches, pits and post holes. Prehistoric pottery was also located.
- **Tullanfoile A** (SMA019) – Full excavation of this located an undated kiln and a series of north/south orientated furrows.
- **Killadroy A** (TT087) – Full excavation of this site located a kiln which has been interpreted as a corn drying kiln (although no evidence of grain was found within the environmental samples).
- **Legacurry A** (TT082) – Full excavation of this site located a burnt mound, two burnt spreads and post holes.
- **Moylagh A & B** (TT081) – Full excavation of this site located fourteen archaeological sites comprising burnt spreads, a pit, ditches, stake/post holes and a possible trough.

Specialist analysis and reporting is currently ongoing for all of these sites.

Mitigation

- 9.4.7 Proposals to mitigate impacts and their effects are presented in section 9.7. The approach reflects recent changes to NIEA's recommended evaluation methodology for major road schemes and archaeological assets. The approach requires trenches to be placed randomly throughout the areas which would be subject to construction, the aim being to reduce the risk of encountering unknown complex archaeological sites during construction.

Evaluation of the predicted effects on cultural heritage assets

- 9.4.8 The evaluation of the predicted effects on the identified assets and areas of potential has involved consideration of the value of the assets and the magnitude of impact on the assets taking into account proposed mitigation.

Value

- 9.4.9 The establishment of the value of cultural heritage assets which make up the baseline environment has involved reference to the guidance provided in Annexes 5, 6 and 7 of HA208/07. The annexes identify factors which it is appropriate to consider during the evaluation of cultural heritage assets. These include the extent to which individual sites and features, groups of assets and landscape scale patterns contribute to an understanding of the past, recognition by virtue of international, national designation and rarity and condition. The guidance recommends the adoption of six ratings for value in

relation to archaeology and built heritage: very high, high, medium, low, negligible and unknown. The unknown category does not apply to historic landscapes. Indicative definitions for the ratings, as described in the guidance are provided in Appendix 9B.

Magnitude of impact

9.4.10 The evaluation of the magnitude of impact has involved reference to the guidance provided in Annexes 5, 6 and 7 of HA208/07. The annexes identify factors which it is appropriate to consider when evaluating magnitude. These include;

- the percentage destruction of an asset or group of assets;
- analysis of the extent to which partial destruction affects the integrity and understanding of an asset or group of assets;
- the extent to which the Proposed Scheme and its associated traffic impinge upon factors that contribute to the setting of assets – including views, topography, vegetation, sound environment, approaches and context, as experienced within the landscape or townscape; and
- the extent to which the Proposed Scheme and predicted changes in traffic flows throughout the study area impinge upon the form and understanding of the historic depth of landscapes.

9.4.11 HA208/07 recommends the adoption of five ratings for magnitude for all three aspects: major, moderate, minor, negligible and no change. Indicative definitions for the ratings, as described in the guidance, for the three aspects are provided in Appendix 9B.

Predicted effects

9.4.12 The prediction of effects has involved the use of the matrices provided in Annexes 5, 6 and 7 of HA208/07 to establish an indicative effect rating for each asset. The matrix, which combines value and magnitude, to determine indicative ratings is replicated in Table 9.1 below. The outcome specific to each asset has then been reviewed by the assessment team and the rating has either been confirmed or modified. Where the team has concluded the finding based on the application of the matrix should be modified, an explanation of the reasons leading to the modification is provided.

9.4.13 The significant effects of an identified impact is dependent on the value / sensitivity of the heritage receptor / resource and the magnitude of the identified impact (beneficial or adverse). Although any adverse change to (effect on) the cultural heritage resource is assessed as an effect of a quantified significance, in order to gain perspective on what constitutes a significant effect overall, it is useful to qualify the matrix based assessment. Therefore a change to the baseline in the order of a moderate, large or very large effect should be viewed as significant, and conversely a change in the order of neutral or slight effect could overall be interpreted as not significant.

Table 9.1 Predicted effects

Value	Magnitude of Impact					
		No change	Negligible	Minor	Moderate	Major
Very high		neutral	slight	moderate or large	large or very large	very large
High		neutral	slight	moderate or slight	moderate or large	large or very large
Medium		neutral	neutral or slight	slight	moderate	moderate or large
Low		neutral	neutral or slight	neutral or slight	slight	slight or moderate
Negligible		neutral	neutral	neutral or slight	neutral or slight	slight

9.5 Baseline environment

Known archaeological sites and features

- 9.5.1 The principal archaeological assets identified within the assessment study area are described below in the context of a timeline of archaeological periods beginning with the first of the periods represented by recorded assets, the Neolithic Period, and ending with the present day.
- 9.5.2 The distribution of the principal assets sub-divided into prehistoric, medieval and post medieval periods within the timeline is shown in Figures 9.1 – 9.3. The detailed location of the recorded sites and features is shown on Figures 9.4 – 9.10. Detailed information specific to each asset is provided in the Gazetteer of Sites in Appendix 9C.
- 9.5.3 A total of fourteen Scheduled Monuments, two State Care Monuments, sixty-six Monuments and Buildings Record (MBR) sites, eighty-two Industrial Heritage Record (IHR) sites and one hundred sites identified during the walkover surveys are located within the assessment study area.

Neolithic Period (4000 BC – 2000 BC)

- 9.5.4 It was during Neolithic Period that farming and the establishment of small but relatively permanent settlements emerged in contrast to the earlier nomadic lifestyle of Mesolithic hunters and gatherers. The Foyle Valley was an attractive area for such activity. Whilst there is no evidence of Neolithic settlements within the study area, a site thought to be of Neolithic origin was excavated in 2002 during construction of the Strabane bypass (93, Figure 9.5). Located close to previous shore levels of the Finn River, the site consisted of several pits and gullies with charcoal rich fills.
- 9.5.5 One of the most distinctive surviving features of Neolithic settlements are earthen and stone tombs, known as megaliths, which are frequently located on high ground

overlooking the landscape. There are four types of megalith; court, portal, passage and wedge, court being the oldest and wedge the most recent.

- 9.5.6 There are three known megaliths and one potential megalith within the study area. A wedge tomb (**150**, Figure 9.6) comprising a single chamber tomb and a court tomb (**151**, Figure 9.6) comprising three chambers are located in close proximity to each other in the vicinity of Lower Beltany in the Strule Valley south of Newtownstewart. Both are Scheduled Monuments. Close to an upslope from the two tombs, there is a further unrecorded feature which was identified during the walkover surveys. This comprises a large cairn of stones (possibly covering the collapsed tomb) surrounded by mature trees and undergrowth. It is thought this may itself be a megalith (**154**, Figure 9.6).
- 9.5.7 The third known megalith is a Scheduled Monument located west of Omagh known as Giants Grave. It is a court tomb (**184**, Figure 9.7) comprising three upright orthostats with one side consisting of a field boundary.
- 9.5.8 The three known megaliths are of high heritage value. The cairn or potential megalith is of low heritage value.

Bronze Age (2500 BC – 400 BC)

- 9.5.9 The Bronze Age was characterised by broad-scale division of the landscape into field systems within which livestock were managed and crops were grown. In contrast to earlier funerary and ceremonial monuments, burial was simpler.
- 9.5.10 There are eight sites and features representing the period within the study area. These comprise standing stones, cist burials and burnt mounds.
- 9.5.11 Standing Stones are a common feature from both this period and the preceding late Neolithic. They served a number of purposes ranging from burial sites to boundary or routeway markers and ritual or commemorative sites. There are three standing stone sites in the study area; their function is not known. The first is a single stone located at Carricklee (**88**, Figure 9.5). The second (**181**, Figure 9.7) in the townland of Deer Park is the site of a recorded stone which is no longer in place. The third, located in Maghercolton, is broken in two (**134**, Figure 9.6). All three are of low heritage value.
- 9.5.12 There are two cist burials within the study area. These comprise small stone lined rectangular cuts which contain either a cremation burial within an urn or a crouched inhumation. The burials sometimes contain other artefacts such as food vessels or implements. The first of the two cist burial sites is in the townland of Woodend where a possible flat cemetery was uncovered and excavated in the 1930's (**54**, Figure 9.4). At least five burials were discovered and excavated at this site. The second site is recorded as a single cist where the only remains were pottery sherds (**13**, Figure 9.4). Both are of low heritage value.
- 9.5.13 Three potential burnt mounds were identified during the walkover surveys. Burnt mounds are horseshoe shaped mounds enclosing a central pit within which stones were heated on fires. They are frequently located close to a water source, such as a stream or spring

or in wet marshy areas. It is thought they were used for cooking, bulk washing and dyeing and leather working. Two of the sites comprise spreads of burnt material and are located in the same field (**213**, Figure 9.9). The third (**133**, Figure 9.6) is a horseshoe-shaped mound located in an area of low lying marsh close to a stream. All three are of low heritage value.

Iron Age (400BC – 400AD)

- 9.5.14 The Iron Age was the period when Celtic culture became established in Ireland. It was a period characterised by the emergence of kingdoms and the consolidation of territories defended by hilltop fortifications and linear earthworks.
- 9.5.15 There are three large enclosures within the study area which are thought to be of Iron Age or Early Medieval origin. Two are Scheduled Monuments of high heritage value. Both are some 85-100m in diameter. One of the two, Tycanny Hill (**222**, Figure 9.9), is a large oval enclosure set around the summit of the hill with good views all round. The second, at Dernabane Hill (**262**, Figure 9.10), has open views to the east. The third enclosure is located at Lisbeg (**254**, Figure 9.9). It is not scheduled and is of medium heritage value.

Early Medieval Period (AD 400 – 1169)

- 9.5.16 The Early Medieval Period was a time of profound internal social and economic change in Ireland. Christianity became established as an enduring influence on the future cultural and social life of the island. Conflicting kingdoms and the pursuit of regal supremacy throughout the island was an ever present facet of life. Viking raids prompted a change in the form of settlement and defence adopted by kingdoms and local communities.
- 9.5.17 The most numerous site types associated with this period are raths (ringforts), souterrains (underground chambers) and enclosures.
- 9.5.18 Rathes are the most widespread and characteristic archaeological field monument in the Irish countryside. They consist of a circular or roughly circular area enclosed by an earthen bank formed of material thrown up from a concentric fosse (or ditch) on its outside. Archaeological excavations have shown that the majority of raths were enclosed farmsteads, which acted as a defence against natural predators such as wolves and against cattle raids between local communities. Souterrains (underground chambers) were used not only for storage but also as hiding places for people and possessions during times of conflict. Souterrains are often found in association with raths.
- 9.5.19 Twenty-five raths or enclosures have been identified within the study area. They are relatively evenly distributed along the Proposed Scheme corridor, though in the context of the wider area there is a particularly high density of sites south of the Brougher Ridge.
- 9.5.20 Seven of the raths are Scheduled Monuments of high heritage value. Three are platform raths and three are counterscarp raths. One of the platform raths (**182**, Figure 9.7) is located on top of a drumlin to the west of Omagh with views focused to the north. The drumlin top has been modified to produce an elongated mound. The second platform

rath (**255**, Figure 9.9 and Plate 9.1) located at Lisdoart, is well preserved with fine views, although it has been disturbed by animal activity. The third platform rath (**232**, Figure 9.9) is well preserved with a slightly domed interior but no evidence of underlying structures. Two of the counterscarp raths (**186** and **188**, Figure 9.7) are located west of Omagh. Both are well preserved. Site **188** has a bivallete form, that is, it has two concentric banks and ditches. The third counterscarp rath (**233** Figure 9.9) is located west of Ballymackilroy. It is a poorly preserved circular enclosure with a domed interior which appears to have been reused as a tree ring. The seventh scheduled rath (**212** Figure 9.9) consists of a single bank and ditch which has been eroded by livestock and is currently overgrown.

Plate 9.1 Lisdoart platform rath (255) north



- 9.5.21 Two of the other eighteen recorded sites (**259** and **252** Figure 9.10) are located on the tops of drumlins on the eastern side of the Blackwater Valley with good views in most directions. Two (**201** and **217** Figure 9.8) have been partially destroyed. They are of medium and low heritage value respectively.
- 9.5.22 Four of the recorded sites are well preserved. Site **212** (Figure 9.8) is located immediately north of the Routing Burn. It occupies the crest of a drumlin and has good views. The site has been slightly eroded by livestock and has become overgrown with gorse and hawthorn. Site **234** (Figure 9.9) is a newly recorded site comprising a tree-lined enclosure surrounded by a possible ditch. The site is located close to and north of

Site **235** (Figure 9.9), west of Ballnasaggart. Site **260** (Figure 9.10) is a rath-like oval enclosure located in an inter-drumlin hollow south of Lissenderry. The site is densely overgrown. All four sites are of low heritage value.

- 9.5.23 One of the raths is poorly preserved. Site **240** (Figure 9.9) is barely visible, and is located in an area of improved land. It is of low heritage value.
- 9.5.24 There are no visible remains of eleven of the recorded sites (**199, 37, 219, 221, 235, 242, 241, 172, 191, 94** and **127**). All are of low heritage value.
- 9.5.25 Evidence of Christian establishment comprises the church and graveyard site of Errigal Keerogue (**230**, Figure 9.9, Plate 9.2), a State Care Monument of high heritage value. The present site dates from the Later Medieval Period. The original site is mentioned in the Annals of Ireland in 810AD and 839AD, indicating that a monastic site was founded here by Dachiarag or Ciaran (Kieran) prior to 810AD, which was in turn replaced at a later date by a church and graveyard. The visible remains are those of the parish church which was destroyed in 1380. This is an important multi-period site which also includes two further recorded features just outside the graveyard; a Holy Well dedicated to St Kieran (**229**, Figure 9.9) and a Bullaun Stone (**228**, Figure 9.9).

Plate 9.2 View from Errigal Keerogue Graveyard south west



Later Medieval Period (AD 1169 – 1600)

- 9.5.26 The defining factor in the Later Medieval Period is the feudalisation of Gaelic-Irish society, which is associated with the influence of the Normans after 1195. They constructed motte and bailey castles which formed the focus of the consolidation of the new lands and heralded a period in which some 3000 castles were introduced into the landscape of Ireland by the turn of the 17th century. There was a marked decline in new ringfort construction and a move towards division of land of which the modern townland is the descendent. The actual boundaries of these land units, however, must have reflected very closely the rural geography of Ireland in the immediate pre-feudal period. By the same token, the land units of the Anglo-Normans – cantreds and manors – were themselves copies of the territories of pre-colonial Ireland. Towns, markets and fairs were established and a new wave of monasticism arrived with the introduction of monastic orders including the Cistercians, Augustinians, Benedictines and Franciscans.
- 9.5.27 Two sites of interest are associated with the period within the study area. A late medieval nunnery (7, Figure 9.4) is thought to have been established by the Franciscans in the townland of Rosnagalliagh (the wood of the nuns) on a site originally founded by Ailid O’Dermot in 879AD. It is recorded in the OS Memoirs as a convent with a church and graveyard, although at the time no trace of the convent was visible. There was reputed to have been a residential building for the nuns to the west of the church. The site was surrounded by a graveyard of three acres though this has been subject to cultivation since the 1830’s. The site is of medium heritage value.
- 9.5.28 Harry Avery’s Castle (142, Figure 9.6, Plate 9.3) was built in the 14th century. It is one of the few Gaelic-built stone castles in Ireland. Thought to be named after Harry Avery O’Neill; the castle is at the heart of the O’Neill territories, an area which did not come under English dominance until Sir Hugh O’Neill was defeated in the 17th century. The castle is built on an artificially scarped mound which forms an elevated bailey surrounded by a curtain wall. A pair of massive D-shaped towers project out from the southern face of the knoll. The site is of high heritage value.

Plate 9.3 View towards Harry Avery's Castle looking north west



Post Medieval Period (AD 1600 – 1900)

- 9.5.29 By the close of the 16th century, Viking, Norman, Welsh, English and Scottish influences had been assimilated into the Celtic culture throughout large parts of Ireland. The clans of Ulster, some of which had largely resisted and rebuffed the incursions that promoted this change, fought to maintain their Celtic culture, a fight which ended with the defeat of Hugh O'Neill at the Battle of Kinsale (1601) and the Flight of the Earls (1607).
- 9.5.30 The strategy adopted to consolidate the newly gained control involved the imposition of English law and the promotion of the plantation of English and Scots settlers who were given rights to develop landed estates, towns and villages. The rights permitted the landlords to retain a proportion of their estate as demesne. However, the remainder had to be leased to tenants. The result was the establishment of landed estates which were manorial in form, the new landlords being made responsible for the welfare and discipline of their tenants. These landed estates with their rent-paying tenantry provided a social and political stability, which in combination with an increase in economic wealth was the catalyst for the emergence and spread of a market-based rural economy and a growth in urbanisation. Specially fortified 'plantation towns' were established. New Buildings (**4**, Figure 9.4), Strabane (**83**, Figure 9.5) and Newtown Stewart (**143** Figure 9.6) are examples of such towns within the study area. The first two are of low heritage value and the third is of medium heritage value.

- 9.5.31 Other significant evidence of post medieval culture within the study area is associated with the development of industry and infrastructure dating from the turn of the 18th century through to the late 19th century.
- 9.5.32 Strabane Canal, a Scheduled Monument of high heritage value (**49**, Figure 9.4, Plate 9.4) was constructed between 1791 and 1796 by the Marquis of Abercorn. Upon completion it extended for some 4 miles between the River Foyle at Leck and Strabane. Competition from the Great Northern Railway in the second half of the 19th century led to a decline in use such that the canal was in a poor state of repair by the turn of the 20th century. The section from the basin at Strabane to the site of the former swing bridge in the townland of Desert was officially closed in 1962. Some restoration of the remainder has been undertaken.
- 9.5.33 The graveyard at Grange Foyle (**30**, Figure 9.4) is an enclosed graveyard with an enclosing wall dated to 1865, the graveyard is associated with Grange Foyle House. The graveyard is located on a low rising knoll and contains graves dating from 1600 to the 1900's.
- 9.5.34 Other sites of low heritage value include:
- Site **21**, Figure 9.4 – a slate quarry;
 - Site **24**, Figure 9.4 – an unspecified quarry;
 - Site **2**, Figure 9.4 – a flax mill;
 - Site **44**, Figure 9.4 – a brickfield;
 - Site **43** and **39**, Figure 9.5 – two laneways;
 - Site **61**, Figure 9.5 – a railway embankment on the former line of the Great Northern Railway between Londonderry and Omagh;
 - Site **82**, Figure 9.5 – the former site of a bridge;
 - Site **211**, Figure 9.8 – site of former brick kiln;
 - Site **174**, Figure 9.7 – site of former crossing;
 - Site **121**, Figure 9.5 – mill race; and
 - Site **160**, Figure 9.6 – laneway/trackway.

Plate 9.4 Strabane Canal in present overgrown state looking south west



Unknown date

- 9.5.35 A small number of sites identified during the desk based studies and walkover surveys are of unknown date. All have been classified in the gazetteer as being of negligible heritage value. One, a Scheduled Monument of unknown date is recorded as a Boulder with Hollows (180, Figure 9.7) but is now, however, noted as a non-antiquity in the Sites and Monuments Record (SMR).

Areas of archaeological potential

- 9.5.36 Forty-one areas of archaeological potential have been identified. These are scheduled in Table 9.2. They comprise:
- areas where geology, such as alluvial deposits, and the network of watercourses are indicative of a potential for early settlement;
 - areas of high ground where preliminary studies and the presence of known archaeological assets in the wider area suggest potential;
 - areas that have been subject to archaeological evaluation which univeted archaeological remains which require further investigation; and
 - areas surrounding known monuments of importance or groups of known monuments and historic map evidence.

- 9.5.37 Alluvium deposited around rivers, streams and lakes hold potential for a number of archaeological features. Mesolithic hunter-gathers are known to have chosen river banks, lake shores and coastal areas for their occupation camps. Evidence for these camps are usually in the form of occupation debris (middens) and flint scatters. These sites, given their locations, are prone to flooding and can become covered by lake or river alluvium. Over time, these layers of alluvium can build up leaving no surface indication of the features beneath. Analysis of pollen cores from alluvium deposits can provide historic data to show the changes in vegetation and land use of the area over time.
- 9.5.38 Drumlins and hills are potential locations for unknown archaeology. The potential is linked to the nature of settlement in the later prehistoric period and the early medieval period when high ground with good views and south facing slopes were favoured.
- 9.5.39 Areas of higher potential associated with known assets include the area surrounding Beltany/Lurganboy. There are two scheduled megaliths and one potential megalith in close proximity suggesting potential for other evidence of settlement.
- 9.5.40 At Deerpark there are a number of Scheduled Monuments in close proximity. Three of these are raths (**182**, **188** and **186**) and one is a megalith (**184**). There is potential for further ritual or occupation sites associated with these Scheduled Monuments.
- 9.5.41 The area surrounding Harry Avery’s Castle has potential for unknown archaeology. There is not only potential for sites which might be associated with the castle but also for sites which could pre-date the castle. The castle is located on high ground overlooking a historic valley making this area a focal point for activity in the past.
- 9.5.42 Errigal Keerogue is an important multi-period site. It is likely that the site not only extends beyond its present boundary wall but that further associated sites would have been located close to the church and graveyard.

Table 9.2 Areas of Archaeological Potential

Area Reference	Reference number	MBR/IHR Reference Number	Site type
1	2	01768:000:00	Mill site
2	271	N/A	Evaluated site named Magherareagh A
3	272	N/A	Evaluated site named Magherareagh B & C
4	273	N/A	Evaluated site named Drumenny Little/Grange Foyle A-D
5	274	N/A	Evaluated site named Ballydonaghy A-D
6	N/A	N/A	Alluvium
7	44	04051:000:00	Brickfield

Area Reference	Reference number	MBR/IHR Reference Number	Site type
8	275	N/A	Evaluated site named Desert A & B
9	54	TYR 005:016	Cist burials in area
10	N/A	N/A	High ground overlooking River Foyle
11	94	TYR 004:007	AP enclosure site
12	N/A	N/A	Organic alluvium
13	141	N/A	Harry Avery's Castle surrounding area
14	145	N/A	Mill site
15	150; 151	TYR 025:037; TYR 025:008	Area of prehistoric potential
16	N/A	N/A	Alluvium
17	N/A	N/A	Summit of drumlin
18	N/A	N/A	Organic alluvium
19	N/A	N/A	Organic alluvium
20	172	TYR 034:015	Enclosure
21	N/A	N/A	Alluvium
22	N/A	N/A	Summit of drumlin
23	182; 184	TYR 034:006; TYR 034:009	Area of potential - Deerpark
24	186	TYR 034:010	Area of potential - Deerpark
25	187	TYR034:033	Possible Holy Well Site
26	N/A	N/A	Summit of drumlin
27	199	TYR 043:010	Enclosure
28	N/A	N/A	Summit of drumlin
29	211	05262:000:00	Brick Kiln
30	277	N/A	Evaluated site named Tycanny A
31	N/A	N/A	Summit of drumlin
32	230	TYR 059:006	Errigal Keerogue- surrounding area
33	234	N/A	Possible enclosure
34	235	TYR 059:073	Enclosure
35	N/A	N/A	Summit of drumlin
36	N/A	N/A	Summit of drumlin
37	255	TYR 059:067	Enclosure

Area Reference	Reference number	MBR/IHR Reference Number	Site type
38	260	TYR 060:021	Rath
39	240	TYR 059:015	Enclosure
40	N/A	N/A	Organic alluvium
41	N/A	N/A	Summit of drumlin

Built heritage

- 9.5.43 Nineteen listed buildings, sixteen extant Industrial Heritage Record (IHR) sites and fifty-four non-designated buildings and structures of cultural heritage value have been identified within the assessment study area.
- 9.5.44 Most of the buildings and structures date from the turn of the 19th century or later. They are dispersed throughout the corridor, though there is a notably greater concentration of sites within the northern part of the corridor along the Foyle Valley and the Mourne Valley as far as Sion Mills. They generally fall into four broad groupings; churches, vernacular dwellings and farm buildings, houses of a formal architectural style and mills associated with local industry.
- 9.5.45 The nineteen listed buildings comprise four churches, eleven dwellings and one mill. The sixteen IHR sites comprise eleven bridges and five mills. The fifty-four non-designated sites comprise vernacular dwellings, vernacular farm buildings, large dwellings, bridges, mills, kilns and milestones. The distribution of the sites is shown in Figure 9.17.
- 9.5.46 The principal sites and features are described below under the four groupings. Their location is shown in Figures 9.4 – 9.10. Detailed information specific to each is provided in the Gazetteer of Sites in Appendix 9C.

Churches

- 9.5.47 The earliest evidence relating to ecclesiastical buildings within the study area comprises three early 19th century churches. The construction of the churches was symptomatic of a widespread building programme initiated by the landed oligarchy of the Established Church as they sought to maintain a position of political pre-eminence following the Act of Union in 1801 and the assimilation of the Irish Parliament as part of the Parliament of the United Kingdom. From 1801 to 1821 funds for the church building programme were provided by Parliament. The programme instigated resurgence in church building across the denominations.
- 9.5.48 Bready Reformed Presbyterian Church (**20**, Figure 9.4) was rebuilt and St Mary's Church, Clogher (**42**, Figure 9.4) was newly built in 1823. Both are simple barn-like structures displaying an economic use of classical architectural detail. St Matthew's Church, Augher (**237**, Figure 9.9) was built in 1831 and is an example of a tower-and-hall plan type which is more architecturally elaborate than the earlier, simple barn-like

structures. The more architecturally elaborate tower-and-hall plan churches became the favoured type of church plan as they declared the Established Church's pre-eminence.

- 9.5.49 There was a second wave of church building in the latter part of the 19th century following the introduction of the Irish Church Disestablishment Act of 1869. The architectural style of choice adopted for new churches built after the Act was the Gothic Revival style, a movement made popular by the Camden Society and architects such as A. W. N. Pugin. It was a style imbued with historicism and liturgical theory. St John's Church, Bready (25, Figure 9.4) is an example from this period of an ecclesiastical Gothic revival building within the study area.
- 9.5.50 All four churches are Grade B listed buildings of medium heritage value.

Dwellings and farm buildings

- 9.5.51 Historically and architecturally important domestic buildings associated with the study area include a mix of vernacular buildings and an emerging formal architecture associated with changes in industrialisation which led to an increase in wealth and resulted in a more affluent and socially ambitious population. Relevant buildings and structures are dispersed throughout the study area (dispersed settlement being one of the defining features of the countryside in Ireland). It stems from traditional farming practices that did not call for organised land division, which in turn meant that 'village living' as seen in other parts of Europe did not occur.
- 9.5.52 The 'vernacular tradition' is a term used to describe the style of rural buildings that have evolved and adapted to the local environment and economy. They are structurally simple, modest in scale and design and, above all, functional. Divisions between different types of vernacular buildings are not always clear cut, for example houses and agricultural buildings are often linked into farmsteads. Although vernacular buildings vary stylistically from area to area (similar to variations in dialect for example) they evolved as contact with people from larger settlements and towns increased and ideas of privacy, hygiene and propriety had their effect so that by the 19th century, vernacular buildings almost appear standardised, and the regional stylistic variations became dissolved and less obvious.
- 9.5.53 The formal architectural styles associated with many of the notable 19th century buildings within the study area are rooted in the plantation schemes of the 16th and 17th centuries.
- 9.5.54 Plantation estates and towns such as Strabane adopted a form in which permanent dwellings of a more sophisticated construction became commonplace for the first time. Rather than re-using and adapting buildings, as had been done for hundreds of years, the construction of new houses became popular, witnessing a departure from the vernacular tradition. Whilst national and international standards of taste and design in architecture were the reserve of wealthy patrons who could afford fashionable architects to design their houses, throughout Ireland house styles varied depending on the social status of the occupants. Between the large architecturally designed houses and the

broad mass of vernacular dwellings is a range of “well-to-do” houses that fuse together formal and vernacular features.

Vernacular buildings

- 9.5.55 One of the vernacular buildings identified and included in the baseline gazetteer is listed, Grade B1, No.40 Peacock Road, Glebe (**113**, Figure 9.5). Its listing reflects the retention of its original plan form. The building is of medium heritage value.
- 9.5.56 All of the sixteen vernacular dwellings identified are uninhabited and in a poor condition. All have been modified to varying degrees. All are of low or negligible heritage value.
- 9.5.57 Most of the sixteen vernacular farm buildings continue to be used for storage or housing of livestock. All are of low heritage value.
- 9.5.58 Two of the vernacular buildings appear to be related to other sites of cultural heritage interest. Site **99** (Figure 9.8) is a two storey farm building of vernacular style with external steps to the first floor. Although there appears to be buildings on the site in the 1st edition OS mapping, the footprints do not correspond to the location of the building today. The 4th edition OS mapping depicts buildings of similar footprints as exist today. The site could have originally been associated with the Gallany House estate which is approximately 600m south-west of the site.
- 9.5.59 Site **23** (Figure 9.4) consists of four stone structures located on the western slopes of Gortmonly Hill overlooking the River Foyle flood plain. The buildings are currently used for housing livestock and have been substantially altered. On the 1st edition OS mapping the site appears as a complex of approximately fifteen rectangular structures. On the 4th edition mapping, however, the structures have been reduced in number to approximately five. The site is situated directly north of a large quarry which is an Industrial Heritage Record site (Site **24**, within the archaeology baseline) and may have been built to house quarry workers and their families. There are no longer visible remains of the quarry.

Formal architectural styles

- 9.5.60 Castletown House (Site **85**, Figure 9.5, Plate 9.5) and Woodend Cottage (Site **53**, Figure 9.4) are examples of private houses that fuse together formal and vernacular architectural elements. Both are Grade B1 listed buildings of medium heritage value.
- 9.5.61 Castletown House is located on the western fringe of Strabane close to the eastern bank of the Finn River. There are two buildings shown on the 1st edition OS map of c.1830. One of the two buildings does not appear on the 4th edition OS mapping of the 1930s and was probably demolished to make way for the construction of the County Donegal Railway line in the 1860s which ran immediately in front of the house. Although it is not known what the house looked like originally, the house as it appears today seems to have been largely remodelled. The list description for the house, however, states that there are still interior elements from the 18th century.

Plate 9.5 Castletown House, site 85, looking west at the south and east elevations



- 9.5.62 Woodend Cottage is a rare example of a non-vernacular thatched building, and is on the 1st edition OS mapping. By the 1870s formal architectural elements such as canted bay windows and a separate gate lodge had been added furthering the formal appearance of the house. This remodelling can be seen with the changes in the footprint of the building depicted on the 4th edition OS mapping.
- 9.5.63 Gallany House (Site **101**, Figure 9.5), Ballyfatten House (Site **108**, Figure 9.5) and Roundhill House (Site **56**, Figure 9.5) are examples of private houses which represent the move to a more formal architectural style in domestic buildings.
- 9.5.64 Gallany House is a Grade B2 listed building of medium heritage value. It is a two-storey, three bay hipped roof house with a symmetrically arranged façade. Despite having been modernised externally the house retains its formal grand appearance overlooking the Mourne Valley to the east. The 1st edition OS mapping depicts the footprint of the house as it is today except that the original formal entrance to the house, which snaked up through the landscape in front of the house, has disappeared, presumably due to agricultural demands on the land, and the farm entrance to the north of the house is now used. Site **100** (Figure 9.5) is an undesignated building of low value. It appears to be a gate lodge dating to the period when this entrance to the estate began to be used as the formal entrance to the house. The gate lodge does not appear on the 1st edition OS mapping but is labelled as 'Lodge' on the 3rd edition mapping suggesting it dates to circa the late nineteenth century.

- 9.5.65 Ballyfatten House is located alongside the existing A5 north of Sion Mills. Roundhill House is located on the B49 within an area of relatively modern housing on the northern fringe of Strabane. Neither are designated and both are of low and medium heritage value, respectively.
- 9.5.66 Two of the listed buildings within the study area are associated with the Arts and Crafts movement. The movement was born from the revival of historic styles (e.g. the Gothic Revival style) and the sense that traditional crafts and traditions in building had been lost to industrialisation. It was introduced to the local area by James Herdman with the remodelling of Sion House, Sion Mills, in 1884. The two listed buildings within the study area are The Red House, Strabane (Site **89**, Figure 9.5) which is Grade B listed and the Gate Lodge to Carricklee House (Site **90**, Figure 9.5) which is Grade B1 listed. Both, which were built at the turn of the 20th century, are of medium heritage value. John Herdman (James Herdman's brother), bought the former Presbyterian Manse at Carricklee in the 1890s and remodelled it as a large family house, complete with stables and a gate house to the entrance. The Gate Lodge (**90**) was probably built by the architect W. J. Unsworth c.1891. Unsworth was the architect of Sion House and the attribution with the Gate Lodge is made on stylistic grounds. Although the listed building description for the Red House (**89**) suggests it was also built for the Herdman family, independent research suggests the Simms family, a local family, built the house in the 1890s before the Herdman family bought it at the turn of the century. The Red House, and Gate Lodge were therefore built by different patrons and should not be read as a unified grouping of buildings.
- 9.5.67 From the latter part of the 19th century, the two listed buildings of The Manse, Caledon Road (Site **266**, Figure 9.10) and Palymira Lodge, Lisdoart Road (Site **256**, Figure 9.10), are interesting examples of how the effects of the fashion for the formal architectural tradition are fused with simple rural forms.

Industrial buildings and structures

- 9.5.68 Industrial buildings represented within the study area primarily relate to 19th century linen production, corn milling, saw milling and the development of the railways.
- 9.5.69 There are seven recorded mill sites within the study area. One of the Grade B1 listed Cleanally Corn Mill at Ballynasaggart (Site **236**, Figure 9.10) is listed and is of medium heritage value.
- 9.5.70 Five of the remaining six are recorded in the IHR. They are redundant and in a poor state of repair. They comprise:
- a redundant corn mill at Magheramason – site 12, Figure 9.4 (low value);
 - a redundant flax mill, corn mill and sawmill south of the Routing Burn at Kilnaheery – Site 215, Figure 9.6 (low value);
 - a redundant flax mill at Beltany – Site 147, Figure 9.6 (low value);

- a redundant flax ring at Deerpark west of Omagh – Site 183, Figure 9.7 (negligible value); and
- a redundant corn mill and sawmill at Lisdoart – Site 249, Figure 9.10 (low value).

9.5.71 The last of the mill sites comprises the site of a redundant mill building, identified from the walkover survey, Site **148**(Figure 9.6). The mill building is 100m south-west of IHR Site **147** on the Beltany Burn, Beltany. It is of low heritage value.

9.5.72 One IHR bridge site, Site **238**(Figure 9.10), is of medium heritage value. It is an ornate stone-built humped bridge at Cleanally and comprises one of three built heritage assets that have a combined group value; the other two assets being St Matthews Church (Site **237**) and Cleanally Corn Mill (Site **236**).

9.5.73 Five of the ten IHR bridge sites (Sites **177, 176, 169, 173** and **190**, Figure 9.7) are associated with the former Great Northern Railway (GNR) line, north-west of Omagh. They are of low heritage value. Site **170** is a non-designated bridge site also associated with the former GNR line and of negligible value. The part of the Great Northern Railway associated with the study area was opened in the 1850s. It was the branch line between Portadown and Londonderry. With the rapidly declining population in the first half of the 20th century, Ireland's transport facilities become largely redundant and the GNR (NI) line was eventually closed in 1965.

Historic landscapes

9.5.74 The assessment has demonstrated that landscape-scale areas of historic landscape which are currently identifiable within the assessment study area generally have their origins in the enclosures of the mid-19th and early 20th centuries. There are localised areas where greater time depth is evident; these are however, limited to locations such as the historic centre of the plantation towns or long established villages and hamlets.

9.5.75 Historic landscape types associated with the 1.5km wide study area comprise:

- enclosed lane;
- settlements;
- communications and industry;
- woodland; and
- parks and recreation.

9.5.76 Each of the types, other than parks and recreation has been subdivided into landscape units.

9.5.77 The distribution of the types and units within the study area is shown in Figures 9.18 – 9.25.

Enclosed Lane

9.5.78 The historic landscape of the study area is characterised largely by late 19th – early 20th century regular enclosures which drastically altered the appearance and use of the landscape. The landscape within which Irish society lived and functioned was, prior to that time, a largely open one with isolated settlements scattered throughout. An analysis of the 1st edition OS historic maps shows that although enclosure was well advanced within Tyrone by that time, much of the landscape was unmanaged and characterised by piecemeal enclosure. The size and shape of enclosures (represented in the characterisation as historic landscape units) were often dictated by the topography, road and river networks. While a number of field boundaries which exist today can be identified on the 1st edition OS maps, these are isolated occurrences and do not affect the historic character of the landscape.

9.5.79 This landscape type has been sub-divided into the following historic landscape units:

- large regular enclosures, late 19th-20th century;
- medium regular enclosures, late 19th-20th century;
- small regular enclosures, late 19th-20th century;
- large irregular enclosures, late 19th-20th century;
- medium irregular enclosures, late 19th-20th century;
- small irregular enclosures, late 19th-20th century; and
- boggy/marshy land.

9.5.80 Detailed information relating to the Historic Landscape Unit Data Sheets is provided in Appendix 9D. They represent the physical manifestation of a significant shift in Irish social and economic organisation. This, together with its uniformity, frequency and common historic origin indicates they are of medium heritage value i.e. an averagely well-preserved historic landscape type with reasonable coherence and time depth. The review of the 1st edition OS mapping demonstrated that the corridor was one in which unenclosed land and significantly larger and less formal land divisions characterised the landscape. The extent of enclosure was clearly evident on the 4th edition OS mapping albeit that some of these have changed in detail.

Settlement

9.5.81 There are three units of settlement associated within the study area:

- Dispersed Settlement;
- Nucleated Development; and
- Landed Estates.

9.5.82 The dominant type of settlement in the study area is one of dispersed, individual dwellings which are spread throughout the countryside. The majority of these houses are

20th and 21st century structures. Although the structures are modern, this pattern of settlement has a long history in Ireland and is a dominant feature of the historic landscape. Many houses have been constructed on or next to the site of 19th century or older dwellings which are no longer occupied.

- 9.5.83 Nucleated Settlements are dispersed throughout the study area. They range in size from the large county town of Omagh to small villages and hamlets such as Ballymagorry and Newtownsaville. With the plantations of the 16th and 17th centuries came a wave of town, estate and village building. Both Omagh and Strabane date to this time. While retaining their historic cores, the towns of Omagh and Strabane have expanded significantly in the 20th century to the extent that the overriding character associated with those areas closest to the Proposed Scheme, is one of modern development.
- 9.5.84 There is one identifiable Landed Estate within the study area, Baronscourt Estate. Since the 1840s the woodland within the estate has been reduced whilst relatively new development in the form of a golf course and holiday homes has been introduced.
- 9.5.85 The settlement pattern within the study area is considered to be of medium heritage value given its historic legibility and time depth.

Communications and industry

- 9.5.86 The principal unit under this type within the study area is the road network. Most local roads within the study area appear on the 1st edition OS maps indicating that they have greater time depth than the enclosed lands. Some of the principal roads have, however, been modified over time such that the value of the network has been assessed being of medium value. There is little evidence of large scale industrial activity within the study area. Industry tended to occur on a small scale and sites such as bleaching fields are detailed on the 1st edition OS maps. These however are not represented on a landscape scale and little physical evidence of this 19th century industry remains today. The quarries which are in evidence today are believed to date to the 20th century.

Woodland

- 9.5.87 There were extensive forests in Ireland up until 1600. Industrialisation, together with the plantations and population increases contributed to the deforestation of the country. By 1800 there were very few forests in the country. During the 20th century it was recognised that a programme of forest plantations was needed and the plantations we see today are the product of these schemes.
- 9.5.88 There are a small number of wooded areas in the present landscape which were in existence during the 1840s. Those with the most visible time depth and historic legibility are Strabane Glen and Baronscourt Estate. The latter, though having been reduced in size over the past two centuries, still retains much of its historic form and character. Mountjoy Forest was a significant area of woodland which has largely been de-forested since the 1840s, though a few remnants can be seen in the present-day landscape. Other woodland within the study area comprises modern plantations dating to the 20th

century. Many of these, particularly those to the west and south of Omagh, have been planted on formerly boggy marshy land thus changing both the use and appearance of the landscape. Woodland as a type is of low heritage value, the more modern woodlands being the dominant unit. The remnant areas of older woodland are valuable in their own right but not at the landscape scale.

Parks and recreation

9.5.89 Recreational areas associated with the study area are of 20th century origin, and are of low heritage value.

9.6 Predicted impacts

9.6.1 The predicted effects specific to each of the identified archaeological and built heritage assets is scheduled and described in detail in Appendix 9E.

Archaeological assets

9.6.2 The assessment has demonstrated that, allowing for mitigation, the Proposed Scheme would have an adverse effect on forty-two of the identified archaeological sites and features within the assessment study area. These are summarised in relation to their designation status and the predicted effect in Table 9.3.

Table 9.3 Impacts on Archaeological Assets

	Neutral	Slight	Moderate	Large	Very Large
Scheduled Monuments/Proposed Scheduled Monuments	-	8	6	-	-
State Care Monuments	-	-	-	2	-
Industrial Heritage Sites	5	-	-	-	-
MBR Sites	8	7	-	-	-
Walkover Sites	9	3	-	-	-
Sites identified through archaeological fieldwork	-	13	2	1	-
SMR Sites	2	-	-	-	-

9.6.3 The table indicates the Proposed Scheme would have a large adverse effect on the setting of two State Care Monuments; Harry Avery’s Castle (**142**) and Errigal Keerogue (**230**) in a context where the setting is an important aspect of the value and understanding of the assets and one site identified during the 2013 site evaluations, Solus A (**270**).

9.6.4 The table further indicates the Proposed Scheme would have a moderate adverse effect on six Scheduled Monuments and two sites identified during the 2013 site evaluations. The impact would be direct on two of the Scheduled Monuments, Strabane Canal (**49**) and Lisdoart Rath (**255**). The impact on the other four Schedule Monuments; Dernabane Hill (**262**), Tycanny Hillfort (**222**) and the wedge tomb (**150**) and court tomb (**151**) at

Beltany would be on their setting by virtue of the proximity of the Proposed Scheme to the sites. The impact would be direct on the two sites identified during the 2013 site evaluation Feddan / Drumcorke (276) and Gort/Errigal A (278)

- 9.6.5 The table also indicates the Proposed Scheme would have a slight adverse effect on eight Schedule Monuments, seven MBR sites, three sites identified during the walkover surveys and thirteen sites identified during the 2013 site evaluation. The impacts on Scheduled Monuments would be on the setting of six raths (182, 212, 188, 186, 232, 233) a court tomb (184) and a large hilltop enclosure (254) (this site has been proposed for scheduling, but is not yet a Scheduled Monument).
- 9.6.6 The slight impacts on seven MBR assets relate to the direct loss of four low value raths and enclosures (260, 240, 199, 221), the loss of low value enclosure identified from aerial photography (94), the impact on the setting of one medium value enclosure (259) and the direct loss of possible remains of a low value Standing Stone (88).

Built heritage

- 9.6.7 The assessment has demonstrated that, allowing for mitigation, the Proposed Scheme would have an adverse effect on twenty of the identified sites and features. These are summarised in relation to their designation status and predicted effect in Table 9.4

Table 9.4 Impacts on Built Heritage Assets

	Neutral	Slight	Moderate	Large	Very Large
Listed Buildings	1	7	-	1	-
Industrial Heritage Sites	-	2	2	-	-
Undesignated Sites	4	8	-	-	-

- 9.6.8 One listed building, Castletown House (85) (Plate 9.5); would be subject to a large adverse effect. The house, which is of medium heritage value would need to be demolished. It is not known what the house looked like originally; however, its current external appearance suggests it has been largely remodelled. The list description for the house, however, states that there are still interior elements from the 18th century. It has not been possible to access the interior of the building so assessment of the building has been restricted to what can be seen of the exterior of the building and its current setting.
- 9.6.9 There would be a moderate impact on two bridges of low heritage value. The bridge carrying Todds Road over the former railway line (176) that ran from Omagh to Londonderry and the bridge which carries Tully Road (169) over the former railway would both need to be demolished.
- 9.6.10 Slight impacts on listed buildings would all be related to the setting of the buildings. Slight impacts on IHRs (Plates 9.6 and 9.7) would involve direct loss of one and impact on the setting of the second. Both are low heritage value assets. In relation to low value undesignated sites four would be demolished and the setting of three would be affected.

Plate 9.6 IHR Bridge Site 63 looking east



Plate 9.7 IHR Bridge Site 71 (south side)



Historic landscapes

9.6.11 The findings of the assessment relative to the five historic landscape types identified within the assessment study area are summarised in Table 9.5. The assessment has demonstrated the Proposed Scheme would have a slight adverse effect on enclosed land and settlement as historic landscape types and would be neutral relative to woodland, communications and industry and parks and recreation.

Table 9.5 Impacts on the Historic Landscapes

Historic Landscape Type	Value	Magnitude of Impact	Mitigation	Effect
Enclosed Land	Medium	Negligible	N/A	Slight
Settlement	Medium	Negligible	N/A	Slight
Woodland	Low	Negligible	N/A	Neutral
Communications and Industry	Low	Negligible	N/A	Neutral
Parks and Recreation	Low	Negligible	N/A	Neutral

9.6.12 The Historic Landscape type which would be most affected by the Proposed Scheme is Enclosed Land. The introduction of the Proposed Scheme within this extensive historic

landscape type would serve to fragment field patterns but would not significantly affect the legibility of the historic form over such an extensive area.

- 9.6.13 In relation to Settlement, the Proposed Scheme primarily impacts upon dispersed settlement. In common with its relationship to enclosed land, it would sever established patterns but not significantly affect the legibility of the historic form. The Proposed Scheme is located on the fringe of New Buildings and Strabane, examples of nucleated settlement. In neither instance would its presence affect the historic form or legibility of either settlement.

9.7 Proposed mitigation

- 9.7.1 The mitigation strategy for the Proposed Scheme allows for a range of further investigations, studies, recording methods and design measures which have been included as part of the Proposed Scheme, taking into account the known presence of sites and features of interest and the knowledge that as yet unknown interests could be located within the areas where construction would take place. Tables 9.6 and 9.7 below outline specific mitigation proposals for a number of known archaeological and built heritage assets which would be impacted by the Proposed Scheme.
- 9.7.2 The areas of the Proposed Scheme which have not already been subject to archaeological evaluation/excavation, and which are not specifically mentioned in tables 9.6 and 9.7 would need to be subject to the new evaluation methodology recommended by NIEA. This would allow for a test trench layout, based on the previous survey results, focusing on identified archaeological features and areas of archaeological potential. This layout should allow for sampling of the entire length of the scheme. The layout would comprise trenches measuring 20-30m in length and 2m wide spaced no more than 20m apart. Archaeological remains found within these areas would have a 10m buffer excavated around them to look for further associated remains. Any further remains found would themselves be subject to the excavation of a 10m buffer. All areas of proposed groundworks (including areas for compounds, storage areas, access roads and car parks) need to be evaluated in this way. The aim of this methodology is that all archaeological remains would be identified at an early stage and can be entirely investigated before construction work starts for the new road.

Table 9.6 Schedule of archaeological assets

Site name/ reference no.	Site type	Proposed mitigation
4	Plantation village	Planting/Screening
23	Demolished buildings	Building recording
49	Strabane Canal	Planting/Screening
102	Standing Stone	Planting/Screening
122	Standing Stone	Planting/Screening
150	Wedge Tomb	Planting/Screening
151	Court Tomb	Planting/Screening
182	Platform Rath	Planting/Screening
184	Court Tomb	Planting/Screening
212	Rath	Planting/Screening
217	Large Enclosure	Planting/Screening
222	Tycanny Hillfort	Planting/Screening
232	Platform Rath	Planting/Screening
233	Rath	Planting/Screening
252	Rath	Planting/Screening
254	Hilltop Enclosure	Planting/Screening
255	Platform Rath (schedule)	Would require excavation and Scheduled Monument Consent.
260	Rath	Planting/Screening

262	Hilltop Enclosure	Planting/Screening
271	TT 027 – Magherareagh A	Full excavation of site evaluated in 2013
272	TT 030 – Magherareagh B	Full excavation of site evaluated in 2013
273	TT 031 – Drummenny Little/Grange Foyle A-D	Full excavation of site evaluated in 2013
274	TT 037 – Ballydonaghy A-D	Full excavation of site evaluated in 2013
275	TT 050 – Desert A & B	Full excavation of site evaluated in 2013
277	TT 097 – Tycanny A	Full excavation of site evaluated in 2013

Table 9.7 Schedule of built heritage assets

Site name/ reference no.	Site type	Proposed mitigation
12	Corn Mill Site	Building Recording
20	Listed Church	Planting/Screening
23	Vernacular Buildings	Building Recording
53	Listed cottage	Planting/Screening
85	Castletown House (listed)	Listed Building consent required for total demolition, building recording would be required prior to demolition.

89	Red House (listed)	Planting/Screening
90	Gate Lodge (listed)	Planting/Screening
101	Gallany House (listed)	Planting/Screening
106	Vernacular dwelling	Building recording
108	Ballyfatten House	Planting/Screening
112	Vernacular dwelling	Building recording
145	Vernacular dwelling	Building recording
169	Bridge	Building recording
170	Bridge	Building recording
173	Bridge	Building recording
176	Bridge	Building recording
200	Vernacular building	Building recording
256	Palmyra Lodge (listed)	Planting/Screening
266	Manse (listed)	Planting/Screening
267	House (listed)	Planting/Screening

Historic landscapes

9.7.3 As there would be no significant impacts on historic landscapes, specific mitigation has not been proposed. The introduction of hedgerows along substantial lengths of the road boundary would, however, serve to reduce the fragmentation of enclosures which would initially result from the alignment of the road through the countryside

9.8 Conclusions and effects

- 9.8.1 The assessments have demonstrated that in relation to archaeological assets the Proposed Scheme would have a significant large effect on two State Care Monuments, Harry Avery's Castle and Errigal Keerogue. The impact would be on the setting of both; the setting is, however, an important part of the value and understanding of both. It would also have a significant moderate effect on six Scheduled Monuments; the impact would be direct in two instances and on the setting of the assets in four instances. Six archaeological sites currently preserved *in-situ* would also be impacted on by the Proposed Scheme. In terms of significance, these sites are considered to be of local importance, however, Magherareagh B may have the potential to be of regional significance. Overall, the impact of the scheme upon archaeological assets is deemed to be slight to moderate adverse, however the use of appropriate mitigation would reduce this impact.
- 9.8.2 In relation to built heritage, the Proposed Scheme would have a large adverse effect by virtue of the need to demolish Castletown House. There would also be a moderate adverse impact on two assets as a result of the need to demolish two IHR sites in the form of bridges built in the mid-19th century as part of the construction of the Great Northern Railway. Overall, the impact of the scheme upon built heritage assets is deemed to be slight adverse, however, the use of appropriate mitigation would reduce this impact.
- 9.8.3 In relation to the historic landscape there would be no significant impact as a result of the introduction of the Proposed Scheme into the landscape. Overall, the impact of the impact of the scheme upon the historic landscape is deemed to be neutral.

10 Landscape effects

10.1 Executive Summary

- 10.1.1 The assessment on landscape effects has examined the potential impact of the Proposed Scheme on landscape character and visual effects. Mitigation of impacts to landscape character and visual impacts has been an integral part of the planning and design processes.
- 10.1.2 The alignment of the Proposed Scheme would involve marked localised modification to the landform within the route corridor and the loss of landscape components. This would result in some conflict with the established landscape, although the magnitude of effect would be mitigated through the proposed planting and localised engineering of the road related to the landform. On establishment of mitigation planting (Year 15 after opening), impacts would be neutral for 2% of the route, slightly adverse for 63%, moderately adverse for 28% and highly adverse for 6%.
- 10.1.3 Adverse effects are anticipated at the River Finn in the vicinity of Strabane, at Deerpark in the vicinity of Harry Avery's Castle, and across the Brougher Ridgeline between Tycanny Hill and Errigal Keerogue.
- 10.1.4 The visual effects assessment has concluded there would be beneficial effects on the views experienced by 77 households and adverse effects on views for 1328 properties, with the nature of visual impact varying from property to property.

10.2 Scope of the assessments

- 10.2.1 The assessments relating to landscape effects have been focused on:
- impacts on the landscape character of the Proposed Scheme corridor and its wider setting which are likely to arise as a result of the introduction of the Proposed Scheme and its associated traffic into the current context; and
 - the visual effects of impacts on views experienced by sensitive receptors which are likely to arise as a result of the introduction of the Proposed Scheme and its associated traffic into the current context.

Landscape character

- 10.2.2 The assessments have investigated the extent to which the scale and form of the Proposed Scheme and its use by traffic would relate to the composition of landform, hydrology, habitats, planting structure, field boundaries, land use patterns and built form which make up the landscape. Impacts associated with the loss and/or fragmentation of key landscape components and introduction of the Proposed Scheme and its traffic into the composition have been evaluated and analysed with the consequent effects on landscape character described.

- 10.2.3 The study area for the assessments includes a composite of regional Landscape Character Areas (LCAs) detailed in the Northern Ireland Landscape Character Assessment (2000) and the Sperrin Area of Outstanding Natural Beauty (AONB). The LCAs included are those within which sections of the Proposed Scheme are located or where the proximity of the Proposed Scheme to an LCA could potentially affect perception of the LCA. The whole of the AONB has been included in light of the presence of the Proposed Scheme on the western margin of the designated landscape. Two areas located within ROI are also included; an area of the Foyle Valley extending between Derry and Strabane and an area to the south of Moy Bridge. The extent of these areas has been defined by the landscape assessment and design team for the project, there being no equivalent national classification for landscape character in the ROI to that within NI. The extent of the study area for the assessments is illustrated in Figure 10.3.
- 10.2.4 Assessments have been undertaken to represent the following points during the implementation and future use of the Proposed Scheme:
- during the winter in the anticipated year of opening for each of the three phases; and
 - during the summer fifteen years following the completion of each phase.
- 10.2.5 The first series of assessments indicates the order of impact which it is predicted the Proposed Scheme would have on landscape character, taking into account mitigation measures such as earthworks specifically provided to aid integration within the landscape. The second series of assessments provides an indication of the extent to which planting and habitat creation, which has been included as part of the Proposed Scheme, would further mitigate effects of the fully completed scheme as they become established and begin to mature.
- Visual effects**
- 10.2.6 The assessments have investigated the extent to which the scale and form of the Proposed Scheme and its use by traffic would change views experienced by sensitive receptors within the assessment study area.
- 10.2.7 Receptors considered comprise occupiers of residential properties and users of communal and recreational areas and facilities where the visual context to these areas is an essential contributor to the enjoyment and experience of users. Such areas and facilities of relevance to the Proposed Scheme include parks and public open space, public footpaths, bridleways and scenic drives.
- 10.2.8 The study area for the assessments has been the Zone of Theoretical Visibility (ZTV), for the Proposed Scheme. The ZTV represents locations / areas where analysis of landform, settlement and large-scale planting has indicated there might be views of the Proposed Scheme and its traffic, should it progress to implementation. Explanation of how the ZTV for the Proposed Scheme has been established is provided in section 10.3.

- 10.2.9 Assessments have been undertaken to represent the following points during the implementation and future use of the Proposed Scheme:
- during construction for each of the anticipated implementation phases;
 - during the winter in the anticipated year of opening for each of the three phases; and
 - during the summer fifteen years following the completion of each phase.
- 10.2.10 The second series of assessments indicates the order of impact which it is predicted the Proposed Scheme would have on identified receptors taking into account mitigation measures such as earthworks and screen fencing. The third series of assessments provides an indication of the extent to which planting and habitat creation, which has been included as part of the Proposed Scheme, would further mitigate effects of the fully completed scheme as they become established and begin to mature.
- 10.2.11 Consideration has also been given to locations where the phasing of the Proposed Scheme could result in receptors being subject to a combination of construction related impacts and operational impacts. Such locations include areas in the vicinity of junctions 3, 13 and 15.

10.3 **Methods of assessment**

- 10.3.1 The landscape character and visual effects assessments have been informed by the guidance provided in the Highways Agency's Interim Advice Note (IAN) 135/10, and the Guidelines for Landscape and Visual Impact Assessment (Third Edition), published by the Landscape Institute and Institute of Environmental Management and Assessment (IEMA) (2013).

Landscape character

- 10.3.2 The landscape character assessments have involved:
- recording and analysis of the landscape and its character within the assessment study area (the baseline environment);
 - identification, quantification and description of impacts which the introduction of the Proposed Scheme and its traffic would be likely to have on the baseline environment,
 - identification of mitigation measures which have been included as part of the Proposed Scheme in light of the identified impacts;
 - evaluation of the predicted effects on landscape character taking mitigation into account; and
 - description of any likely significant effects relative to the EIA Directive and Regulations.

Baseline environment

10.3.3 Analysis and description of the baseline environment has involved:

- reference to the landscape assessment baseline environment data presented in the A5WTC ES 2010;
- a review of the regional Landscape Character Areas (LCA's) included within the assessment study area as detailed in the Northern Ireland Landscape Character Assessment (2000) (information relating to the LCAs is available in Appendix 10A);
- desk based analysis of Ordnance Survey Northern Ireland (OSNI) mapping and aerial photography in relation to landform, vegetation, hydrology and settlement pattern (the information derived from the studies is available in Appendix 10B);
- site surveys; and
- definition of project specific Landscape Character Zones (LCZ's) and Landscape Character Sub-Zones (LCSZ's) derived from desk based analysis, aerial photography and site surveys.

10.3.4 The project specific LCZs comprise parts of the landscape within the Proposed Scheme corridor and its wider setting where the Proposed Scheme would be likely to influence perception of the landscape by virtue of the dual carriageway and/or its traffic being open to view or there being an awareness of their presence as new components in the landscape. Many of the LCZs are contained within a single LCA, although there are some locations where they overlap LCA boundaries as a result of the findings of the more detailed analysis of the landscape and its component parts, which has been undertaken as part of the project specific assessment.

10.3.5 The LCSZs comprise parts of the LCZs where the project specific surveys and analysis have identified locally distinct parts of the landscape types which constitute the LCZs.

10.3.6 Definition and description of LCZs and LCSZs has involved a combination of analysis of data collected relating to hydrology, landform, land cover, enclosure, settlement and cultural context which is summarised in Appendix 10C and site survey.

Identification of impacts

10.3.7 The identification of impacts has involved a process of quantification and description of the loss, severance or modification of landscape components (for example areas of woodland, field boundaries, landform, etc.) and of the extent to which the introduction of the Proposed Scheme is likely to affect the composition and perception of the LCSZs.

Evaluation of effects

10.3.8 The evaluation of effects has been based on consideration of each LCSZ's sensitivity to change and the magnitude of impact which it is predicted would be likely to occur as a result of the introduction of the road and associated traffic into the LCSZs in the assessment years described in 10.2.4.

- 10.3.9 The determination of sensitivity to change has involved consideration of the susceptibility of the identified LCSZs to change taking into account the form of development proposed and the quality, condition and value of the LCSZs.
- 10.3.10 Landscape value relates to aspects of scenic quality, historic and cultural associations and identity, wildlife interests, rarity and recreational use. Landscape quality and value are often recognised through designation from local to national scale. An absence of formal designation does not necessarily however imply a low quality or value; a landscape may have a particular value at the local level even though its quality may be considered unremarkable.
- 10.3.11 Sensitivity to change has been classified as being high, moderate or low using the guideline descriptors in Table 2, Annex 1 of IAN 135/10. The descriptors from the table are replicated in Table 10.1.

Table 10.1: Landscape sensitivity

Sensitivity	Typical descriptors
High	<p>Landscapes which by nature of their character would be unable to accommodate change of the type proposed. Typically these would be;</p> <ul style="list-style-type: none"> • Of high quality with distinctive elements and features making a positive contribution to character and sense of place; • Likely to be designated, but the aspects which underpin such value may also be present outside designated areas, especially at the local scale; • Areas of special recognised value through use, perception or historic and cultural associations; • Likely to contain features and elements that are rare and could not be replaced.
Moderate	<p>Landscapes which by nature of their character would be able to partly accommodate change of the type proposed. Typically these would be;</p> <ul style="list-style-type: none"> • Composed of commonplace elements and features creating generally unremarkable character but with some sense of place; • Locally designated, or their value may be expressed through non-statutory local publications; • Containing some features of value through use, perception or historic and cultural associations; • Likely to contain some features and elements that could not be replaced.
Low	<p>Landscapes which by nature of their character would be able to accommodate change of the type proposed. Typically these would be;</p>

	<ul style="list-style-type: none"> • Comprised of some features and elements that are discordant, derelict or in decline, resulting in indistinct character with little or no sense of place; • Not designated; • Containing few, if any, features of value through use, perception or historic and cultural associations; • Likely to contain few, if any, features and elements that could not be replaced.
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10.3.12 The magnitude of impact has been classified using the guideline descriptors in Table 1, Annex 1 of IAN 135/10. The table is replicated in Table 10.2 below. The classifications of relevance to the Proposed Scheme have been major adverse, moderate adverse, minor adverse, negligible adverse, no change and minor beneficial.

Table 10.2: Magnitude of impact on landscape character

Magnitude of impact	Typical descriptors
Major adverse	Total loss or large scale damage to existing character or distinctive features and elements, and/or the addition of new but uncharacteristic conspicuous features and elements.
Moderate adverse	Partial loss or noticeable damage to existing character or distinctive features and elements, and/or the addition of new but uncharacteristic noticeable features and elements.
Minor adverse	Slight loss or noticeable damage to existing character or distinctive features and elements, and/or the addition of new but uncharacteristic noticeable features and elements.
Negligible adverse	Barely noticeable loss or damage to existing character or distinctive features and elements, and/or the addition of new but uncharacteristic noticeable features and elements.
No change	No noticeable loss, damage or alteration to character or features or elements.
Negligible beneficial	Barely noticeable improvement of character by the restoration of existing features and elements, and/or the removal of uncharacteristic features and elements, or by the addition of new characteristic elements.
Minor beneficial	Slight improvement of character by the restoration of existing features and elements, and/or the removal of uncharacteristic features and elements, or by the addition of new characteristic elements.
Moderate beneficial	Partial or noticeable improvement of character by the restoration of existing features and elements, and/or the removal of uncharacteristic

	features and elements, or by the addition of new characteristic elements.
Major beneficial	Large scale improvement of character by the restoration of existing features and elements, and/or the removal of uncharacteristic features and elements, or by the addition of new characteristic elements.

10.3.13 The classifications for sensitivity to change and magnitude of impact for the LCSZs have initially been combined using the matrix detailed in Table 3, Annex 1 of IAN 135/10 and as replicated in Table 10.3 below, to provide a preliminary evaluation of the likely effect on each LCSZ. Where the matrix suggests alternative ratings such as moderate/large, the assessment team has selected the appropriate classification. All of the ratings have then be reviewed by the assessment team and either confirmed or modified.

10.3.14 The review has been informed by the typical descriptors for neutral and adverse effects provided in Table 4, Annex 1 of IAN 135/10, as replicated in Table 10.4 below. Where it has been concluded the rating should vary from that initially indicated in the matrix, the new rating has been identified along with the reasoning for the modification.

Table 10.3: Predicted effects on landscape character

		Magnitude of impact				
		No Change	Negligible	Minor	Moderate	Major
Landscape sensitivity to change	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Moderate	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate

Table 10.4: Predicted effect on landscape character - typical descriptors

Effect category	Typical descriptors of effect
Very large beneficial	The Proposed Scheme would: <ul style="list-style-type: none"> • Greatly enhance the character (including quality and value) of the landscape • Create an iconic high quality feature and/or series of elements • Enable a sense of place to be created and greatly enhanced
Large beneficial	The Proposed Scheme would: <ul style="list-style-type: none"> • Enhance the character (including the quality and value) of the landscape

Effect category	Typical descriptors of effect
	<ul style="list-style-type: none"> • Enable the restoration of characteristic features and elements lost as a result of changes from inappropriate management or development. • Enable a sense of place to be enhanced
Moderate beneficial	<p>The Proposed Scheme would:</p> <ul style="list-style-type: none"> • Improve the character (including the quality and value) of the landscape • Enable the restoration of characteristic features and elements partially lost as a result of changes from inappropriate management or development. • Enable a sense of place to be restored
Slight beneficial	<p>The Proposed Scheme would:</p> <ul style="list-style-type: none"> • Complement the character (including the quality and value) of the landscape • Maintain or enhance characteristic features and elements • Enable some sense of place to be restored
Neutral	<p>The Proposed Scheme would:</p> <ul style="list-style-type: none"> • Maintain the character (including the quality and value) of the landscape • Blend in with characteristic features and elements • Enable a sense of place to be retained
Slight adverse	<p>The Proposed Scheme would:</p> <ul style="list-style-type: none"> • Not quite fit the character (including the quality and value) of the landscape • Be at variance with characteristic features and elements • Detract from a sense of place
Moderate adverse	<p>The Proposed Scheme would:</p> <ul style="list-style-type: none"> • Conflict with the character (including the quality and value) of the landscape • Have an adverse impact on characteristic features and elements • Diminish a sense of place
Large adverse	<p>The Proposed Scheme would:</p> <ul style="list-style-type: none"> • Be at considerable variance with the character (including the quality and value) of the landscape • Degrade or diminish the integrity of a range of characteristic features and elements • Damage a sense of place

Effect category	Typical descriptors of effect
Very large adverse	<p>The Proposed Scheme would:</p> <ul style="list-style-type: none"> • Be at complete variance with the character (including the quality and value) of the landscape • Cause the integrity of characteristic features and elements to be lost. • Cause a sense of place to be lost

10.3.15 Where the assessment has indicated a classification of moderate adverse or greater, the findings for the LCSZs have been further considered to determine if the effect on any single LCSZ or group of LCSZs constitutes a significant effect relative to the EIA Regulations. Consideration has also been given to the effects on the LCZs and LCSZs to determine if they would be likely to have a wider effect on any of the national Landscape Classification Areas or the AONB that make up the study area.

Visual effects

10.3.16 The assessments for visual effects have involved:

- establishment of the ZTV for the Proposed Scheme;
- identification of sensitive receptors within the ZTV;
- recording and analysis of the baseline environment relative to views experienced by the receptors identified within the ZTV;
- identification, quantification and description of the impact on views experienced by receptors that the introduction of the Proposed Scheme and its associated traffic would be likely to have;
- identification of mitigation measures for inclusion as part of the Proposed Scheme in light of the predicted impacts;
- evaluation of the predicted effects on views taking mitigation into account; and
- identification of predicted significant effects relative to the EIA Regulations.

Establishment of the ZTV

10.3.17 The ZTV has been defined using a combination of digital modelling and site based verification and mapping.

10.3.18 A preliminary digital plotting of the ZTV was created using a computer-generated three-dimensional model, generated within “ArcGIS” software utilising its viewshed analysis application. A digital relief model was created by embedding the following data inputs into a single terrain map:

- OS contour mapping, with contours at 10m intervals;
- a three dimensional AutoCAD terrain model of the Proposed Scheme;

- digitised areas of woodland planting (assumed at a generic 15m height); and
- digitised building groups and areas of settlement (assumed at a generic 10m height).

10.3.19 The identification of areas from which it is likely there would be views of the Proposed Scheme involved the use of sequential observation points set at regular intervals along the centre line of the Proposed Scheme from which radial calculations of visibility were made. The height of the observation points was set 4m above the proposed finished road level, to reflect the likelihood that high sided vehicles using the Proposed Scheme could be open to view.

10.3.20 The output was a series of digital viewshed maps representing areas of theoretical visibility which in combination made up a preliminary ZTV for the Proposed Scheme. Elevation rasters and hillshading techniques within ArcGIS were used to give a graphic representation of the terrain and inform the understanding of the digital ZTV.

10.3.21 The preliminary ZTV was then reviewed on site in 2010 and 2014. The site surveys involved:

- verification of a core ZTV within which the Proposed Scheme and its associated traffic could potentially have a significant effect on receptors;
- refinement of the ZTV within this core, where a thorough assessment of local terrain and vegetation/settlement pattern could establish either filtered or solid thresholds of visibility;
- identification of distant ridgelines and landforms that give a visible context to the Proposed Scheme corridor and which set a realistic limit of visibility for the proposed road and its traffic; and
- the exclusion of more distant areas initially identified by the digital ZTV as theoretically visible but which the site-based review demonstrated would be beyond the limit of everyday visibility.

Identification of visual receptors

10.3.22 The identification of potential receptors has involved use of OSNI Pointer data, OS mapping and site surveys to inform the plotting of buildings, areas of public recreational use, rights of way, cycle routes, informal routes and local roads located within the finalised ZTV. Areas within the core ZTV of the Proposed Scheme were fully assessed. Areas beyond this threshold, but still within the wider extents of the ZTV were reviewed and specific sensitive receptors identified, such as well used recreational locations or receptors with potentially wide reaching views of the Proposed Scheme corridor. Views from within the Sperrin AONB and other recognised viewpoints within the ZTV were accordingly included.

Description of the baseline environment and identification of impacts

10.3.23 Site surveys were undertaken in 2010, 2013 and 2014 to confirm receptors and record baseline views and to identify and describe impacts. The surveys involved recording of:

- receptor type and number (houses, footpaths, open space etc.);
- the form and quality of the existing view;
- the distance between receptor and the Proposed Scheme;
- the angle of view towards the Proposed Scheme;
- the elevation of receptor in relation to the Proposed Scheme (view up / view down / level view);
- the location of the Proposed Scheme in the view (foreground / mid-ground / background); and
- the extent of the existing view predicted to be influenced by the Proposed Scheme.

10.3.24 Receptors have been classified as being of high, moderate or low sensitivity as defined in Table 1 of Annex 2 in IAN 135/10, as replicated in Table 10.5 below.

Table 10.5: Visual sensitivity

Sensitivity	Typical descriptors
High	Residential properties; Users of Public Rights of Way or other recreational trails (e.g. National Trails and footpaths). Users of recreational facilities where the purpose of that recreation is enjoyment of the countryside (e.g. Country Parks, National Trust or other access land).
Moderate	Outdoor workers; Users of scenic roads, railways or waterways or users of designated tourist routes; Schools and other institutional buildings, and their outdoor areas.
Low	Indoor workers; Users of main roads (e.g. trunk roads) or passengers in public transport on main arterial routes; Users of recreational facilities where the purpose of that recreation is not related to the view (e.g. sports facilities).

10.3.25 Determination of the magnitude of impact has involved consideration of the extent to which the Proposed Scheme and its associated traffic would appear in existing views and how the consequent composition and quality of the view is likely to be affected, taking mitigation into account.

10.3.26 Magnitude of impact has been classified as being major, moderate, minor negligible or no change as defined in Table 2 of Annex 2 in IAN 135/10 as replicated in Table 10.6 below.

Table 10.6: Magnitude of impact

Magnitude	Typical descriptors
Major	The Proposed Scheme, or a part of it, would become the dominant feature or focal point of the view.
Moderate	The Proposed Scheme, or a part of it, would form a noticeable feature or element of the view which is readily apparent to the receptor.
Minor	The Proposed Scheme, or a part of it, would be perceptible but not alter the overall balance of features and elements that comprise the existing view.
Negligible	Only a very small part of the Proposed Scheme would be discernible, or it is at such a distance that it would form a barely noticeable feature or element of the view.
No Change	No part of the Proposed Scheme, or work or activity associated with it, is discernible

Evaluation of effects and description of significant effects

- 10.3.27 The evaluation of effects has involved consideration of the sensitivity of the receptor and the magnitude of impact the Proposed Scheme and its associated traffic would be likely to have on the baseline view.
- 10.3.28 The evaluation has involved reference to the matrix set out in Table 3 of Annex 2 in IAN 135/10 as replicated in Table 10.7 below.

Table 10.7: *Predicted visual effects*

		Magnitude of impact				
		No Change	Negligible	Minor	Moderate	Major
Visual Sensitivity	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Moderate	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate

- 10.3.29 Reference has been made to the typical descriptors provided in Table 4 of Annex 2 of IAN 135/10 to inform the selection of the rating where Table 10.7 suggests alternatives might be available and to test the findings based on the application of the matrix. The descriptors suggested in IAN 135/10 are replicated in Table 10.8 below.

Table 10.8: Predicted visual effects – typical descriptors

Effect category	Typical descriptors
Very large beneficial	The project would create an iconic new feature that would greatly enhance the view
Large beneficial	The project would lead to a major improvement in a view from a highly sensitive receptor
Moderate beneficial	The proposals would cause obvious improvement to a view from a moderately sensitive receptor, or perceptible improvement to a view from a more sensitive receptor.
Slight beneficial	The project would cause limited improvement to a view from a receptor of medium sensitivity, or would cause greater improvement to a view from a receptor of low sensitivity.
Neutral	No perceptible change in the view.
Slight adverse	The project would cause limited deterioration to a view from a receptor of medium sensitivity, or cause greater deterioration to a view from a receptor of low sensitivity.
Moderate adverse	The project would cause obvious deterioration to a view from a moderately sensitive receptor, or perceptible damage to a view from a more sensitive receptor.
Large adverse	The project would cause major deterioration to a view from a highly sensitive receptor, and would constitute a major discordant element in the view.
Very large adverse	The project would cause the loss of views from a highly sensitive receptor, and would constitute a dominant discordant feature in the view.

Each identified receptor has been assessed and categorised relative to effect. They have, however, been grouped and sub-divided into 15 sections of the Proposed Scheme corridor to aid the description of the visual effects which have been identified.

10.4 Baseline environment – landscape character

- 10.4.1 The relationship of the Proposed Scheme to the LCAs defined in the Northern Ireland Landscape Character Assessment and included within the landscape character study area is illustrated in Figure 10.2. The principal characteristics and features associated with the LCAs are described in Appendix 10A. Analysis of the Proposed Scheme corridor landscape and its component features is described in Appendix 10B.
- 10.4.2 The landscape of the study area is a diverse one of river valleys, hill masses and drumlin farmlands that extend across the west of Northern Ireland between Londonderry, Strabane and Omagh, linking with the Republic of Ireland to the south of Aughnacloy.
- 10.4.3 The broad valley of the River Foyle dominates the landscape between Londonderry and Strabane. Its more developed eastern margin is linked by the existing A5 corridor, flanked by the Sperrin Hills to the east and the shallow rise of the Donegal hills to the west. The influence of the Sperrin Hills intensifies south of Strabane, enclosing a more

intimate network of river valley landscapes that converge with the Rivers Strule and Mourne River near Newtownstewart.

10.4.4 To the south, post glacial valley landscapes and the expanse of the glacial lowland plateaus surrounding Omagh take prominence. An intricate rural landscape of concealed streams and drumlin landforms extends south to the rise of the Brougher Ridge and its characteristic crests of Knockmany Hill and Slievemore, before returning to the drumlin farmlands of the Clogher Valley.

10.4.5 Beyond Ballygawley and the A4, the defined drumlin landscape of the River Blackwater extends to Aughnacloy, set against the distant summit of Slieve Beagh in the ROI.

LCZs and LCSZs

10.4.6 The LCZs and LCSZs identified within the assessment study area are scheduled in Table 10.9. Their location within the study area and their relationship to the wider regional LCA's is shown in Figure 10.3. Detailed descriptions of each are provided in Appendix 10C and shown in Figures 10.4, 10.5, 10.6, 10.7, 10.8 and 10.9.

Table 10.9: Landscape character zones and sub-zones

Landscape Character Zone	Sub Zones
1 Lower Foyle Valley	1.1 New Buildings and Ballougry Hill 1.2 River Foyle Meander 1.3 Burn Dennet and Glenmornan River Valleys 1.4 Foyle Floodplain
2 Gortmonly Hill	2.1 Gortmonly Hill
3 Lifford Hills	3.1 Binnion and Black Hill 3.2 Cavan and Dromore Hills 3.3 Croaghan Hill 3.4 Southern Lifford Hills
4 Upper Foyle Valley	4.1 Knockavoe and Meenashesk Hill Slopes 4.2 Enclosed Mourne River Valley 4.3 Newtownstewart Floodplain 4.4 Owenkillew Valley and Plateau Bogs
5 Lower Derg Valley	5.1 Derg Valley Farmland
6 Western Sperrins	6.1 Meenashesk Highland Bogs and Forest
7 Strule Valley and Bessy Bell	7.1 Baronscourt Valley 7.2 Bessy Bell 7.3 Enclosed River Strule Valley 7.4 Sperrins Lower Slopes
8 Omagh Drumlin Farmlands	8.1 Wooded River Strule Valley 8.2 Fairy Water Drumlins 8.3 Crockavanny Drumlins 8.4 South Omagh Drumlin Farmlands 8.5 Eskragh Water and Routing Burn Drumlins

Landscape Character Zone	Sub Zones
9 Brougher and Slievemore Ridgeline	9.1 Slievelahan Farmlands 9.2 Crocknatummoge Hillform 9.3 Garvaghy Valley 9.4 Beltany and Tullanafoile Farmlands 9.5 Knockmany Ridgeline 9.6 Ballymackilroy Moraines
10 Clogher Valley	10.1 Clogher and Augher Drumlin Farmlands 10.2 Ballygawley and Ballyreagh A4 corridor
11 Blackwater Valley	11.1 Black Hill and Aughnacloy Drumlins 11.2 Blackwater Drumlins 11.3 Favour Royal Forest
12 Branny Hill	12.1 Branny Hill
Urban Areas	U1 Strabane and Lifford U2 Sion Mills U3 Newtownstewart U4 Omagh U5 Aughnacloy

LCZ 1 Lower Foyle Valley

10.4.7 The River Foyle occupies a broad, characteristically U-shaped semi-rural river valley between Londonderry and Strabane. It is a large-scale landscape where the river and floodplain are flanked by the Lifford Hills to the west and the more elevated profile of the Sperrin Hills to the east. The north-western fringe of the Sperrin Hills is defined by a series of lower hills that form a transition between the high valley perimeter and the floodplain. Gortmonly Hill to the south of Magheramason and Knockavoe and to the east of Strabane are locally prominent hills. The existing A5 follows the eastern margins of the River Foyle, linking developments on this more extensively settled side of the river. There is a significant break of landform in the form of the valley of the east-west flowing Burn Dennet, a tributary of the River Foyle as it descends from the Sperrin Hills to the east. The hill slopes south of the Burn Dennet valley mark the north western extent of the Sperrin Area of Outstanding Natural Beauty (AONB).

10.4.8 Four LCSZs have been identified within the LCZ:

LCSZ 1.1 – New Buildings and Ballougry Hill

10.4.9 This is an attractive river landscape in which the wide channel of the River Foyle is contained by the slopes of Ballougry Hill (65m Above Ordnance Datum (ADO)) to the west and the north-western fringes of the Sperrin Hills to the east. The settlement of New Buildings is prominent on the eastern margin of the river, broadly defining the southernmost limit of urban development along the river edge, south of Londonderry. The substantial part of New Buildings, comprising a mix of older and more recent estate-styled housing and areas of small-scale commercial development, is located on the existing A5 corridor, which runs parallel with the river beyond a margin of open, grazed

fields. Magheramason, a small village, is located on the existing A5 below the lower northern slopes of Gortmonly Hill. Beyond these settlements there are scattered individual houses and farmsteads, set within a regular and moderately sized field network defined by hedgerows with frequent hedgerow trees, descending to the river edge.

- 10.4.10 The quality of the composition of the river and its immediate margins has been formally recognised by its designation as an Area of High Scenic Value in the Derry Area Plan 2011 (see Figure 10.1). It is a high quality landscape with a value which is recognised at a county level by virtue of its designation in the Area Plan and which has a high sensitivity to change.

LCSZ 1.2 – River Foyle Meander

- 10.4.11 There is a distinct, wide meander in the River Foyle at Creaghor and Cloghboy, west of the locally prominent Gortmonly Hill. There is a low rise (30m AOD) within the meander on which the hamlets of Creaghor and Gortavea are situated. The existing A5 is aligned immediately below the flanking slopes of Gortmonly Hill at Bready. The village of St Johnstown which is west of the river overlooks the western river margin and is set within an area of otherwise sparsely settled and largely pastoral farmland. Planting is sparse and fields are moderately sized, creating an open character with a sense of remoteness. The landscape is crossed by a dense network of local watercourses that drain towards the River Foyle, between Ballougry Hill to the north and the low drumlins that fringe Dooish Mountain and Binnion Hill. It is a landscape of good quality and local value, which has a moderate sensitivity to change.

LCSZ 1.3 – Burn Dennet and Glenmornan River Valleys

- 10.4.12 The Burn Dennet valley is wide in profile, flanked by extended, moderately steep south-facing slopes and markedly steeper north-facing slopes. A number of watercourses descend and converge towards the River Foyle, the valley being a focus for dispersed settlement around a heavily wooded and enclosed network of roads and lanes. To the south, the Glenmornan River valley is markedly more enclosed where it flows through the villages of Ballymagorry and Artigarvan. Local sand and gravel extraction is an active, though relatively discrete activity in both valleys. It is a landscape of good quality and local value which has a moderate sensitivity to change.

LCSZ 1.4 – Foyle Floodplain

- 10.4.13 The floodplain comprises wide margins of typically large, rectilinear fields to either side of the River Foyle, some of which are enclosed by hedgerows and many of which are fenced. The Burn Dennet, Glenmornan River and Swouldy Burn all discharge into the Foyle at this wide confluence of river catchments. Settlement is generally sparse, other than along the raised eastern fringe of the floodplain where the A5 corridor approaches Strabane. The A5 corridor, the wooded course of the disused Strabane Canal and the distinctive Corkan Isle frame a sequence of linear features set within the river landscape. The birch woodland and bog habitat of McKean's Moss is distinctive, as are small groupings of farmsteads set on locally elevated ground within the floodplain. The

floodplain is a landscape of good quality and local value which has a moderate sensitivity to change.

LCZ 2 Gortmonly Hill

- 10.4.14 Gortmonly Hill (200m AOD) is a locally prominent north western outlier of the Sperrin Hills. It has a distinctively elongated, rounded form which marks the juncture of the Foyle valley with its tributary, the Burn Dennet. Its profile is accentuated by the absence of planting on the hill's mid and upper slopes and crest. There are managed hedges, overgrown hedgerows and pockets of woodland on the lower western facing slopes which meet with, and serve as a foil to the nearby villages of Magheramason and Bready. This is a landscape of good quality and local value. Due to its form and prominence it has a low capacity to accommodate change of the type proposed and has a high sensitivity to change.

LCZ 3 Lifford Hills

- 10.4.15 The "Lifford Hills" appear as a low and undulating horizon of hill crests that broadly define the western margin of the River Foyle and which are separated by lower lying tributary valleys. The scale and form of the hills become increasingly prominent towards Strabane, where the distinct form of Croaghan Hill provides a local landmark to the west of Lifford. Settlement is scattered and sparse on the hills, tending more towards the lower lying river valleys and their connecting network of minor roads.

- 10.4.16 Four sub-zones have been identified within the LCZ:

LCSZ 3.1 – Binnion and Black Hill

- 10.4.17 These are the most northerly range of hills that flank the River Foyle. They comprise a series of undulating crests that rise from the lower riverside slopes towards Londonderry and which are separated from Cavan and Dromore by the valley of the Swouldy Burn. It is an area of mixed arable fields rising to upland pastures, punctuated by large, geometric coniferous plantations. Settlement is sparse, with isolated farmsteads across mid slopes and ribbons of residential development along a network of sheltered lanes. It is a cohesive landscape of good quality and local value. It is a landscape with a limited capacity to accommodate change of the type proposed such that it has a high sensitivity to change.

LCSZ 3.2 – Cavan and Dromore Hills

- 10.4.18 This is an area of low hills that flank the narrowing River Foyle floodplain towards Lifford and Strabane, and which is defined by the valleys of the Swouldy Burn and Deelee River, tributaries to the River Foyle. The hills continue the largely pastoral character of farmlands, pockets of scrub and small belts of broadleaved woodland associated with the landscape of Binnion and Black Hill and exhibit the same sense of cohesion and character. This is a landscape of unremarkable quality and local value. It is a landscape with a limited capacity to accommodate change of the type proposed such that it has a high sensitivity to change.

LCSZ 3.3 – Croaghan Hill

- 10.4.19 The distinctive, open moorland summit of Croaghan Hill frames the southern valley side of the Deelee River. At 200m AOD, it is the highest and most prominent of the hills providing both a landmark and backdrop to the settlements of Lifford and Strabane when viewed from within the Foyle Valley. It is a landscape of good quality and of medium local value. It is a landscape with a limited capacity to accommodate change of the type proposed such that it has a high sensitivity to change.

LCSZ 3.4 – Southern Lifford Hills

- 10.4.20 This is an area of low hills that rise from Carricklee Hill and Orchard Hill (70-80m AOD) south of Strabane to Urney Hill (140m AOD) west of Glebe, terminating at Whisker Hill (200m AOD) on the northern side of the Derg Valley. There is an increasing sense of remoteness as pasture gives way to rolling moorland and blanket bog on the higher ground. The moderately graded eastern slopes of the hills constitute the undulating western valley side of the Mourne River. It is a landscape of good quality and local value which has a high sensitivity to change.

U1 Strabane and Lifford

- 10.4.21 Strabane and Lifford are situated on either side of a 500m wide floodplain, where the Mourne River and Finn River converge to form the River Foyle. Strabane, the larger of the two towns is located east of the river, its old town centre flanked by contemporary commercial development and set back from the floodplain at the confluence of the rivers. The existing A5 corridor passes the western fringes of the town centre, separating the town from its adjacent river landscape. Larger areas of residential development are located south of the Mourne River; those in the vicinity of Urney Road define the westernmost edge of the town where it extends as far as the immediate margins of the River Finn.
- 10.4.22 Lifford is located to the west of the confluence. In contrast to its neighbour, the town has a direct frontage onto the river and open views across the river to Strabane.
- 10.4.23 The settlements and intervening floodplain comprise a townscape / landscape of unremarkable quality and local value which has a moderate sensitivity to change.

LCZ 4 Upper Foyle Valley

- 10.4.24 The Upper Foyle Valley comprises the main tributary valleys of the Mourne River, River Strule and the Owenkillew River beyond Strabane, extending south and east towards the settlement of Newtown Stewart. The valley landscape is more intimate in scale and character than that of the River Foyle north of Strabane. The western fringes of the hills and mountains that constitute the Sperrin AONB define the eastern valley side.
- 10.4.25 Four LCSZs have been identified within the LCZ:

LCSZ 4.1 – Knockavoe and Meenashesk Hill Slopes

- 10.4.26 This constitutes the eastern side of the river valley below the higher, rugged crests of the two prominent peaks of Knockavoe and Meenashesk which are located within the Sperrin AONB. Steep pasture, rocky outcrops and pockets of woodland frame a largely

pastoral landscape of medium-sized fields bounded by overgrown hedgerows to the north, which are increasingly managed to the south. There is frequent woodland cover along the steeper sections of river bank. It is a landscape of good quality of local, though potentially county value, which has a high sensitivity to change.

LCSZ 4.2 – Enclosed Mourne River Valley

10.4.27 This LCSZ comprises the narrow river valley in the context of the rolling pastoral farmlands of the lower slopes of Glentimon Hill, Whisker Hill and Clady Hill. There are defined settlements at Glebe, Sion Mills and Victoria Bridge, the latter owing their presence to an industrial past of mills founded on the river as a resource. The heritage and townscape value of Sion Mills has been recognised through its designation as a Conservation Area. Other reminders of former industry include the embankments of the former Great Northern Railway (NI) that ran in parallel with the river and a number of stone bridges that once carried the railway. Away from the valley floor the pattern is one of dispersed farmsteads and clusters of dwellings, set within a network of local roads and narrow lanes.

10.4.28 The area is one of good quality and local, though potential county value. The context of settlement, transport corridors and high proportion of mature woodland following the valley suggest a capacity to accommodate change of the type proposed. The LCSZ has a moderate sensitivity to change.

LCSZ 4.3 – Newtownstewart Floodplain

10.4.29 The floodplain in the vicinity of Newtownstewart is markedly wider than within the gently incised Mourne River valley to the north, a result of the confluence of the Owenkillev and River Strule immediately to the east of the town. The meandering river courses are a notable feature of a landscape of arable/pastoral farmland with few hedgerow trees and sparse woodland cover. Irregular moraines along the valley edge locally contain the river landscape. The landscape is one of unremarkable quality and local value which has a moderate sensitivity to change.

LCSZ 4.4 – Owenkillev Valley and Plateau Bogs

10.4.30 The Owenkillev Valley constitutes the head of the Upper Foyle Valley where it rises east from Newtownstewart into a plateau of raised bogs, moorland and acid grassland framed by the hills of the western Sperrins. It is a sparsely habited landscape with an exposed, wild character that forms a part of the Sperrin AONB. It is a landscape of good quality and national value which has a high sensitivity to change.

U3 Newtownstewart

10.4.31 Newtownstewart is a compact town set on the lower slopes of Bessy Bell. It has a good townscape quality, recognised by its designation as a Conservation Area. The town's relationship with the river floodplain, the context of Bessy Bell and wider Sperrin Hills, along with the relationship to Harry Avery's Castle set on an elevated moraine above the town combine to create a distinctive location, with a strong sense of place. It is a

townscape of good quality and local, though potentially county value, which has a high sensitivity to change.

LCZ 5 Lower Derg Valley

- 10.4.32 The lower Derg Valley is a wide, broadly U-shaped upland valley framed by rounded hills. The lower valley slopes and relatively narrow river floodplain support gently undulating pasture within which there is an increasing complexity and interest where the river meanders through areas of hummocky moraines. Ardstraw is located on the river some 2km west of its confluence with the River Strule at a point where the valley narrows between the prominent Clady Hill to the north and Forsters Mountain to the south. Woodland is generally sparse. It is a landscape of good quality and local value which has a moderate sensitivity to change.

LCZ 6 Western Sperrins

- 10.4.33 The summits of Knockavoe and Meenashesk provide a distinctive profile to the east of Strabane, set above a number of lower outlying hill slopes with summits ranging between 240 and 332m AOD. The area represents the north-western limit of the Sperrin AONB. The steeply rising hill slopes are capped by moorland, with vegetation diminishing to a limited cover of windblown shrubs and hedges. Extensive coniferous plantations are conspicuous features across an otherwise exposed upland landscape, with farming practices typically limited to rough pasture. It is a landscape of good quality and national value which has a high sensitivity to change.

LCZ 7 Strule Valley and Bessy Bell

- 10.4.34 The profile of Bessy Bell (420m AOD) serves as one of the most prominent of the outlying hills that define the western limits of the Sperrins, connecting on a broad scale with the mountain landscape to the east and creating a physical divide between the Foyle Valley to the north and the extensive drumlin landscapes surrounding Omagh to the south. Bessy Bell is a familiar reference point from large distances and as such associates a strong sense of place with this particular locality.
- 10.4.35 Within this hill landscape, the Strule Valley south of Newtownstewart is narrow and incised as the river flows between Bessy Bell to the immediate west and the lower Mary Gray and Deers Leap (230m and 200m AOD respectively) to the east. Both Mary Gray and Deers Leap, along with the River Strule and the eastern flanking slopes of Bessy Bell are located within the Sperrin AONB. The A5 corridor runs parallel with and above the course of the River Strule.

- 10.4.36 Four LCSZs have been identified within the LCZ:

LCSZ 7.1 – Baronscourt Estate

- 10.4.37 The estate is a heavily wooded, designed landscape (recorded within the Register of Parks and Gardens) which occupies the lower slopes of Forster's Mountain to the west and Bessy Bell to the east. Beyond its northern boundary at Wood End there is an area of partly wooded and quarried moraines, which serve to separate the Baronscourt Estate from the Mourne Valley. The historic site of Harry Avery's Castle is situated on a locally

exposed crest along these moraines, visible above the town of Newtown Stewart. It is a landscape of good quality and local, though potentially county value, which has a high sensitivity to change.

LCSZ 7.2 – Bessy Bell

- 10.4.38 Bessy Bell is a prominent hill with a distinctive profile. Its lower eastern slopes are farmed and settled up to the point where Castletown Road runs at a level above the lower Strule Valley. There are panoramic views to the east across the valley towards the summit of Mullaghcarn and Gortin Forest. The pastoral landscape gives way at higher levels to a combination of upland grazing with woodland plantations and visually prominent wind turbines that are exposed to distant views, particularly from the east and south. It is a landscape of good quality and local value which has a high sensitivity to change.

LCSZ 7.3 – Enclosed River Strule Valley

- 10.4.39 The narrow valley of the River Strule is well vegetated where it flows between the surrounding hill slopes of Bessy Bell, Mary Gray and Deers Leap. The valley is locally distinct, although the river is relatively discrete being often masked by landform and vegetation. The existing A5 runs parallel with and slightly above the river, along the lower slopes of Bessy Bell. The field pattern is small and rectilinear across the lower valley, giving way to increasingly large and more irregular enclosures across the mid and upper slopes of the hills. There is a marked transition where the steeper slopes of Bessy Bell meet with the existing A5 and where woodland cover is relatively sparse. Prospects from the valley are predominantly eastwards for users of the existing A5, where the lower hill profiles of Mary Gray and Deers Leap serve to frame wider views of the higher Sperrins.
- 10.4.40 The narrow valley with its contained views along the river, the presence of existing primary transport routes and belts of mature woodland suggest some capacity to accommodate change of the type proposed. It is a landscape of good quality and local value which has a moderate sensitivity to change.

LCSZ 7.4 – Sperrins Lower Slopes

- 10.4.41 A prominent and elevated ridgeline of hills rises beyond the lower form of Deers Leap, where the pastoral, wooded landscape of the river farmlands gives way to upper hill slopes of heather moorland across the hill crests of Mullaghcarn, Slieveard, Curraghchosaly and Mary Gray. These hill crests define the western edge of the wider, central Sperrin mountains landscape and are wholly contained within the Sperrin AONB. It is a landscape of high quality and national value which has a high sensitivity to change.

LCZ 8 Omagh Drumlin Farmland

- 10.4.42 The outlying hills of the Sperrins give way to an extensive, farmed drumlin landscape north of Omagh across the Strule Valley and its confluence with the Fairy Water. This wide drumlin plateau, broadly encircled by sandstone ridges, extends for many miles across a cohesive farmed landscape south to the Brougher Ridge, beyond the villages of Sixmilecross, Gortaclare and Fintona. The landscape is dominated by thick drift

deposits, forming a complex terrain of drumlin fields and glacio-fluvial deposits at lower levels, rising at its margins to meet with the surrounding hills.

10.4.43 Five LCSZs have been identified within the LCZ:

LCSZ 8.1 – Wooded River Strule Valley

10.4.44 The landscape of the Strule valley to the north of Omagh is characterised by the drumlin terrain and numerous belts of woodland cover associated with the local river and stream networks, local settlement and areas of raised bog. Distinctive belts of mature mixed broadleaved and occasional coniferous woodland define the river valley and border numerous tributary streams that flow from the nearby hills. Dense copses of woodland are associated with small villages and farmsteads. There are areas of raised bog, the most notable in the context of the Proposed Scheme being Tully Bog Special Area of Conservation (SAC) and Area of Special Scientific Interest (ASSI). This is a landscape of good quality and local, though potentially county value, which has a moderate sensitivity to change.

LCSZ 8.2 – Fairy Water Drumlins

10.4.45 This part of the drumlin plateau extends across the Fairy Water Valley between the hills of Bessy Bell and Pigeon Top. On higher ground the drumlins are extended and irregular in form, creating a rolling landscape that gives broad prospects to the east and west. There are large areas of raised bog at these higher levels, with overgrown hedgerows, occasional copses of broadleaf and coniferous woodland and some patches of wet woodland in boggy areas. Fairy Water and its numerous tributaries are well concealed by the drumlin landscape. Settlement is limited to scattered farmsteads and isolated properties dispersed along the valley. It is a landscape of unremarkable quality and local value which has a moderate sensitivity to change.

LCSZ 8.3 – The Crockavanny Drumlins

10.4.46 This area of drumlin farmland, elevated at 30m above the surrounding plateau lies between the residential edge of Omagh and the local rise of Pigeon Top to the west. The drumlins are more densely arranged than in other parts of the drumlin plateau, while the higher ground offers wider views across the immediate landscape. There is a tight network of roads and local lanes within the well managed farmland in which tree planting and hedgerows are prominent. Settlement is dispersed though noticeably more concentrated than in the wider plateau, reflecting the proximity of Omagh and the intimate and appealing nature of this part of the drumlin landscape. It is a landscape of good quality and local value which has a moderate sensitivity to change.

LCSZ 8.4 – South Omagh Drumlin Farmlands

10.4.47 This area comprises a complex network of shallow, domed drumlins that extend from the south of Omagh as far as the Brougher and Slievemore ridgeline, south of the villages of Sixmilecross, Gortaclare, Moylagh and Fintona. Drumragh Water and the Camowen River converge towards Omagh, carrying waters from a wide network of streams that flow to the north as they descend the dip slope of the ridge. There are narrow floodplains

where the rivers trace their courses between the drumlins and a patchwork of generally pastoral irregular fields, with hedgerows and fence lines, interspersed with large pockets of low scrub and wet woodland across areas of localised bog.

- 10.4.48 Settlement comprises dispersed farms and detached dwellings, many of which are recent introductions. Principal roads radiate from Omagh, connecting a number of smaller clustered settlements along the northern edge of the Brougher Ridge. The roads are generally well integrated within the undulating, intimate landscape such that their influence is well contained. Occasional distant views towards the surrounding hill masses of the Sperrin Hills and the Brougher Ridge give some sense of orientation within the wider landscape. It is a landscape of good quality and local value which has a moderate sensitivity to change.

LCSZ 8.5 – Eskragh Water and Routing Burn.

- 10.4.49 This transitional drumlin farmland landscape is enclosed to the east and west by the hills of the Brougher and Slievemore Ridgeline. It comprises a locally low-lying extension of the drumlin landscape south of Omagh, defined by the Eskragh Water and Routing Burn valleys. The settlement of Moylagh, a cluster of properties set around a local watercourse with open views to the southwest, is located at the point of transition from drumlin farmland to neighbouring hills. Field patterns are irregular, often enclosed by mature overgrown hedgerows, with areas of sedge that signify a change of ground condition over the enclosed pastures. The association with the surrounding slopes of the Brougher Ridge creates a sense of enclosure that contrasts with the more open and defined drumlin farmland to the north. It is a landscape of good quality and local value which has a moderate sensitivity to change.

LCZ 9 Brougher and Slievemore Ridge

- 10.4.50 The Brougher and Slievemore Ridgeline comprises a broad series of sandstone ridges that extend southwest to northeast from Enniskillen to Pomeroy. The northwest facing dip slopes rise from the drumlin farmlands south of Omagh. The steep southeast facing scarp slope is a distinctive and prominent feature which significantly influences perception of the landscape across a wide area to the south. There is a band of irregular, hummocky moraines at the foot of the scarp slope which forms a zone of transition from ridge face to valley floor. The ridge has a rich cultural heritage; there is evidence of megalithic settlement along the upper ridge and concentrations of raths in lower areas. Improved grassland contrasts with rough grazing across upland hills. There are blocks of coniferous plantations and blanket bog which contribute to a mosaic of land cover.
- 10.4.51 Six LCSZs have been identified within the LCZ:
- LCSZ 9.1 – Slivelahan Farmlands
- 10.4.52 The Slivelahan Farmlands rise from the expanse of the surrounding drumlin landscape towards the rounded summit of Slievemore. The wind turbines of Slievedivena appear prominently in the landscape. It is an open area of hill farming with predominantly large

regular fields, narrow hedge lines and fences on the higher ground. It is a landscape of good quality and local value which has a moderate sensitivity to change.

LCSZ 9.2 – Crocknatummoge

- 10.4.53 Crocknatummoge is a locally prominent hill on the dip slope of the Brougher ridge, set within an open area of hill farming with predominantly large regular fields and narrow hedge lines reflecting the land pattern of the Slievelahan Farmlands. It is a landscape of good quality and local value which has a moderate sensitivity to change.

LCSZ 9.3 – Garvaghy Valley

- 10.4.54 This is a distinctive valley within the open hill slope farmland of the dip slopes, Garvaghy Big Hill forming a locally prominent rise. The existing A5 runs to the eastern side of the valley, passing the small settlement of Garvaghy which is located centrally within the recess of the valley. Blocks of coniferous plantation are features of the hill top landscape near the summits of Rarogan Hill and Knockbrack. It is a landscape of good quality and local value which has a moderate sensitivity to change.

LCSZ 9.4 – Beltany and Tullanafoile Farmlands

- 10.4.55 This area comprises a continuation of the dip slope, rising from the southernmost limit of the Eskragh and Routing Burn drumlins in a series of rounded hills towards the ridge tops of Knockmany and Tycanny. Shallow, raised valleys descend the ridge top between Tycanny Hill, Beltany Hill and Knockmany. Settlement is dispersed and relatively sparse. Medium to large, generally rectilinear fields are enclosed by a mix of managed and overgrown hedges, often with numerous hedgerow trees. Birch scrub woodland occupies the valley floor south of Newtownsaville, one of numerous pockets of wet woodland that occur on cut over bogs across the higher valleys. The ridgeline of Knockmany forms a distinctive backdrop. It is a landscape of good quality and local value which has a moderate sensitivity to change.

LCSZ 9.5 – The Knockmany Ridgeline

- 10.4.56 The Knockmany Ridgeline is characterised by a series of distinct hills comprising Knockmany, Killaney, Tullycorker, Tycanny and Beltany Hill. Coniferous plantations and belts of woodland linked by a network of pasture with continuous and mostly well-managed hedgerows are defining features of the hilltops and upper slopes. The ridge is recessed in areas, notably at Tullyvernan where the B83 passes to the west of Knockmany Forest. There is an elevated recess in the ridge, enclosed between Birneys Hill, Tycanny Hill and Errigal. Here the sense of enclosure is heightened by large areas of woodland. The historic site of Errigal Keerogue, which has cultural associations dating back to pre-800AD and the early Christian period, commands far reaching panoramic views from its elevated location. It is a landscape of very attractive quality and local, though potentially county value, with a high sensitivity to change.

LCSZ 9.6 – Ballymackilroy

- 10.4.57 A defined outwash spread of moraines creates a series of hummocks and small ridges that rise to meet the face of the ridge. The Roughan watercourse descends from

Ballymackilroy through the moraines and the village of Ballynasaggart. It is an area of clustered settlement with ribbons of properties that flank the watercourse. Farmland is generally open pasture with irregular, moderately-sized fields enclosed by maintained hedges. There are hedgerow trees in significant number, which add a sense of enclosure and intimacy to parts of the area. It is a landscape of good quality and local value which has a high sensitivity to change.

LCZ 10 Clogher Valley

10.4.58 The Clogher Valley is an extensive drumlin farmland, confined by the sandstone ridges of Brougher and Slievemore to the north and Slieve Beagh to the south. The landscape is typically characterised by relatively large fields and a mixture of managed and overgrown hedges, drained by a network of locally concealed streams that feed the upper Blackwater and Ballygawley Water. The settlements of Clogher, Augher and Ballygawley are located along the A4 corridor where it runs broadly centrally east to west through the valley. There are some areas of estate-styled landscape comprising a mixture of woodland and parkland.

10.4.59 Two LCSZs have been identified within the LCZ:

LCSZ 10.1 – Clogher and Augher Drumlin Farmlands

10.4.60 This is a narrowing, shallow landscape of drumlin farmland closely linked with the moraines of the Brougher Ridge. The land pattern is characteristic of the wider valley landscape, with large fields, managed hedge lines and a varying density of mature hedgerow trees. Houses and farmsteads are dispersed, linked by a network of roads and lanes that run with the topography. Hilltop farmsteads and dwellings are common features, sometimes with far reaching views across the valley towards the surrounding hills. It is a landscape of good quality and local value which has a moderate sensitivity to change.

LCSZ 10.2 – Ballygawley and Ballyreagh A4 Corridor

10.4.61 Ballygawley is a small town located at the junction of the A4 and A5, set within the valley of the Ballygawley Water. The landscape beyond the town is generally pastoral drumlin farmland, set below the broad rise of Killymorgan and Legaroe Hill on the ridge line. There are several larger houses and estate landscapes that appear prominently in the landscape. An irregular pattern of fields and hedgerows with hedgerow trees and areas of plantation contribute to a landscape which is well wooded. It is a landscape of good quality and local value which has a moderate sensitivity to change.

LCZ 11 Blackwater Valley

10.4.62 The confluence of the Upper Blackwater with Ballygawley Water marks a point of transition from the open Clogher Valley to a more intimate drumlin landscape, through which the River Blackwater becomes more locally defined and recessed. This is a landscape broadly contained by the mass of Slieve Beagh to the southwest and the rounded summits of Branny Hill, Ivy Hill and Aghnahoe Hill to the northeast.

10.4.63 Three LCSZs have been identified within the LCZ:

LCSZ 11.1 – Black Hill and Aughnacloy Drumlins

- 10.4.64 To the south of the A4, large and steeply sloped drumlins and moraines characterise the rising ground to the east of the River Blackwater. Elevated from the River Blackwater, the drumlins are more pronounced and irregular than within the valley. The existing A5 negotiates the hummocky moraines that border Branny Hill, where there are occasional and expansive views towards Slieve Beagh across the Blackwater drumlins. The influence of the existing A5 is confined and its influence on the wider landscape setting limited. It is a landscape of good quality and local value which has a moderate sensitivity to change.

LCSZ 11.2 – Blackwater Drumlins

- 10.4.65 Within the Blackwater Valley west and south of Aughnacloy there is a dispersed pattern of rounded drumlins, the form of which is accentuated by a patchwork of relatively small, irregular fields enclosed by managed hedgerows and mature hedgerow trees. Perception of the area is heavily influenced by the rounded nature of the drumlins around which the river meanders. Rathes are a frequent and visible characteristic of the area, adding to the sense of place and time depth. Settlement is dispersed with occasional clusters of dwellings along local roads. It is a landscape of very attractive quality and local, though potentially county value, which has a high sensitivity to change.

LCSZ 11.3 – Favour Royal Forest

- 10.4.66 Favour Royal is an extensive area of managed woodland, part of which is a Registered Park and Garden. The large woodland blocks are distinctive and discernible at distance from surrounding areas, although the subtlety of the planting and its responsiveness to the drumlin landform only becomes evident at a local scale. It is a landscape of good quality and county value which has a high sensitivity to change.

U5 – Aughnacloy

- 10.4.67 Aughnacloy is a compact and nucleated town. Its historic core is located on a drumlin crest, set above the meandering River Blackwater and contained by a landscape of pronounced drumlin farmland. Its broad main street accommodates the existing A5. The town's churches are conspicuous features and landmarks within the local landscape.
- 10.4.68 A designed landscape (which is a Registered Park and Garden) in the form of a large "thistle" pattern is a peculiar feature linked to the town, extending out to the west of the town edge. Despite its scale, the geometric form of the field pattern is not a highly evident feature on the surrounding landscape. It is a townscape considered to be of a good quality and a medium value, with a high sensitivity to change.

LCZ 12 Branny Hill

- 10.4.69 This is an area of unusually broad drumlin topography, characterised by a series of steep and rounded hills that rise above a varied drumlin terrain. The area comprises several rounded hills with shallow valleys that radiate from the hill mass. Land use is typically pastoral, open farmland with a mixture of field sizes that are variable in pattern and

enclosed by a mix of well-maintained and overgrown hedges. It is a landscape of good quality and local value which has a moderate sensitivity to change.

10.5 Baseline environment – visual context

10.5.1 The extent of the ZTV for the Proposed Scheme is illustrated in Figures 10.10 to 10.16. An overview of the principal receptors identified is provided in Figures 10.18 to 10.23. The principal receptors identified within the 15 sections of the visual assessment study area adopted for the purposes of describing the baseline environment are scheduled below. Contextual viewpoints and accompanying descriptions throughout the Proposed Scheme corridor are presented in Appendix 10D.

V1: New Buildings to Burn Dennet

10.5.2 Principal receptors comprise:

- properties to the west of New Buildings;
- scattered properties to the west of the River Foyle;
- properties within Magheramason;
- properties on Dunnalong Road and Meenagh Hill, west of Magheramason;
- scattered farms and dwellings on the western slopes of Gortmonly Hill;
- properties within Bready;
- clusters of properties in the vicinity of Grange Road, Willow Road, Grangefoyle Road, Ash Avenue, Drumenny Road and the existing A5 corridor;
- users of the Foyle Valley Public Right Of Way (PROW);
- users of the Sustrans National Cycle Network Routes 92 and 93 (and Faughan Valley Cycle Trail); and
- users of the Foyle Canoe Trail.

V2: Burn Dennet to Strabane

10.5.3 Principal receptors comprise:

- farms and dwellings in Cloghcor;
- properties to the east of the existing A5 corridor, between Cloghcor and Ballymagorry;
- properties to the western residential edge of Ballymagorry;
- properties within the floodplain, along Greenlaw Road and Park Road;
- properties in the vicinity of Spruce Road, Woodend Road and Victoria Road and the junction with the existing A5;

- properties on higher ground associated with the east facing slopes of the Lifford Hills;
- users of the Central Sperrin Scenic Driving Route;
- users of the Strabane Canal Public Walking Route; and
- users of the Foyle Canoe Trail.

V3: Strabane and Lifford

10.5.4 Principal receptors comprise:

- properties bordering the existing A5 and Woodend Road, approaching Strabane from the north;
- properties along the line of Derry Road and elevated properties on rising ground to the east;
- scattered properties along Park Road;
- retail development and residential properties alongside the existing A5 corridor within Strabane;
- properties bordering the Mourne River within the town;
- outward facing properties along Carrick Strand and Cedar Road, to the south of the Mourne River;
- outward facing properties bordering the A5, south of the Mourne River;
- properties on Urney Road, Finn View and Glenfinn Park;
- properties on the southern residential fringe of Lifford;
- properties on Summerhill Crescent and along the crest of Castletown Road;
- users of the Sustrans National Cycle Network Route 92;
- users of the Central Sperrin Scenic Driving Route through Strabane; and
- users of the Foyle Canoe Trail.

V4: Strabane to Sion Mills

10.5.5 Principal receptors comprise:

- scattered properties and farmsteads between Strabane and Sion Mills, along Strahans Road, Knockroe Road, Orchard Road and Peack Road;
- the western residential fringe of Sion Mills;
- properties to the eastern edge of Glebe on Sperrin View;
- properties on Bellspark Road and High Road;
- users of the Local Cycle Route from Sion Mills to Castlederg;

- users of the Central Sperrin Scenic Driving Route; and
- users of the Sperrin Route 6 Regional Cycle Route (and Derg Valley Cycle Trail).

V5: Sion Mills to Ardstraw

10.5.6 Principal receptors comprise:

- properties on Seein Road, west of Glentimon;
- properties on the southern fringe of Victoria Bridge, along Fyfin Road;
- properties bordering the A5, south of Victoria Bridge;
- isolated properties and farmsteads along Uralreagh Road;
- users of the Central Sperrin Scenic Driving Route; and
- users of the Sustrans National Cycle Network Route 92.

V6: Ardstraw to Newtownstewart

10.5.7 Principal receptors comprise:

- scattered properties along Derg Road, to the north of Ardstraw;
- properties and farmsteads in the vicinity of Deerpark Road, south of the Derg River;
- properties and farmsteads on Milltown Road and Magheracolten Road;
- isolated properties near the junction of Drumlegagh Road North, Golf Course Road and Baronscourt Road;
- users of the Central Sperrin Scenic Driving Route;
- users of the Sustrans National Cycle Network Route 95 (and Newtownstewart to Strabane Cycle Trail); and
- users of the Sustrans National Cycle Network Route 92 (and Derg Valley Cycle Trail).

V7: Newtownstewart to Mountjoy

10.5.8 Principal receptors comprise:

- the southern and western residential fringes of Newtownstewart;
- visitors to Harry Avery's Castle and isolated properties along Oldcastle Road;
- elevated, scattered properties along Glen Road and Castletown Road;
- properties on the lower slopes of Bessy Bell, west of the existing A5 corridor;
- scattered dwellings to the east of the Strule Valley, along Carrigans Road, including elevated properties on the slopes of Deers Leap;
- users of the Ulster Way between Castletown Road and Carrigans Road;
- users of the Robbers Table, Gortin (Public Walking Route and PROW);

- users of the Sustrans National Cycle Network Route 95 (and Derg Valley Cycle Trail);
- users of the Sustrans Cycle Route 92 (and Newtownstewart to Strabane Cycle Trail, Belfast to Ballyshannon Cycle Trail); and
- users of the South Sperrin and Central Sperrin Scenic Driving Routes.

V8: Mountjoy to Gillygooley Road

10.5.9 Principal receptors comprise:

- scattered properties north and west of Mountjoy, along Castletown Road, Cashty Road and Lisnagirr Road;
- properties on Rash Road and Tully Road;
- properties on Drumlegagh Road South and the A5, adjacent to Tully Bog and north of the Fairy Water;
- properties along the A5 to the northernmost urban fringe of Omagh;
- isolated properties off Mellon Park Drive; and
- users of the South Sperrin Scenic Driving Route.

V9: Gillygooley Road to Doogary

10.5.10 Principal receptors comprise:

- isolated and grouped properties along Gillygooley Road, to the northern limit of Omagh;
- scattered properties and farmsteads along Aghnamoyle Road and in farmland to the north west of Omagh;
- properties on Tamlaght Road, Bracken Road, A32 Clanabogan Road and Brookmount Road, west of Omagh;
- properties on the south-western urban fringe of Omagh;
- a row of properties on Loughmuck Road, to the south-west of Omagh;
- isolated properties along Beagh Road, Ballynahatty Road, Blackfort Road and Drumragh Road; and
- users of the South Sperrin Scenic Driving Route.

V10: Doogary to Moylagh

10.5.11 Principal receptors comprise:

- properties at the junction of the A5 and B83;
- Tattykeel Cottages and properties at the northern and southern extents of Tattykeel Road alongside the A5;

- isolated farms/dwellings alongside and east of the existing A5;
- properties near the A5 junction with Drumconnelly Road;
- properties along Tullyrush Road, between the existing A5 and the B83;
- properties along Rarone Road;
- properties situated along Augher Point Road between the existing A5 and Moylagh; and
- users of the Sustrans National Cycle Network Route 92 (and Belfast to Ballyshannon Cycle Trail).

V11: Moylagh to Newtownsaville

10.5.12 Principal receptors comprise:

- properties within Moylagh (along the B46 Moylagh Road, Augher Point Road and Meenmore Road);
- farms and properties along Legacurry Road;
- scattered properties near the junction with Killadroy Road and Greenmount Road;
- scattered properties along Routingburn Road;
- scattered properties along Springhill Road; and
- isolated farmsteads between Routingburn Road and Newtownsaville.

V12: Newtownsaville to Errigal

10.5.13 Principal receptors comprise:

- properties within Newtownsaville;
- isolated farms and properties along Tullanafoile Road;
- isolated farms and properties along Newtownsaville Road;
- isolated farms and properties along Tycanny Road and the lower reaches of Rarogan Road;
- isolated farms and properties along minor roads rising west from Newtownsaville Road (Glenalt Road, Cormore Road and the northern extents of School Road); and
- users of the Carleton Trail at Knockmany Hill.

V13: Errigal to Ballygawley

10.5.14 Principal receptors comprise:

- properties at Errigal;
- visitors to Errigal Keerogue Church (State Care Monument);
- properties along Glenhoy Road;

- elevated properties along Glencuil Road;
- properties at Ballynasaggart;
- isolated properties along Sess Road, south of Ballynasaggart;
- elevated properties along Feddan Road, between Ballynasaggart and the A4;
- isolated hill top farms between Feddan Road and the A4;
- the western residential fringes of Ballygawley and properties in the vicinity of the existing A4/A5 junction; and
- St Ciarans College and residential properties along Tullybryan Road.

V14: Ballygawley to Aughnacloy

10.5.15 Principal receptors comprise:

- properties at Lisdoart and along Ballynany Road and Tullywinny Road;
- isolated farmstead and dwellings across the open drumlin landscape between Tullywinny Road and Lisginny Road;
- clustered properties on the crest line of Lisginny Road;
- isolated properties in the valley recess of Lisginny Road towards the existing A5 Tullyvar Road; and
- scattered properties in the vicinity of Old Chapel Road and Old Chapel Road Spur in the valley recess west of the existing A5.

V15: Aughnacloy

10.5.16 Principal receptors comprise:

- two and 3 storey residential developments to the northern fringe of Aughnacloy;
- isolated properties bordering the existing A5 between Aughnacloy and Aughnacloy Golf Club;
- members and visitors to Aughnacloy Golf Club;
- new residential development bordering Aughnacloy Golf Club;
- isolated properties within drumlin farmland to the east of Aughnacloy, Carnteel Road and Rehaghy Road;
- properties bordering the A28 Caledon Road south east of Aughnacloy;
- properties and new-build residential development along and in the vicinity of Douglas Road;
- properties to the south of the A5 Irish border; and
- users of the Ulster Way long distance footpath ("link section" Scarva to Aughnacloy) and Sliabh Beagh Way.

10.6 Predicted effects and mitigation - landscape character

LCZ 1 Lower Foyle Valley

LCSZ 1.1 – New Buildings and Ballougrgy Hill

10.6.1 The introduction of the Proposed Scheme along the margins of the River Foyle to the west of New Buildings and Magheramason would have a marked detrimental effect on the designated Area of High Scenic Value that defines the approach towards Londonderry along the river valley. The road would serve to fragment the gently undulating fields between the settlements and the river, albeit that the setting of the road within and on a sequence of generally shallow cuttings and low embankments would partly mitigate the impact. Refer to Appendix 10F Figures 10F.1 and 10F.2.

10.6.2 Proposed mitigation comprises:

- areas of planting to frame the roundabout on the existing A5 and integrate the fragmented parcels of land at the gateway to New Buildings as the settlement is approached from the north;
- planting on low embankments immediately west of Magheramason where the road and its associated traffic would be in close proximity to property on the western and northern edge of the settlement; and
- re-instatement of hedgerows along the road boundary to reduce fragmentation where existing lengths of hedgerow would be removed to accommodate the Proposed Scheme.

10.6.3 The magnitude of impact would be moderate and adverse in the opening and future assessment years on a landscape of moderate sensitivity. The predicted effect would be moderate adverse in both years.

LCSZ 1.2 – River Foyle Meander

10.6.4 The Proposed Scheme would be located on the eastern fringe of the LCSZ close to the interface with Gortmonly Hill. It would follow an alignment immediately west of Magheramason on low embankment and shallow cutting and along a shallow fold to the east of a low rise within the prominent meander in the River Foyle east of St Johnstone. Side roads would be carried over the dual carriageway, the most prominent of which would be Dunnalong Road with its skewed alignment and extended embankments.

10.6.5 Proposed mitigation comprises:

- woodland and scrub planting on side road embankments to minimise local impacts;
- hedgerow planting along the road boundary to make good severance of existing hedgerows; and
- scrub and tree planting to replace small areas that would be removed to accommodate the alignment and complement existing areas of scrub within the vicinity – this includes planting in small severed field parcels which it is not viable to return to agricultural use.

10.6.6 In the context of the sub-zone, the Proposed Scheme would be located on the margin of the wider valley landscape, set within the wide and gently undulating meander such that its potential influence would be well-contained. The magnitude of impact would be minor and adverse in both the opening year and future assessment year on a landscape of moderate sensitivity to change. The predicted effect would be slight adverse in both years.

10.6.7 Impacts associated with the interface of the Proposed Scheme at Gortmonly Hill are transitional with this LCSZ. The effects on landscape character in this northern part of the Proposed Scheme corridor associated with Bready and Gortmonly Hill are described as part of the evaluation of LCSZ 2 – Gortmonly Hill.

LCSZ 1.3 – Burn Dennet and Glenmornan River Valleys

10.6.8 The Proposed Scheme would emerge south of Bready and Gortmonly Hill (LCSZ 2), converging with and then crossing the existing A5 before moving west into the Foyle Floodplain (LCSZ 1.4). Its location at the western extremity of this sub-zone is such that there would be no material impact on the wider tributary valley landscape to the east.

10.6.9 There would be a marked but localised impact on character where the Proposed Scheme passes close to housing and farmsteads on Willow Road and then on high embankment over the existing A5. The existing field pattern would be locally severed, with a consequent impact on the existing composition of local housing and roads within the wider landscape.

10.6.10 There would be a contrast with the character of the existing A5 corridor by virtue of the horizontal alignment required for a dual carriageway and the necessary introduction of embankments and cuttings to achieve a vertical profile that meets with current design standards. Proposed woodland and scrub planting would serve to soften the appearance of these embankments and the formality of the new road alignment, in keeping with the pattern of overgrown hedgerows, areas of scrub and mature trees found within the area.

10.6.11 The road and its associated landscaping would become a new focus in the transition from tributary valley to broad floodplain.

10.6.12 The magnitude of impact on the character of the tributary valley landscape would be minor adverse in the opening year and future assessment year on a landscape of moderate sensitivity to change. The predicted effect would be slight adverse in both years.

LCSZ 1.4 – Foyle Floodplain

10.6.13 The Proposed Scheme would be located on the easternmost fringes of the Foyle floodplain, emerging onto the floodplain at Grange Foyle and crossing the tributary valleys of the Burn Dennet and Glenmornan Rivers before converging with the existing A5 corridor north of Strabane (LCSZ U2).

10.6.14 Between Grange Foyle and the Glenmornan River, the Proposed Scheme would be predominantly on embankment and west of the existing A5 corridor, extending into the

floodplain landscape at the river crossings, while in close proximity to the A5 at McKean's Moss. The road would be initially exposed and perceived as a new focus in the landscape, defining the transition from the tributary valley of the Burn Dennet and Glenmornan Rivers to the broader floodplain of the River Foyle.

- 10.6.15 South of the Glenmornan River, impacts would be largely limited to a contained corridor defined by mature planting along the former Strabane Canal and the existing A5 corridor, between which the dual carriageway would run predominantly on embankment towards Strabane. There would be no material impact on the wider floodplain landscape extending across the pastures down to the River Foyle and Corkan Isle and the floodplain west of the river between the Swouldy Burn and Deelee River. The Proposed Scheme would, however, fragment the local landscape on the approach to Strabane between the canal and existing A5, to either side of the proposed grade separated junction, J3.
- 10.6.16 To the north of J3, the corridor is relatively wide and there would be a clear distinction between the Proposed Scheme and the existing A5. To the south, the corridor becomes markedly narrower. There would be no clear differentiation between the two roads such that there would be an increase in the influence of road related traffic on landscape character at this point of interface with the floodplain and the settled approaches to Strabane.
- 10.6.17 The arrangement of the proposed junction would provide for the main carriageway being kept on low embankment and the relatively short slip-road access link being elevated on high embankment to cross over the dual carriageway. It is an approach that would reduce the potential impact of the extensive junction arrangement. The junction and the traffic using it would, nonetheless, constitute a prominent feature in the local landscape.
- 10.6.18 Proposed mitigation comprises:
- woodland and scrub planting to soften the appearance of embankments and the exposure of the new road alignment within the floodplain between Grange Foyle and the Glenmornan River;
 - a robust framework of planting at the grade-separated junction west of Ballymagorry (J3) - the impact in this location would, however, remain locally significant;
 - intermittent areas of planting on the embankment slopes to the north of the junction;
 - dense planting on embankments to the south of the junction; and
 - planting of hedgerows along the road boundary to reconnect with severed field boundaries.
- 10.6.19 Impacts on the character of the floodplain would not be widely significant. The magnitude of impact within the contained corridor along the eastern margin of the sub-zone would be moderate adverse in the opening and future assessment years on a landscape of moderate sensitivity to change. The predicted effect would be moderate adverse in both years.

LCSZ 2 Gortmonly Hill

- 10.6.20 The Proposed Scheme involves the introduction of a deep cutting on the western facing slopes of Gortmonly Hill close to the settlement of Bready. It is a feature which would markedly influence the distinctive form and appearance of this locally prominent hill and its perception from the wider landscape of the Foyle Valley immediately west of the hill and as it is approached from the south. Refer to Appendix 10F Figures 10F.3, 10F.4, 10F.17 and 10F.18.
- 10.6.21 Proposed mitigation comprises:
- extensive profiling of the larger, eastern cutting slope in order to create a smooth transition from its northern interface with the existing hill slope (approx. 1 in 5 gradient) through to its steeper southern interface at the wooded southern exit to the cutting (approx. 1 in 2 gradient);
 - grading out at the apex of the newly formed cutting to reduce the potential severity of impact where the top of cutting meets with the natural slope profile of the hill - this would avoid the appearance of a substantial notch in the skyline of the hill's existing profile;
 - retention of as much existing woodland as possible at the southern exit to the cutting and planting of scrub woodland to re-establish the woodland edge at the point of transition into the cutting; and
 - scrub planting at the transition from profiled slope to natural slope at the northern end of the cutting.
- 10.6.22 The cutting slopes would be kept open and grassed to further reduce potential contrast between the lower re-profiled slopes and the open pasture towards the crest of the hill.
- 10.6.23 The proposed profiling and targeted planting would serve to reduce an otherwise potentially major adverse magnitude of impact, such that the magnitude of impact would be moderate adverse on a landscape of high sensitivity to change in the opening year and future assessment year. The predicted effect would be moderate adverse in both years.

LCZ 3 Lifford Hills

LCSZ 3.1 – Binnion and Black Hill / 3.2 – Cavan and Dromore Hills / 3.3 – Croaghan Hill

- 10.6.24 The Proposed Scheme would be located to the east of the rivers Foyle and Finn, such that there would be no direct impact on these northern parts of the Lifford Hills landscape. There are elevated views from the hills across the river valleys to the east, which take in the context of the Foyle floodplain, settlement and development along the existing A5 including Lifford and Strabane, and the backdrop of the Sperrin outlying hills with the higher, more distant mountains beyond.
- 10.6.25 The introduction of the Proposed Scheme within what are generally distant and frequently panoramic views, in a context where the relationship between floodplain,

transport corridor, settlement and upland backdrop would not change, would not have a material impact on the perception of the three sub-zones from which the views are available. The magnitude of impact would be no change on three areas of landscape that are of high sensitivity to change. The predicted effect would be neutral.

LCSZ 3.4 – Southern Lifford Hills

- 10.6.26 The Proposed Scheme would be aligned in a sequence of deep cuttings through the undulating low hills that shape the agricultural landscape of the lower slopes of this eastern part of the wider sub-zone. The northernmost of these cuttings, running south from junction 7 is some 2km long and up to 20m deep, with rock outcrops. Refer to Appendix 10F Figure 10F.20.
- 10.6.27 As a result of the containment provided by the cuttings, there would be a less pronounced awareness of the road and its traffic from the nearby semi-industrial and expanding residential fringe of Strabane and from the settlements of Glebe and Sion Mills. The location of the road in deep cuttings enables side road crossings to be kept at, or close to, existing ground levels, avoiding potentially localised impacts.
- 10.6.28 The location of the proposed junction 8 on Peacock Road has been arranged to take advantage of a degree of containment afforded by the form of the low hills in this location.
- 10.6.29 Proposed mitigation comprises:
- woodland and scrub planting on cuttings and embankments to minimise local impacts;
 - hedgerow planting along the road boundary to make good severance of existing managed hedgerows that define locally large fields; and
 - woodland planting to compensate loss required for the construction of the junction at Peacock Road, and to contain its impact locally.
- 10.6.30 In light of the design and mitigation measures which would be adopted there would be no marked influence on the wider character of the southern grouping of the Lifford Hills and impact on its eastern fringe would be highly localised. The magnitude of impact would be minor adverse in the opening year and future assessment year on a landscape of high sensitivity to change. The predicted effect would be slight adverse in both years.

U1 Strabane and Lifford

- 10.6.31 The Proposed Scheme would be located on the eastern margin of the 500m-wide floodplain of the Rivers Foyle and Finn that separates the towns of Strabane and Lifford. The dual carriageway would be on high to medium height embankment for much of its length. A second bridge would span the Mourne River approximately 100m to the west of the existing crossing. The dual carriageway would then run close to the southern margin of the River Finn, north of Urney Road and to the west of the town.
- 10.6.32 The effect would be the establishment of a new western edge to Strabane. This would reinforce an existing sense of severance of town and river north of the Mourne River and

introduce new severance between the south-western parts of the town along Urney Road, where the settlement extends to the banks of the River Finn. As proposed woodland and scrub planting establishes on the embankments of the new road, it would serve to soften the impact of the earthworks and close views of traffic. There would be no direct impact on the town centre and no marked effect on the character of the substantial part of the town located to the east of the existing A5.

- 10.6.33 At Lifford the local character would not markedly change. The Proposed Scheme would, in effect, replace the existing A5 as the perceived edge of Strabane from across the floodplain. The dual carriageway and its traffic would initially appear more prominent in the outlook from the town's waterfront than the existing A5, which itself is partially screened by roadside planting. The outlook would change as proposed planting establishes and matures and the planting becomes a mid-ground buffer and setting to the floodplain, over which there would be views of the eastern parts of Strabane as they rise against the backdrop of the foothills of the Sperrins.
- 10.6.34 There would be a localised and significant impact where the existing relationship of housing to the west of Urney Road and the Finn River would be severed. The presence of the Proposed Scheme would have a marked effect on this localised part of the valley landscape which would reduce as proposed tree and scrub planting matures, however the influence of the road would remain marked. Refer to Appendix 10F Figures 10F.5, 10F.6 and 10F19.
- 10.6.35 The magnitude of impact on the two towns generally would be moderate adverse in the opening year reducing to minor adverse in the future assessment year on a landscape/townscape of moderate sensitivity to change. The predicted effect would be moderate adverse in the opening year reducing to slight adverse in the future assessment year.
- 10.6.36 The magnitude of impact where the Proposed Scheme would be aligned on the margins of the Finn River west of Urney Road would be major adverse in the opening year and future assessment year on a landscape/townscape of moderate sensitivity to change. The predicted effect would be large adverse in both years.

U2 Sion Mills

- 10.6.37 The impact of the Proposed Scheme relative to its location in deep cutting as it passes between Sion Mills and Glebe has been described as part of the assessment of LCSZ 3.4 – The Southern Lifford Hills.
- 10.6.38 Where the Proposed Scheme passes close to Sion Mills, there would be no direct impact on the urban form of the town and no marked change in perceptions of the settlement by virtue of the introduction of the dual carriageway in deep cutting west of the settlement. The magnitude of impact relative to the urban form and character of the settlement would be negligible in the opening year and future assessment year on a townscape of high sensitivity to change. The predicted effect would be neutral.

LCZ 4 Upper Foyle Valley

LCSZ 4.1 – Knockavoe and Meenashesk Hill Slopes

- 10.6.39 There would be no direct impact on the hill slope landscapes of Knockavoe and Meenashesk, the upper limit of which broadly aligns with the boundaries of the Sperrin AONB. There would be no marked visual relationship between the alignment of the Proposed Scheme within the Foyle and Mourne Valleys to the west that would influence the appreciation of the character of the sub-zone. The magnitude of impact would be negligible in the opening year and future assessment year on a landscape of high sensitivity to change. The predicted effect would be neutral.

LCSZ 4.2 – Enclosed Mourne River Valley

- 10.6.40 The Proposed Scheme would follow the lower western slopes of the Mourne Valley above Victoria Bridge, running between deep to moderate cutting and high to moderate embankment as it crosses several minor tributary valleys that descend the lower slopes of Whisker Hill and Clady Hill. Although there are occasional woodland areas on these hill slopes, they would not substantially break the initial impact of the extended lengths of embankment across the valley recesses.
- 10.6.41 Proposed mitigation comprises:
- blocks of woodland planting on sections of embankment (particularly where there are side road crossings, junctions and tributary valley crossings) to compensate for localised loss of existing woodland and to reduce the exposure of the elevated road and its associated traffic on the valley side; and
 - planting of hedgerows along the road boundary to make good severance of existing hedgerows that define locally large fields and to mask the presence of the tops of cutting slopes.

- 10.6.42 The presence of the embankments on the valley side would have an impact of moderate adverse magnitude in the opening year on a landscape of moderate sensitivity to change. This would reduce to minor adverse as the proposed planting establishes and matures. The predicted effect would be moderate adverse in the opening year reducing to slight adverse in the future assessment year.

LCSZ 4.3 – Newtownstewart Floodplain

- 10.6.43 Where the Proposed Scheme is aligned along the western margin of the Mourne valley, towards its crossing of the Derg valley at the north-western limit of the floodplain there is a transition from river valley setting towards the higher ground of the Baronscourt Estate and hill slopes above Newtownstewart. The dual carriageway and its associated traffic would be open to view from the east, although it would be seen in a similar context to that of the existing A5. The effect would be a perceived widening and increase in the influence of the strategic road corridor as part of the wider landscape.
- 10.6.44 Proposed mitigation comprises planting of hedgerows along the road boundary to make good severance of existing hedgerows that define locally large fields.

10.6.45 The magnitude of impact would be minor adverse in the opening year and future assessment year on a landscape of moderate sensitivity to change. The predicted effect would be slight adverse in both years.

LCSZ 4.4 – Owenkillew Valley and Plateau Bogs

10.6.46 There would be no direct impact on the plateau bog and elevated valley margin landscape setting north of Newtown Stewart, above the Strule and Owenkillew Rivers. Nor would there be a marked visual relationship with the Proposed Scheme running west of Newtown Stewart that would influence the appreciation of the character of this landscape. The magnitude of impact would be no change in the opening year and future assessment year on a landscape of high sensitivity. The predicted effect would be neutral.

LCZ 5 Lower Derg Valley

10.6.47 The Proposed Scheme is located on the eastern margin of the sub-zone, west of the confluence of the Derg River and Mourne River. There would be no direct impact on the core characteristics or quality of the Derg Valley above Ardstraw.

10.6.48 As the dual carriageway crosses the interface between the Derg Valley and the floodplain, there would be a sequence of generally shallow cuttings and low embankments. There would be deeper cuttings on either side of the crossing of the Derg River, which would allow both Derg and Deerpark Roads to be carried over the dual carriageway close to existing levels.

10.6.49 To the south, the road would rise away from the floodplain towards the Baronscourt Estate and Deer Park, where a length of higher embankment would enable Magheracolten Road to pass beneath the dual carriageway.

10.6.50 Proposed mitigation comprises:

- grading out of embankment slopes to the east of Magheracolten Road to soften the impact of the high embankments required to accommodate the underbridge for the local road;
- blocks of woodland planting along sections of embankment, particularly where there are side road crossings and at the southern approaches towards the Baronscourt Estate; and
- planting of hedgerows along the road boundary to make good severance of existing managed hedgerows that define locally large fields.

10.6.51 The dual carriageway and its associated traffic would be open to view over a wide area although it would be seen in a similar context to that of the existing A5. The effect would be a perceived widening and increase in the influence of the strategic road corridor as part of the wider landscape.

10.6.52 The magnitude of impact in the opening year and future assessment year on a landscape of moderate sensitivity to change would be minor adverse. The predicted effect would be slight adverse in both years.

LCZ 6 Western Sperrin Foothills

10.6.53 There would be no direct impact on the LCZ and no marked visual relationship between the Proposed Scheme in the valley landscapes to the west that would influence the appreciation of the character of this upland landscape within the Sperrin AONB. The magnitude of impact would be no change in the opening year and future assessment year on a landscape of high sensitivity to change. The predicted effect would be neutral.

LCZ 7 Strule Valley and Bessy Bell

LCSZ 7.1 – Baronscourt Valley

10.6.54 The Proposed Scheme passes along the northern edge of the sub-zone, close to the local ridge at Wood Hills that runs above the Strule Valley to the west of Newtownstewart and on which Harry Avery's Castle is prominently sited.

10.6.55 There would be no direct impact on the core interests that form the focus of the heavily wooded Baronscourt Registered Park and Garden. The Proposed Scheme would have an impact on the historic landscape where the dual carriageway crosses agricultural land on low embankment at Deerpark, beyond the compact grade separated junction at Baronscourt Road (J10) and passes immediately south of Harry Avery's Castle in deep cutting. The severance of the landscape and introduction of a modern road in this context would have a potentially large adverse impact.

10.6.56 Proposed mitigation comprises:

- alignment of the road to the south of Harry Avery's Castle in deep cutting to avoid a change in the backdrop to the view of the castle when viewed from within the valley below Newtownstewart. Localised steepening of the cutting slope would ensure the characteristic hill profile of the castle's setting is retained. Refer to Appendix 10F Figures 10F.22;
- targeted planting of the cutting slopes to the south of Harry Avery's Castle, to establish a foil of planting in the modified view of the castle from the western slopes of Bessy Bell and the Baronscourt Road; and
- planting of hedgerows and individual groupings of trees to compensate for loss of existing field boundaries.

10.6.57 Whilst the Proposed Scheme would not have a direct impact on the Baronscourt Estate and design measures have been introduced which would serve to reduce the potential order of impact, the magnitude of impact between the Estate and Newtownstewart in the opening year and future assessment year on a landscape of high sensitivity would be major adverse. The predicted effect would be large adverse in both years.

LCSZ 7.2 – Bessy Bell

- 10.6.58 The Proposed Scheme crosses the open, lower northern slopes of Bessy Bell above Newtownstewart through a series of moderately deep cuttings which would sever a network of small-scale, open fields enclosed by broken hedges. The cuttings enable side roads to cross over the dual carriageway either at, or close to, existing ground level and reduce the extent to which the road and its associated traffic would influence views towards the hill from Newtownstewart, the existing A5 corridor and the eastern side of the Strule Valley below Mary Gray. Refer to Appendix 10F Figures 10F.7 and 10F.8.
- 10.6.59 Where the Proposed Scheme is aligned along the eastern slopes of Bessy Bell it is in the Sperrin AONB. It would be seen above the existing A5, which also runs within the AONB at a lower and more contained location within the Strule valley. The road would be visually exposed to the wider context of the AONB from Mary Gray, where the views would be across the Strule Valley against a backdrop of wind turbines on the upper slopes of Bessy Bell. Being largely in cutting, it would not fundamentally change the context of views although there would be some degree of fragmentation due to its linear form when viewed in entirety along the edge of the Strule Valley (see LCSZ 7.3). Refer to Appendix 10F Figures 10F.9 and 10F.10.
- 10.6.60 Proposed mitigation comprises:
- planting of intermittent areas of scrub on cutting slopes; and
 - planting of hedgerows to make good severance associated with the alignment.
- 10.6.61 The proposed alignment would not influence the appreciation of the distinctive massing and profile of the hill as a prominent and distinctive feature of the local landscape. The magnitude of impact in the opening and future assessment year on a landscape of high sensitivity to change would be minor adverse. The predicted effect would be slight adverse in both years.

LCSZ 7.3 – Enclosed River Strule Valley

- 10.6.62 The Strule Valley below Bessy Bell is within the Sperrin AONB. It is a contained valley of small and irregular pastoral fields bordered by often mature and overgrown hedges. Steeply descending local roads connect Castletown Road with the existing A5. The Proposed Scheme would follow an alignment along the western slopes of the lower valley approximately 100m west and above the line of the existing A5. The alignment would sever the field pattern and create a sequence of cuttings, sidelong cuttings and embankments which would have a marked effect on the lower slopes. In combination with the river and existing road it would comprise a third, more visible linear component along the lower valley. Refer to Appendix 10F Figures 10F.9 and 10F.10.
- 10.6.63 Proposed mitigation comprises:
- dense woodland and scrub planting on embankment and sidelong cutting slopes to mask the impacts of the modified landform and reflect existing woodland pockets and mature hedgerow vegetation across the lower hill slopes;

- profiling of exposed rock in cuttings and planting in soil pockets to reduce the potential severity of exposed rock faces; and
- planting of hedgerows to connect with pockets of local woodland planting and to reinforce the structural pattern of field margins.

- 10.6.64 The Proposed Scheme would have a material effect on the quality of the landscape at this western limit of the Sperrin AONB. It would be seen above the existing A5, which also runs within the AONB at a lower and more contained location within the Strule valley. The road would be visually exposed to the wider context of the AONB from Mary Gray and Deers Leap, where the views would be across the Strule Valley against a backdrop of wind turbines on the upper slopes of Bessy Bell.
- 10.6.65 There would be some degree of fragmentation when viewed in entirety along the edge of the Strule Valley. Its location on the hill slope below Castletown Road would however avoid potential impacts of a large order that a higher alignment on the mid or upper slopes of Bessy Bell would involve. Traffic using the road would be open to view from within the valley in the opening year, an impact which would reduce as the proposed planting establishes and matures.
- 10.6.66 The choice of alignment close to the valley floor and proposed planting would serve to reduce the potential order of impact. The magnitude of impact would be moderate adverse in the opening year; this would reduce as planting establishes and matures, but would remain moderate adverse in the future assessment year on a landscape of moderate sensitivity to change. The predicted effect would be moderate adverse in both years.

LCSZ 7.4 – Sperrins Lower Slopes

- 10.6.67 The Proposed Scheme would not have a direct impact on this western part of the Sperrin AONB. Views from these hill tops across the Strule Valley towards Bessy Bell tend to focus towards the distinctive profile of the hill and the prominent wind farm ascending to its crest. The location of the Proposed Scheme on the lower slopes above the valley floor would not be markedly different from the existing relationship of traffic using the existing A5 to the views across the valley and accordingly would not have an effect on perception of the character of the AONB to the east of the river. The magnitude of impact in the opening year and future assessment year would be negligible on a landscape of high sensitivity to change. The predicted effect would be neutral in both years.

U3 Newtownstewart

- 10.6.68 There would be no direct impact on the form of Newtownstewart and no marked change in the perception of the town by virtue of potential glimpses of traffic on the hill slopes above the southern fringes of the town, east of Harry Avery's Castle. The magnitude of impact relative to the urban form and character of the settlement would be negligible in the opening year and future assessment year on a townscape of high sensitivity to change. The predicted effect would be neutral.

LCZ 8 Omagh Drumlin Farmlands

10.6.69 A consistent characteristic of the drumlins that shape the topography of this character zone is the degree of enclosure they provide where sections of the proposed dual carriageway would be aligned between the landforms. Higher orders of impact would occur where the standards of horizontal alignment required preclude movement of the alignment to avoid larger drumlins and hills and significant cuttings through or into drumlin slopes cannot be avoided.

LCSZ 8.1 – Wooded River Strule Valley

10.6.70 A short section of the Proposed Scheme would pass through the western fringe of this sub-zone as it emerges from the Strule Valley and enters the transitional drumlin farmland north of Omagh towards the crossing of the Fairy Water. Rash Road would be locally raised to cross the alignment, similarly the link road and slip road roundabouts at the Omagh North Junction (J11) would be raised on embankment to cross and provide for access onto the dual carriageway. The section between would be in moderately deep cutting, crossing the disused railway line to the western edge of Tully Bog.

10.6.71 Proposed mitigation comprises:

- woodland planting on the side road embankments;
- dense planting to establish a framework of woodland to enclose the junction and complement areas of woodland to the east and west;
- planting of hedgerows to reduce severance of field patterns; and
- sensitive siting and grading of deposition materials to integrate with the local drumlin landscape.

10.6.72 The magnitude of impact would be minor adverse in the opening year and future assessment year on a landscape of moderate sensitivity to change. The predicted effect would be slight adverse in both years.

LCSZ 8.2 – Fairy Water Drumlins

10.6.73 The Proposed Scheme would cross the easternmost fringe of this sub-zone, close to the western urban fringe of Omagh and south of the Fairy Water. The dual carriageway route would move between cutting and low embankment, within a landscape of shallow drumlins contained broadly by Bessy Bell to the north and the Crockavenny drumlins (LCSZ 8.3) to the south. There would be some loss of hedgerow, hedgerow trees and some small established woodland copses where the Proposed Scheme would sever moderately sized pastoral fields.

10.6.74 Proposed mitigation comprises:

- woodland planting on side road embankments and at junctions;
- scrub planting at the entry and exit to short sections of cutting, also where side roads cross cuttings and in the vicinity of the Fairy Water crossing; and

- planting of hedgerows and linear belts of woodland planting to reconnect severed land parcels and tie in with local vegetation.

10.6.75 The magnitude of impact in the opening year and future assessment year would be minor adverse on a landscape of moderate sensitivity to change. The predicted effect would be slight adverse in both years.

LCSZ 8.3 – Crockavanny Drumlins

10.6.76 The alignment of the Proposed Scheme through this locally elevated part of the drumlin farmlands would create a sequence of short deep cuttings as a result of the density of the locally interlocking, rounded hills. There would be marked severance of a locally intricate field pattern, defined by dense outgrown hedgerows and loss of distinctive groupings of trees.

10.6.77 Proposed mitigation comprises:

- woodland planting on side road embankments and at junctions;
- scrub planting at the entry and exit to short sections of cutting, where side roads cross cuttings and in the vicinity of the Fairy Water crossing;
- planting of hedgerows and linear belts of woodland planting to reconnect severed land parcels and local planting; and
- sensitive siting and grading of deposition materials to integrate with the local drumlin landscape.

10.6.78 The magnitude of impact in the opening year and future assessment year would be minor adverse on a landscape of moderate sensitivity to change. The predicted effect would be slight adverse in both years.

LCSZ 8.4 – South Omagh Drumlin Farmlands

10.6.79 The drumlin farmlands extend south from Omagh, creating a wide and homogenous landscape of rounded drumlin landforms interspersed by a network of rivers and streams. Roads radiate from Omagh, linking with the small towns of Beragh, Seskinore and Fintona along the line of the B46 corridor at the foot of the Brougher Ridge.

10.6.80 Deep cuttings through tightly packed, pronounced drumlins would be a noticeable feature of the initial section of the Proposed Scheme where it runs south from the junction with the A32 Clanabogan Road (J12), beyond the residential fringes of Omagh and towards the junction and link road with the existing A5 at Doogary (J13). The dual carriageway would be elevated across the A32 and set in deep cutting at J13 such that the approach roads to the slip road roundabouts would be kept relatively low and the overbridge linking them would not be prominently elevated.

10.6.81 South of Doogary, the alignment diverges from the existing A5 corridor and becomes visually separated by virtue of the drumlin terrain. There would be lengths of road running either at or close to existing ground levels, interrupted by occasional large cuttings or embankments. These occur where the required horizontal alignment standards have

precluded avoidance of larger drumlins or where significant undulations require infilling to achieve vertical alignment standards.

- 10.6.82 A number of side roads would cross the Proposed Scheme throughout the sub-zone, either elevated on embankment and bridged over the main alignment or passing beneath the dual carriageway which would be on embankment.
- 10.6.83 Proposed mitigation comprises:
- dense woodland and scrub planting along substantial sections of the road other than through the peatlands at Doogary;
 - a dense framework of woodland planting at the existing A5 junction and link roads;
 - planting of hedgerows and hedgerow trees to reconnect the severed field pattern;
 - planting of small areas of severed land to tie in with existing vegetation cover; and
 - sensitive siting and grading of deposition materials to integrate the Proposed Scheme within the local drumlin landscape.
- 10.6.84 Impacts would vary between the section of the road between Clanabogan Road and the A5 junction and that south of the junction at Doogary. There would be extensive local modifications to landform associated with the former, although the extent of influence would be well contained by the tightly packed nature of the drumlins surrounding the alignment.
- 10.6.85 South of the junction, where the vertical alignment would be generally near to existing ground levels, the road would be more open to views within the landscape and the relative interventions on landform more significant in scale, albeit within a relatively well contained visual envelope. Its relationship to the landscape of the sub-zone would be similar to that of the existing A5.
- 10.6.86 In both instances, the magnitude of impact in the opening year and future assessment year would be minor adverse on a landscape of moderate sensitivity to change. The predicted effect would be slight adverse in both years.

LCSZ 8.5 – Eskragh Water and Routing Burn Drumlins

- 10.6.87 The Proposed Scheme would pass through the eastern margin of the sub-zone, through a shallow recessed continuation of the drumlin landscape within the incline of the Brougher Ridge. As it passes the villages of Moylagh and Newtownsaville there would be open views to the west over the shallow Eskragh Water Valley towards Crocknatummoige.
- 10.6.88 Moylagh is a compact village set within an enclosed river recess with open views to the southwest. There would be significant impact on its setting where the Proposed Scheme crosses immediately west of the village, both by virtue of its proximity at the grade separated junction (J14) and deep wide cuttings that would substantially modify local landform north and south of the village. Refer to Appendix 10F Figures 10F.11 and 10F.12.

- 10.6.89 South of Moylagh, the Proposed Scheme would generally run close to existing ground levels or on low embankment and in shallow cutting, other than at the crossing of Greenmount / Killadroy Roads. Here, the impact on landform would be locally marked, where the dual carriageway crosses above Greenmount Road and Killadroy Road is returned in a deep sidelong cutting to link with Greenmount Road.
- 10.6.90 The impact of severance of fields and hedgerows would increase south of Greenmount Road and towards Newtownsaville, where there is a locally intimate field pattern defined by well-established and frequently outgrown hedgerows. Newtownsaville is a compact settlement, a cluster of properties occupying a rural context within the Brougher Ridge. The settlement would be heavily influenced by the Proposed Scheme where it passes close by across a local stream, directly to the east of the village.
- 10.6.91 Proposed mitigation comprises:
- a dense framework of woodland planting at the Moylagh junction to contain the form of the junction and serve as a screen to the village;
 - a dense framework of woodland planting at Greenmount / Killadroy Roads;
 - linear belts of planting on low embankments;
 - woodland planting on embankments east of Newtownsaville and scrub on embankments south of the village to mitigate the impact on setting and to complement waterside tree and shrub growth associated with the stream between the village and road;
 - planting of hedgerows to reduce severance of field patterns and introduction of hedgerow trees;
 - planting of small areas of severed land where this would tie into the vegetation pattern; and
 - the sensitive siting and grading of deposition materials to integrate with local landform.
- 10.6.92 The magnitude of impact within the sub-zone in general in the opening year and in the future assessment year would be minor adverse on a landscape of moderate sensitivity to change. The predicted effect would be slight adverse in both years.
- 10.6.93 The magnitude of impact at Moylagh would, however, be major adverse in the opening year. This would reduce to moderate adverse in the future assessment year when the proposed planting framework has begun to mature. The predicted effect would be large adverse in the opening year reducing to moderate adverse in the future assessment year.
- U4 Omagh**
- 10.6.94 There would be no direct impact on the form of Omagh and no marked change in perceptions of the town either by virtue of the presence of the Proposed Scheme west and south of the town. The magnitude of impact relative to the urban form and character

of the town in the opening year and future assessment year would be no change on a townscape of moderate sensitivity to change. The predicted effect would be neutral in both years.

LCZ 9 Brougher and Slievemore Ridge

LCSZ 9.1 – Slivelahan Farmlands

10.6.95 The Proposed Scheme would cross the westernmost fringe of this sub-zone, entering deep cutting south of Moylagh through the hills to the west of Curr Mountain. The impact of the Proposed Scheme here is addressed within the description of impacts and predicted effects linked with the nearby village of Moylagh (LCSZ 8.5 Eskragh and Routing Burn Drumlins).

10.6.96 The Proposed Scheme would not have a direct impact on or be prominent in views from the sub-zone in general. The magnitude of impact in the opening year and future assessment year would be negligible on a landscape of moderate sensitivity to change. The predicted effect would be neutral in both years.

LCSZ 9.2 – Crocknatummoge Hillform

10.6.97 The Proposed Scheme would not have a direct impact on or be prominent in views from this sub-zone. The magnitude of impact in the opening year and future assessment year would be negligible on a landscape of moderate sensitivity to change. The predicted effect would be neutral in both years.

LCSZ 9.3 – Garvaghy Valley

10.6.98 The Proposed Scheme would not have a direct impact on or be evident in views from this sub-zone. The magnitude of impact in the opening year and future assessment year would be no change for a landscape of moderate sensitivity to change. The predicted effect would be neutral in both years.

LCSZ 9.4 – Beltany and Tullanafoile Farmlands

10.6.99 The Proposed Scheme would run south between Newtownsaville and the rise of Tycanny Hill, along the western margin of Tullanafoile Hill on low embankment and in occasional shallow sidelong cutting. Its potential impact would be partially mitigated by the proximity of areas of wet birch woodland and scrub on the valley floor at Newtownsaville Bog.

10.6.100 The road would be raised on high embankment to cross over Tullanafoile Road, which descends sharply across a local fold in the landscape between Tullanafoile Hill and Tycanny Hill. It would then run on sidelong cutting, where Tycanny Road rises on low approach embankments and an area of profiled deposition prior to bridging over the dual carriageway. The alignment would sever existing field patterns and involve some loss of areas of established woodland on the hill slopes in the vicinity of Tullanafoile Road.

10.6.101 Proposed mitigation comprises:

- extensive scrub planting along both sides of the dual carriageway to contain lower level views of traffic and complement the birch scrub across the valley floor;

- dense woodland planting on high embankments where Tullanafoile Road crosses beneath the main alignment, to compensate and tie in with existing planting;
- shrub and tree planting in linear belts between Tycanny Road and Tycanny Hill;
- planting of hedgerows to reduce severance of field patterns and introduction of hedgerow trees;
- planting of small areas of severed land to tie in with the existing vegetation framework; and
- sensitive siting and grading of deposition materials to integrate the Proposed Scheme with local landform.

10.6.102 The magnitude of impact in the opening year would be moderate adverse. This would reduce once proposed planting establishes and matures, but remain moderate adverse in the future assessment year on a landscape of moderate sensitivity. The predicted effect would be moderate adverse in both years.

LCSZ 9.5 – Knockmany Ridgeline

10.6.103 The alignment of the Proposed Scheme through this attractive and secluded ridge landscape of distinctive hills and woodland between Tycanny Hill and Errigal would be kept low within the local landscape, as a means of reducing its potential prominence on the ridge skyline. There would be substantial modification to landform, with major cuttings at Tycanny Hill and below Errigal church and graveyard. The cuttings through both hills would have impacts from the Clogher Valley to the south. Refer to Appendix 10F Figures 10F.13, 10F.14, 10F.15, 10F.16 and 10F.24.

10.6.104 Proposed mitigation comprises:

- grading out of the lower cutting slopes at Tycanny Hill to reduce the extent of visible exposed rock cutting;
- extensive and dense woodland planting between Tycanny Hill and Birneys Hill to contain the impact of the dual carriageway and integrate the roadside landscape with mature areas of woodland along the stream course that flows between the two hills;
- planting of small areas of severed land to tie in with the local vegetation pattern and to further mask the presence of the dual carriageway;
- extensive and dense woodland and scrub planting on the upper slopes and crest of the Errigal cutting slopes to soften the break in profile below the churchyard, also to provide a foil to views west whilst maintaining the existing widespread vistas from this culturally important site; and
- planting of hedgerows to reduce severance of field patterns and introduction of hedgerow trees.

10.6.105 The enclosed nature of this part of the ridgeline would restrict the impact to the well-defined fold between Tycanny Hill, Birneys Hill and Errigal, whilst the low vertical alignment and extensive planting that is proposed would help to mask and contain the road within the sub-zone. The two large cuttings at Tycanny Hill and Errigal would however represent a large impact on the landscape character of the ridge and would be evident from the adjacent drumlin landscape of the Clogher Valley.

10.6.106 The presence of the road in this attractive and distinctive landscape with its cultural associations and the substantial modifications to existing landform, would result in a magnitude of impact in the opening year and future assessment year which would be major adverse on a landscape of high sensitivity to change. The predicted effect would be large and adverse in both years.

LCSZ 9.6 – Ballymackilroy Moraines

10.6.107 The Proposed Scheme would follow a straight alignment as it skirts the southernmost edge of a belt of moraines that mark the transition from the Brougher Ridge to the Clogher Valley. It would cross the Roughan Burn and pass to the south of Ballynasaggart. A series of relatively low embankments and shallow cuttings would avoid substantial modification of landform, whilst a low, local rise to the east serves to partially separate the road in deep cutting from Ballynasaggart.

10.6.108 Proposed mitigation comprises:

- large belts of woodland and shrub planting on embankment and cutting slopes;
- planting of hedgerows to make good fragmentation of existing hedge lines;
- the sensitive siting and grading of deposition materials to integrate the Proposed Scheme within the local drumlin landform.

10.6.109 Whilst the proposed mitigation would reduce the impact of the Proposed Scheme across the moraines, its presence at this point of transition and the formality of the road alignment required as the dual carriageway begins to climb from valley to ridge, would result in a magnitude of impact in the opening year and future assessment year which would be moderate adverse on a landscape of high sensitivity to change. The predicted effect would be in the upper order of moderate adverse in both years.

LCZ 10 Clogher Valley

LCSZ 10.1 – Clogher and Augher Drumlin Farmlands

10.6.110 The Proposed Scheme would cross the northernmost part of this sub-zone, running in deep cutting south of Crew Hill before emerging at grade with the landscape towards the proposed roundabout junction with the A4, west of Ballygawley (J15). There would be no marked loss of woodland habitat or hedgerow on the pattern of large and intensively farmed fields. There would be a localised impact on landscape context particularly in views from higher ground to the north, where the road would be perceived as an additional element of transport infrastructure in combination with recent modifications to the A4 corridor.

10.6.111 Proposed mitigation comprises:

- occasional areas of shrub planting on cutting slopes;
- planting of hedgerows to make good fragmentation of hedge lines; and
- the sensitive siting and grading of deposition materials to integrate the Proposed Scheme within the local landform.

10.6.112 The impact would occur in the context of the recent modifications to the A4 and would be highly localised in the context of the landscape sub-zone. The magnitude of impact in the opening year and future assessment year would be minor adverse on a landscape of moderate sensitivity to change. The predicted effect would be slight adverse in both years.

LCSZ 10.2 – Ballygawley and Ballyreagh A4 Corridor

10.6.113 Minor changes in alignment along the recently modified A4 corridor, its junction with the existing A5 and at Tullybryan Road would not have a marked impact on the sub-zone. The magnitude of impact in the opening year and future assessment year would be negligible on a landscape and local townscape of moderate sensitivity to change. The predicted effect would be neutral in both years.

LCZ 11 Blackwater Valley

LCSZ 11.1 – Black Hill and Aughnacloy Drumlins

10.6.114 The Proposed Scheme would break through a rise on the southern edge of the Clogher Valley at Lisdoart, initially in deep cutting, to enter this sub-zone of the drumlin landscape that separates the Clogher Valley from the Blackwater Valley. From a shallow crest east of Lisdoart the dual carriageway road would follow an alignment along the middle of three linear folds towards Aughnacloy; each defined by northwest to southeast orientated ranks of drumlins and with the existing A5 and A28 corridors occupying the folds on either side. This alignment would reduce potentially large impacts on the drumlin topography and ensure that any potential wider influence is contained.

10.6.115 To the north of Aughnacloy, at the proposed junction with the existing A5 (J16) there would be substantial cutting and modification of surrounding landform in order to accommodate the proposed horizontal and vertical alignment. In bypassing the town to the east, the route alignment would then be contained by the drumlin landform with limited sections of deep cutting through drumlin profiles at Lissenderry and towards the proposed junction with the A28 (J17).

10.6.116 There would be some loss of woodland that extends within the drumlins and across the proposed alignment. The alignment would also sever a relatively small-scale, irregular pattern of fields, many of which are enclosed by mature outgrown hedge lines and within which there are small pockets of woodland.

10.6.117 Proposed mitigation comprises:

- extensive planting of woodland and linear belts of woodland to contain the dual carriageway and complement the local composition of landform and infrastructure;
- woodland and shrub planting with trees on embankment and cutting slopes at side road crossings;
- planting of woodland pockets within small areas of severed land to compensate for loss of similar features;
- planting of hedgerows and hedgerow trees to re-establish the character of the field pattern; and
- the sensitive siting and grading of deposition materials to integrate the Proposed Scheme within the local drumlin topography.

10.6.118 The magnitude of impact resulting from the introduction of the proposed dual carriageway within the middle fold between the drumlins, the consequent avoidance of extensive and significant impacts on landform, and the scale and relationship of proposed planting to existing planting would be moderate adverse in the opening year, reducing to minor adverse in the future assessment year as the planting framework matures. The effect on a landscape of moderate sensitivity would be moderate adverse in the opening year, reducing to slight adverse in the future assessment year.

LCSZ 11.2 – Blackwater Drumlins

10.6.119 A short section of the Proposed Scheme, running between the proposed A28 junction (J17) and its southern termination with the existing A5 south of Aughnacloy, would be a single carriageway section with short sections of embankment and larger cuttings to the north and west of Cottage Hill. This would not constitute a marked intrusion in the context of the sub-zone generally and would not significantly influence the perception of the character of the valley. However, moderately sized rectilinear fields would be severed and there would be some noticeable loss of existing mature field margins and trees to the south of the A28, along the northern edge of Cottage Hill.

10.6.120 Proposed mitigation would comprise:

- woodland and shrub planting with trees on embankments, cutting slopes and side road crossings;
- planting of hedgerows and the introduction of hedgerow trees to reduce severance of field patterns and ultimately compensate for the loss of existing mature vegetation; and
- sensitive grading of deposition materials to integrate with local hill slopes.

10.6.121 The magnitude of impact in the opening year and future assessment year would be minor adverse on a landscape of high sensitivity to change. The predicted effect would be slight adverse in both years.

LCSZ 11.3 – Favour Royal Forest

- 10.6.122 The Proposed Scheme would not have a direct impact on or be prominent in views from this sub-zone. The magnitude of impact in the opening year and future assessment year would be negligible on a landscape of moderate sensitivity to change. The predicted effect would be neutral in both years.

U5 Aughnacloy

- 10.6.123 There would be no direct impact on the urban form of Aughnacloy or perception of its townscape and no effect on the Thistle (Registered Park and Garden) landscape to the west of the town. There would be a minor change in context at the limits of the town where the residential edge would meet with the proposed new junctions and crossings of the radial routes that connect the town. The magnitude of impact relative to the urban form and overall character of Aughnacloy in the opening year and future assessment year of the settlement would be negligible on a townscape of high sensitivity to change. The predicted effect would be neutral in both years.

LCSZ 12 – Branny Hill

- 10.6.124 The Proposed Scheme would not have a direct impact on this LCSZ or be prominent in views from this drumlin landscape. The magnitude of impact in the opening year and future assessment year would be no change on a landscape of moderate sensitivity to change. The predicted effect would be neutral in both years.

Summary of landscape character effects

- 10.6.125 Table 10.10 below provides a summary of the predicted effects on the project specific LCSZs which have formed the focus of the assessment.

Table 10.10: Summary of effects on landscape character

Ref No.	Description	Proposed Scheme Length	Phase	Sensitivity to change	Magnitude of impact (Opening Year)	Magnitude of impact (Future assessment year)	Predicted effect (Opening year)	Predicted effect (Future assessment year)
LCZ 1 Lower Foyle Valley								
1.1	New Buildings and Ballougy Hill	3.1km	1	Moderate	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse
1.2	River Foyle Meander	2.7km	1	Moderate	Minor Adverse	Minor Adverse	Slight Adverse	Slight Adverse
1.3	Burn Dennet and Glenmornan River Valleys	1.3km	1	Moderate	Minor Adverse	Minor Adverse	Slight Adverse	Slight Adverse
1.4	Foyle Floodplain	8.4km	1	Moderate	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse
LCZ 2 Gortmonly Hill								
2.1	Gortmonly Hill	1.5km	1	High	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse
LCZ 3 Lifford Hills								
3.1	Binnion and Black Hill	-	1	High	No change	No change	Neutral	Neutral
3.2	Cavan and Dromore Hills	-	1	High	No change	No change	Neutral	Neutral
3.3	Croaghan Hill	-	2	High	No change	No change	Neutral	Neutral
3.4	Southern Lifford Hills	5.5km	2	High	Minor Adverse	Minor Adverse	Slight Adverse	Slight Adverse
LCZ 4 Upper Foyle Valley								
4.1	Knockavoe and Meenashesk Hill Slopes	-	2	High	Negligible	Negligible	Neutral	Neutral
4.2	Enclosed Mourne River Valley	3.2km	2	Moderate	Moderate Adverse	Minor Adverse	Moderate Adverse	Slight Adverse
4.3	Newtownstewart Floodplain	1.4km	2	Moderate	Minor Adverse	Minor Adverse	Slight Adverse	Slight Adverse
4.4	Owenkillev Valley and Plateau Bogs	-	2	High	No Change	No Change	Neutral	Neutral

Ref No.	Description	Proposed Scheme Length	Phase	Sensitivity to change	Magnitude of impact (Opening Year)	Magnitude of impact (Future assessment year)	Predicted effect (Opening year)	Predicted effect (Future assessment year)
LCZ 5 Lower Derg Valley								
5.1	Derg Valley Farmlands	3.0km	2	Moderate	Minor Adverse	Minor Adverse	Slight Adverse	Slight Adverse
LCZ 6 Western Sperrins								
6.1	Meenashesk Highland Bogs and Forest	-	2	High	No Change	No Change	Neutral	Neutral
LCZ 7 Strule Valley and Bessy Bell								
7.1	Baronscourt Valley	0.8km	2	High	Minor Adverse	Minor Adverse	Moderate Adverse	Slight Adverse
7.1	Baronscourt Valley (Deer Park)	1.4km	2	High	Major Adverse	Major Adverse	Large Adverse	Large Adverse
7.2	Bessy Bell	2.1km	2	High	Minor Adverse	Minor Adverse	Slight Adverse	Slight Adverse
7.3	Enclosed River Strule Valley	6.5km	2	Moderate	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse
7.4	Sperrins Lower Slopes	-	2	High	Negligible	Negligible	Neutral	Neutral
LCZ 8 Omagh Drumlin Farmlands								
8.1	Wooded River Strule Valley	2.4km	2	Moderate	Minor Adverse	Minor Adverse	Slight Adverse	Slight Adverse
8.2	Fairy Water Drumlins	1.3km	2	Moderate	Minor Adverse	Minor Adverse	Slight Adverse	Slight Adverse
8.3	Crockavanny Drumlins	2.8km	2	Moderate	Minor Adverse	Minor Adverse	Slight Adverse	Slight Adverse
8.4	South Omagh Drumlin Farmlands	10.5km	1/2	Moderate	Minor Adverse	Minor Adverse	Slight Adverse	Slight Adverse
8.5	Eskragh Water and Routing Burn Drumlins	4.3km	1	Moderate	Minor Adverse	Minor Adverse	Slight Adverse	Slight Adverse
8.5	Eskragh Water and Routing Burn Drumlins (Moyleagh)	0.7km	1	Moderate	Major Adverse	Moderate Adverse	Large Adverse	Moderate Adverse
LCZ 9 Brougher and Slievemore Ridgeline								

Ref No.	Description	Proposed Scheme Length	Phase	Sensitivity to change	Magnitude of impact (Opening Year)	Magnitude of impact (Future assessment year)	Predicted effect (Opening year)	Predicted effect (Future assessment year)
9.1	Slievalahan Farmlands	0.9km	1	Moderate	Negligible	Negligible	Neutral	Neutral
9.2	Crocknatummoge Hillform	-	1	Moderate	No change	No change	Neutral	Neutral
9.3	Garvaghy Valley	-	1	Moderate	No change	No change	Neutral	Neutral
9.4	Beltany and Tullanafoile Farmlands	2.4km	1	Moderate	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse
9.5	Knockmany Ridgeline	3.5km	1	High	Major Adverse	Major Adverse	Large Adverse	Large Adverse
9.6	Ballymackilroy Moraines	1.6km	1	High	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse
LCZ 10 Clogher Valley								
10.1	Clogher and Augher Drumlin Farmlands	2.6km	1	Moderate	Minor Adverse	Minor Adverse	Slight Adverse	Slight Adverse
10.2	Ballygawley and Ballyreagh A4 Corridor	1.0km	1	Moderate	Negligible	Negligible	Neutral	Neutral
LCZ 11 Blackwater Valley								
11.1	Black Hill and Aughnacloy Drumlins	7.9km	3	Moderate	Moderate Adverse	Minor Adverse	Moderate Adverse	Slight Adverse
11.2	Blackwater Drumlins	1.2km	3	High	Minor Adverse	Minor Adverse	Slight Adverse	Slight Adverse
11.3	Favour Royal Forest	-	3	High	No Change	No Change	Neutral	Neutral
LCZ 12 Branny Hill								
12.1	Branny Hill	-	3	Moderate	No Change	No Change	Neutral	Neutral
Urban Centres								
U1	Strabane Urban Centre	1.1km	2	Moderate	Moderate Adverse	Minor Adverse	Moderate Adverse	Slight Adverse
U1	Strabane (Urney Road)	0.9km	2	Moderate	Major Adverse	Major Adverse	Large Adverse	Large Adverse
U2	Sion Mills	-	2	High	Negligible	Negligible	Neutral	Neutral
U3	Newtownstewart	-	2	High	Negligible	Negligible	Neutral	Neutral
U4	Omagh	-	2	Moderate	No Change	No Change	Neutral	Neutral

Ref No.	Description	Proposed Scheme Length	Phase	Sensitivity to change	Magnitude of impact (Opening Year)	Magnitude of impact (Future assessment year)	Predicted effect (Opening year)	Predicted effect (Future assessment year)
U5	Aughnacloy	-	3	High	Negligible	Negligible	Neutral	Neutral

10.7 Predicted effects and mitigation – visual context

- 10.7.1 The findings of the assessment for receptors identified within the 15 sections of the Proposed Scheme corridor used for the purposes of describing visual effects are scheduled in the visual impact tables in Appendix 10E. Receptor groups identified in the visual impact tables and effect specific to individual receptors within groups in the opening year and future assessment year are shown in Figures 10.24 – 10.83.
- 10.7.2 Summaries of the predicted effects for each of the 15 sections are provided in Tables 10.11 to 10.25 below. Each table is followed by a brief description of the location where receptors would be subject to effects of moderate adverse, or greater, in the future assessment year. The bracketed and underscored references for these receptors refer to the receptor groupings as shown in the figures, which then enable effects on specific receptors to be identified.
- 10.7.3 Potential effects on receptors within approved development sites are summarised with reference to sites as identified in Figures 10.24 – 10.83.
- 10.7.4 Impacts during construction are assessed by receptor groupings, with a summary description provided for areas where effects would be large adverse or greater.
- 10.7.5 Receptors which would be affected by two construction phases (Phases 1 and 2 at Junction 3 north of Strabane, Phases 1 and 2 at Junction 13 south of Omagh, Phases 1 and 3 at Junction 15 Ballygawley) are highlighted in Figures 10.24 – 10.83. Summaries of the predicted effects on receptors for each phase of construction and the consequent implication on timescales of visual effect are provided at the end of this section.
- 10.7.6 Photomontages and descriptions of the likely changes in view in the year of opening and in year 15 from key viewpoints along the Proposed Scheme corridor are presented in Appendix 10F.
- V1: New Buildings to Burn Dennet**
- 10.7.7 The numbers of receptors which would be subject to visual effects in the opening and future assessment years are summarised below and sub-divided in greater detail in Appendix 10E. Refer also to Figures 10.24 – 10.31 for the location of each of the receptor groupings and approved developments referenced.

Table 10.11: Summary of visual effects, V1: New Buildings to Burn Dennet

Description	Opening year						Future assessment year						Total
	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	
Receptors	23	713	170	180	79	1	65	848	193	60	0	0	1166
NCN 92 (Ballougrgy)				*					*				
NCN 92 (Binnion)			*					*					
NCN 93			*						*				
Foyle Canoe Trail			*						*				

10.7.8 Comparison of effects between the opening year and future assessment year when mitigation would be established demonstrates that:

- very large adverse effects would reduce from 1 to none;
- large adverse effects would reduce from 79 to none; and
- moderate adverse effects would reduce from 180 to 60.

10.7.9 The following receptor groups would be subject to moderate adverse effects in the future assessment year:

- properties along Victoria Road and Edgewater, New Buildings (V1-05, V1-07);
- individual properties along the existing A5 between New Buildings and Magheramason (V1-10);
- properties on the western edge of Magheramason along Dunnalong Road (V1-16 and V1-19);
- a single property off Victoria Road (V1-30);
- scattered properties off the existing A5 and Donaghedy Road to the south of Bready (V1-43 and V1-44);
- properties and farmsteads off Willow Road (V1-48 and V1-49); and
- properties on Ash Avenue and Drumenny Road (V1-52, V1-53 and V1-55).

10.7.10 Approved development would increase the number of receptors with a potential view of the Proposed Scheme by an estimated 240 residential properties. Of these, 14 would be

subject to potentially large adverse effects in the future assessment year (12 at P-004, 1 at P-007 and 1 at P-012) and 12 subject to potentially moderate adverse effects (2 at P-002 and estimated 10 at P-005). The remaining receptors would be subject to no more than slight adverse visual effects in the future assessment year.

10.7.11 Construction impacts would be most significant at the following locations:

- properties situated between Junctions J1 and J2 south of New Buildings - junction roundabouts and connecting routes and proposed satellite compound situated in proximity to J2 (V1-04, V1-05, V1-07, V1-08, V1-09, V1-10);
- properties on the western fringes of Magheramason - main alignment and overbridge construction for Dunalong Road (V1-16, V1-24);
- Bready - extensive cutting formation and overbridge construction crossing the existing A5 (V1-34, V1-35, V1-37, V1-39, V1-40);
- Donaghedy Road – proximity of construction works, overbridge construction for Donaghedy Road, deposition area, proposed main site compound location (V1-42, V1-43, V1-44, V1-47);
- Willow Road and Ash Avenue – proximity of construction works, overbridge construction across existing A5 (V1-48, V1-49, V1-51, V1-52, V1-53); and
- Burn Dennet Bridge – floodplain embankments and bridging of the Burn Dennet River (V1-53, V1-54, V1-55, V1-56).

V2: Burn Dennet to Strabane

10.7.12 The numbers of receptors which would be subject to visual effects in the opening and future assessment years are summarised below and sub-divided in greater detail in Appendix 10E. Refer also to Figures 10.30 – 10.35 for the location of each of the receptor groupings and approved developments referenced.

Table 10.12: Summary of visual effects, V2: Burn Dennet to Strabane

Description	Opening year						Future assessment year						Total
	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	
Receptors	3	52	151	56	17	2	3	209	48	11	10	0	281
Central Sperrins Driving Route			*					*					
Strabane Canal			*					*					

- 10.7.13 Comparison of effects between the opening year and future assessment year when mitigation would be established demonstrates that:
- very large adverse effects would reduce from 2 to none;
 - large adverse effects would reduce from 17 to 10; and
 - moderate adverse effects would reduce from 56 to 11.
- 10.7.14 Large adverse effects in the future assessment year would relate to:
- properties on Cloughcor Grove (V2-05);
 - single properties on Park Road (V2-12 and V2-16);
 - a single property on the A5 Victoria Road (V2-19); and
 - properties on Spruce Road (V2-20).
- 10.7.15 Moderate adverse effects in the future assessment year would relate to:
- properties off Ballydonagh Road in Cloghcor (V2-03 and V2-05);
 - a single elevated property on Lowerton Road (V2-09);
 - a single property north of Ballymagorry on Greenlaw Road (V2-10);
 - properties north of Strabane off Park Road (V2-17); and
 - properties north of Strabane on the A5 Victoria Road (V2-22).
- 10.7.16 Approved development would increase the number of receptors with a potential view of the Proposed Scheme by 71 residential properties. Of these, an estimated 5 would be subject to potentially moderate adverse effects in the future assessment year (an estimated 4 at P-015 and 1 at P-018). The remaining receptors would be subject to no more than slight adverse visual effects in the future assessment year.
- 10.7.17 Construction impacts would be most significant at the following locations:
- Cloghcor – proximity of construction works on high embankment (V2-02, V2-03, V2-04, V2-05);
 - Greenlaw Road and Park Road – proximity of embankment construction within floodplain and bridging over Park Road (V2-10, V2-12); and
 - Junction 3, north of Strabane – junction infrastructure, proximity of construction works, proposed satellite compound location (V2-16, V2-19, V2-20, V2-22).

V3: Strabane and Lifford (Construction Phase 2)

- 10.7.18 The numbers of receptors which would be subject to visual effects in the opening year and future assessment years are summarised below and sub-divided in greater detail in Appendix 10E. Refer also to Figures 10.34 – 10.37 for the location of each of the receptor groupings and approved developments referenced.

Table 10.13: Summary of visual effects, V3: Strabane and Lifford

Description	Opening year						Future assessment year						Total
	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	
Receptors	0	150	472	96	88	10	0	518	209	27	62	0	816
NCN 92			*						*				-
Central Sperrin Driving Route			*						*				-
Foyle Canoe Trail			*					*					-

10.7.19 Comparison of effects between the opening year and future assessment year when mitigation would be established demonstrates that:

- very large adverse effects would reduce from 10 to none;
- large adverse effects would reduce from 88 to 62; and
- moderate adverse effects would reduce from 96 to 27.

10.7.20 Large adverse effects in the future assessment year would relate to:

- a row of properties north of Strabane on the A5 Victoria Road (V3-04);
- properties at Barnhill Court adjacent to the existing A5 (V3-08);
- a property on Park Road north of Strabane (V3-09);
- a property on Lifford Road immediately north of the River Foyle (V3-14); and
- properties off Urney Road and Glenfinn Park in the west of Strabane (V3-21, V3-23 and V3-24). Refer to Appendix 10F Figure 10F.19.

10.7.21 Moderate adverse effects in the future assessment year would relate to:

- properties north of Strabane on the A5 Victoria Road (V3-01);
- properties on Park Road north of Strabane (V3-09);
- properties on Lifford Road immediately north of the River Foyle (V3-14);
- properties on the A5 Great Northern Link (V3-19 and V3-20);
- properties off Urney Road and Glenfinn Park in the west of Strabane (V3-23). Refer to Appendix 10F Figure 10F.19.

10.7.22 Construction impacts would be most significant at the following locations:

- A5 Victoria Road, north of Strabane – proximity of embankment construction across wide fields of view (V3-01, V3-03, V3-04, V3-08);
- Park Road – immediate proximity of construction (V3-09);
- Lifford Road and A5, Mourne River – proximity of embankment construction, junction infrastructure (J4, J5 and J6) and bridge crossing of the Mourne River (V3-14, V3-18, V3-19); and
- Urney Road and Glenfinn Park – immediate proximity of construction, roundabout construction (J7) adjacent to the Finn River (V3-21, V3-23, V3-24).

V4: Strabane to Sion Mills (Construction Phase 2)

10.7.23 The numbers of receptors which would be subject to visual effects in the opening and future assessment years are summarised below and sub-divided in greater detail in Appendix 10E. Refer also to Figures 10.38 – 10.41 for the location of each of the receptor groupings and approved developments referenced.

Table 10.14: Summary of visual effects, V4: Strabane to Sion Mills

Description	Opening year						Future assessment year						Total
	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	
Receptors	0	171	323	82	31	1	9	477	89	24	9	0	608
Sperrin Route 6			*						*				-
Central Sperrin Driving Route		*						*					-

10.7.24 Comparison of effects between the opening year and future assessment year when mitigation would be established demonstrates that:

- very large adverse effects would reduce from 1 to none;
- large adverse effects would reduce from 31 to 9; and
- moderate adverse effects would reduce from 82 to 24.

10.7.25 Large adverse effects in the future assessment year would relate to:

- scattered receptors to the south of Strabane on Strahans Road, Knockroe Road and Orchard Road (V4-01, V4-06 and V4-07);
- scattered receptors off Peacock Road to the north of Sion Mills (V4-09);
- a small group of receptors on Garden Road to the south of Sion Mills (V4-20); and

- a single receptor on High Road (V4-23).

10.7.26 Moderate adverse effects in the future assessment year would relate to:

- scattered receptors off Orchard Road and Peacock Road to the north of Sion Mills (V4-07, V4-10 and V4-11);
- properties on the western edge of Sion Mills on Lismore Grove, Rose Vale and Primrose Park (V4-12, V4-14 and V4-17); and
- a small group of receptors on Garden Road to the south of Sion Mills (V4-20).

10.7.27 Approved development would increase the number of receptors with a potential view of the Proposed Scheme by 3 residential properties and 2 other developments. Of these, 2 of the properties would be subject to potentially large adverse effects in the future assessment year (2 within receptor group P-024) and 1 subject to potentially moderate adverse effects (P-026). The remaining receptors would be subject to no more than slight adverse visual effects in the future assessment year.

10.7.28 Construction impacts would be most significant at the following locations:

- Strahans Road, Knockroe Road and Orchard Road, south west of Strabane – proximity of construction, overbridge construction for Strahans Road and Orchard Road (V4-01, V4-06, V4-07);
- Junction 8, north of Sion Mills – junction infrastructure (V4-09, V4-10); and
- Sion Mills – proximity of significant cutting excavation and overbridge construction for Primrose Park and Bellsparck Road (V4-12, V4-14, V4-17, V4-19, V4-20, V4-23).

V5: Sion Mills to Ardstraw (Construction Phase 2)

10.7.29 The numbers of receptors which would be subject to visual effects in the opening and future assessment years are summarised below and sub-divided in greater detail in Appendix 10E. Refer also to Figures 10.40 – 10.45 for the location of each of the receptor groupings and approved developments referenced.

Table 10.15: Summary of visual effects, V5: Sion Mills to Ardstraw

Description	Opening year						Future assessment year						Total
	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	
Receptors	0	54	84	21	8	0	0	122	36	6	3	0	167
NCN 92			*					*					
Central Sperrin Scenic Driving Route			*					*					

- 10.7.30 Comparison of effects between the opening year and future assessment year when mitigation would be established demonstrates that:
- large adverse effects would reduce from 8 to 3; and
 - moderate adverse effects would reduce from 21 to 6.
- 10.7.31 Large adverse effects in the future assessment year would relate to:
- properties on Seein Road (V5-03); and
 - a single receptor on Concess Road (V5-05).
- 10.7.32 Moderate adverse effects in the future assessment year would relate to scattered properties on Concess Road, Fyfin Road and Urbalreagh Road (V5-06, V5-08, V5-14, V5-16 and V5-19).
- 10.7.33 Approved development would increase the number of receptors with a potential view of the Proposed Scheme by an estimated 150 residential properties. Of these, 1 would be subject to potentially moderate adverse effects in the future assessment year (P-032). The remaining receptors would be subject to no more than slight adverse visual effects in the future assessment year.
- 10.7.34 Construction impacts would be most significant at the following locations:
- Seein Road – re-alignment of Seein Road and overbridge construction, significant embankment construction (V5-02, V5-03);
 - Victoria Bridge Junction 9 – junction infrastructure, satellite compound (V5-08, V5-09); and
 - Urbalreagh Road – proximity of construction (V5-12, V5-14, V5-16, V5-19).

V6: Ardstraw to Newtownstewart (Construction Phase 2)

- 10.7.35 The numbers of receptors which would be subject to visual effects in the opening and future assessment years are summarised below and sub-divided in greater detail in Appendix 10E. Refer also to Figures 10.44 – 10.47 for the location of each of the receptor groupings and approved developments referenced.

Table 10.16: Summary of visual effects, V6: Ardstraw to Newtownstewart

Description	Opening year						Future assessment year						Total
	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	
Receptors	0	25	35	15	10	0	0	60	13	9	3	0	85
Central Sperrin Driving Route			*						*				

NCN 92			*					*					
NCN 95			*					*					

10.7.36 Comparison of effects between the opening year and future assessment year when mitigation would be established demonstrates that:

- large adverse effects would reduce from 10 to 3; and
- moderate adverse effects would reduce from 15 to 9.

10.7.37 Large adverse effects in the future assessment year would relate to properties on Magheracoltan Road (V6-08 and V6-09).

10.7.38 Moderate adverse effects in the future assessment year would relate to:

- scattered properties along Millbrook Road and Magheracoltan Road (V6-04, V6-05, V6-07, V6-09 and V6-10); and
- properties off Drumlegagh Road North and Baronscourt Road (V6-12 and V6-13).

10.7.39 Approved development would increase the number of receptors with a potential view of the Proposed Scheme by an estimated 2 residential properties and a horse riding centre (P-035). Of these, 1 would be subject to potentially moderate adverse effects in the future assessment year (P-035). The remaining receptors would be subject to no more than slight adverse visual effects in the future assessment year.

10.7.40 Construction impacts would be most significant at the following locations:

- Magheracoltan Road and Deerpark Road – proximity of construction, bridge crossing of the Derg River, overbridge constructions for Derg Road and Deerpark Road, overbridge earthworks across Magheracoltan Road (V6-01, V6-03, V6-04, V6-05, V6-08, V6-09, V6-10, V6-11); and
- Junction 10 – junction infrastructure, candidate satellite compound (V6-12, V6-13).

V7: Newtownstewart to Mountjoy (Construction Phase 2)

10.7.41 The numbers of receptors which would be subject to visual effects in the opening and future assessment years are summarised below and sub-divided in greater detail in Appendix 10E. Refer also to Figures 10.46 – 10.53 for the location of each of the receptor groupings and approved developments referenced.

Table 10.17: Summary of visual effects, V7: Newtownstewart to Mountjoy

Description	Opening year						Future assessment year						Total
	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	
Receptors	0	27	108	41	20	0	0	128	51	14	3	0	196

Description	Opening year						Future assessment year						Total
	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	
The Ulster Way (Quality Length)				*					*				
Robbers Table (PROW and route)		*						*					
NCN 92				*					*				
NCN 95				*					*				
South Sperrin Scenic Driving Route			*						*				

10.7.42 Comparison of effects between the opening year and future assessment year when mitigation would be established demonstrates that:

- large adverse effects would reduce from 20 to 3; and
- moderate adverse effects would reduce from 41 to 14.

10.7.43 Large adverse effects in the future assessment year would relate to:

- isolated properties along Oldcastle Road (V7-03 and V7-04); and
- Harry Avery's Castle (V7-09).

10.7.44 Moderate adverse effects in the future assessment year would relate to:

- isolated properties along Oldcastle Road and Glen Road (V7-02, V7-04, V7-08 and V7-11);
- scattered properties on West Road, Castletown Road and Killinure Road, with moderate adverse impacts (V7-12, V7-13, V7-14 and V7-22); and
- scattered properties on Cashty Road (V7-29);

10.7.45 Approved development would increase the number of receptors with a potential view of the Proposed Scheme by 4 residential properties. Of these, 3 would be subject to potentially moderate adverse effects in the future assessment year (P-036, P-037 and P-040). The remaining receptor would be subject to no more than slight adverse visual effects in the future assessment year.

10.7.46 Construction impacts would be most significant at the following locations:

- Oldcastle Road and Harry Avery's Castle – significant cutting excavation and overbridge construction for Oldcastle Road (V7-02, V7-03, V7-04, V7-09);
- Glen Road and Gortgranagh Road – re-alignment of local roads, significant cutting excavation, candidate aggregate processing area (V7-07, V7-08, V7-10);
- Strule Valley – significant site cutting excavation, proximity of construction works, candidate main compound location (V7-12, V7-13, V7-14, V7-17, V7-19, V7-20, V7-22, V7-25, V7-26, V7-27); and
- Cashty Road – proximity and exposure of construction (V7-29).

V8: Mountjoy to Gillygooley Road (Construction Phase 2)

10.7.47 The numbers of receptors which would be subject to visual effects in the opening and future assessment years are summarised below and sub-divided in greater detail in Appendix 10E. Refer also to Figures 10.52 – 10.57 for the location of each of the receptor groupings and approved developments referenced.

Table 10.18: Summary of visual effects, V8: Mountjoy to Gillygooley Road

Description	Opening year						Future assessment year						Total
	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	
Receptors	0	1	78	37	14	0	0	77	33	18	2	0	130
South Sperrins Driving Route			*						*				

10.7.48 Comparison of effects between the opening year and future assessment year when mitigation would be established demonstrates that:

- large adverse effects would reduce from 14 to 2; and
- moderate adverse effects would reduce from 37 to 18

10.7.49 Large adverse effects in the future assessment year would relate to properties off Lisnagirr Road (V8-05).

10.7.50 Moderate adverse effects in the future assessment year would relate to:

- scattered receptors off Lisnagirr Road and Tully Road (V8-02 and V8-07);
- properties on Drumlegagh Road South (V8-08);
- a single property off Mellon Park Drive (V8-12); and
- a single property off Gillygooley Road (V8-15).

10.7.51 Approved development would increase the number of receptors with a potential view of the Proposed Scheme by an estimated 196 residential properties. Of these, 2 would be subject to potentially large adverse effects in the future assessment year (P-044 and P-045) and an estimated 55 subject to potentially moderate adverse effects (an estimated 12 at P-041, 2 at P-043, 1 at P-046 and an estimated 40 at P-047). The remaining receptors would be subject to no more than slight adverse visual effects in the future assessment year.

10.7.52 Construction impacts would be most significant at the following locations:

- Dunteige Road – construction of overbridge to Dunteige Road, exposure of construction (V8-02, V8-03);
- Lisnagirr Road – construction of overbridge embankments (V8-05);
- Tully Road – proximity of construction, re-alignment of Rash Road via overbridge (V8-07);
- Junction 11 – junction infrastructure, candidate satellite compound (V8-08, V8-10); and
- Mellon Park Drive and Gillygooley Road – local re-alignment and overbridge construction for both roads, proximity of construction (V8-12, V8-15, V8-16).

V9: Gillygooley Road to Doogary (Construction Phase 2)

10.7.53 The numbers of receptors which would be subject to visual effects in the opening and future assessment years are summarised below and sub-divided in greater detail in Appendix 10E. Refer also to Figures 10.56 – 10.61 for the location of each of the receptor groupings and approved developments referenced.

Table 10.19: Summary of visual effects, V9: Gillygooley Road to Doogary

Description	Opening year						Future assessment year						Total
	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	
Receptors	0	36	60	26	15	0	0	86	30	20	1	0	137
South Sperrins Driving Route			*						*				

10.7.54 Comparison of effects between the opening year and future assessment year when mitigation would be established demonstrates that:

- large adverse effects would reduce from 15 to 1; and
- moderate adverse effects would reduce from 26 to 20.

- 10.7.55 Large adverse effects in the future assessment year would relate to a single property on Beagh Road (V9-17).
- 10.7.56 Moderate adverse effects in the future assessment year would relate to:
- scattered properties on Mullaghmena and Aghnamoyle Road to the north of Omagh (V9-02, V9-03);
 - scattered properties on Bracken Road, Brookmount Road and off Loughmuck Road to the west and south of Omagh (V9-05, V9-08, V9-09, V9-15);
 - properties on Beagh Road (V9-16); and
 - scattered receptors on Blackfort Road and Drumragh Road (V9-21, V9-23 and V9-24).
- 10.7.57 Approved development would increase the number of receptors with a potential view of the Proposed Scheme by an estimated 222 residential properties. Of these, 2 would be subject to potentially moderate adverse effects in the future assessment year (P-049 and P-053). The remaining receptors would be subject to no more than slight adverse visual effects in the future assessment year.
- 10.7.58 Construction impacts would be most significant at the following locations:
- Aghnamoyle Road – exposure of construction, construction of overbridge for Aghnamoyle Road (V9-01, V9-02, V9-03);
 - Bracken Road – proximity of construction, overbridge construction for Tamlaght Road (V9-05);
 - Junction 12 – junction infrastructure and associated earthworks, candidate satellite compound, overbridge construction for Loughmuck Road (V9-08, V9-09, V9-15);
 - Beagh Road – construction of overbridge, proximity of mainline construction (V9-17);
 - Blackfort Road and Drumnargh Road – extensive local cutting and embankment formation, proximity of mainline construction, overbridge construction for Blackfort Road (V9-21, V9-23, V9-24); and
 - Brookmount Road north of Junction 12 – embankment construction across Brookmount Road.

V10: Doogary to Moylagh (Construction Phase 1)

- 10.7.59 The numbers of receptors which would be subject to visual effects in the opening and future assessment years are summarised below and sub-divided in greater detail in Appendix 10E. Refer also to Figures 10.60 – 10.65 for the location of each of the receptor groupings and approved developments referenced.

10.7.60

Table 10.20: Summary of visual effects, V10: Doogary to Moylagh

Description	Opening year						Future assessment year						Total
	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	
Receptors	0	5	32	22	23	3	0	17	35	18	15	0	85
NCN 92			*						*				

10.7.61 Comparison of effects between the opening year and future assessment year when mitigation would be established demonstrates that:

- very large adverse effects would reduce from 3 to none;
- large adverse effects would reduce from 23 to 15; and
- moderate adverse effects would reduce from 22 to 18.

10.7.62 Large adverse effects in the future assessment year would relate to:

- a small group of properties on Doogary Road (V10-09) Refer to Appendix 10F Figure 10F.23;
- properties off Tullyrush Road (V10-15, V10-17 and V10-20); and
- scattered properties off Rarone Road and Augher Point Road (V10-23 and V10-27).

10.7.63 Moderate adverse effects in the future assessment year would relate to:

- scattered receptors on Blackfort Road and Drumragh Road (V10-04);
- properties on the existing A5 Doogary Road (V10-05 and V10-11);
- properties off Tullyrush Road (V10-18 and V10-19); and
- scattered properties off Rarone Road and Augher Point Road (V10-22, V10-26, V10-27, V10-28 and V10-29).

10.7.64 Approved development would increase the number of receptors with a potential view of the Proposed Scheme by an estimated 8 residential properties and 1 guest house. Of these, 3 would be subject to potentially large adverse effects in the future assessment year (1 at P-055 and 2 at P-057) and 1 subject to potentially moderate adverse effects (P-060). The remaining receptors would be subject to no more than slight adverse visual effects in the future assessment year.

10.7.65 Construction impacts would be most significant at the following locations:

- Tattykeel – proximity of mainline construction, J13 infrastructure and earthworks, overbridge construction for Tattykeel Road (V10-04, V10-05);
- Drumconnelly Road and Tattykeel Road – proximity of mainline construction, overbridge construction and re-alignment of Drumconnelly Road (V10-09, V10-11, V10-13);
- Tullyrush Road – mainline crossing of Tullyrush Road on embankment, proximity of mainline construction (V10-15, V10-17, V10-18, V10-19, V10-20);
- Rarone Road – overbridge construction for Rarone Road, deposition area, proximity of mainline construction (V10-22, V10-23); and
- Augher Point Road – proximity of mainline construction within wide fields of view (V10-27, V-28, V-29).

V11: Moylagh to Newtownsaville (Construction Phase 1)

10.7.66 The numbers of receptors which would be subject to visual effects in the opening and future assessment years are summarised below and sub-divided in greater detail in Appendix 10E. Refer also to Figures 10.66 – 10.69 for the location of each of the receptor groupings and approved developments referenced.

Table 10.21: Summary of visual effects, V11: Moylagh to Newtownsaville

Description	Opening year						Future assessment year						Total
	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	
Receptors	0	12	25	16	18	0	0	27	21	14	9	0	71

10.7.67 Comparison of effects between the opening year and future assessment year when mitigation would be established demonstrates that:

- large adverse effects would reduce from 18 to 9;
- moderate adverse effects would reduce from 16 to 14.

10.7.68 Large adverse effects in the future assessment year would relate to:

- properties off Moylagh Road and Augher Point Road (V11-01 and V11-02). Refer to Appendix 10F Figures 10F.11 and 10F.12;
- properties off Greenmount Road and Killadroy Road (V11-08, V11-11, V11-12 and V11-13); and
- a single property on Routingburn Road (V11-15).

- 10.7.69 Moderate adverse effects in the future assessment year would relate to:
- properties off Moylagh Road and Augher Point Road (V11-01, V11-02 and V11-04). Refer to Appendix 10F Figures 10F.11 and 10F.12;
 - properties off Greenmount Road and Killadroy Road (V11-10 and V11-12);
 - scattered properties on Killadroy Road and Routingburn Road (V11-15 and V11-18); and
 - a single property north of Newtownsaville (V11-17).
- 10.7.70 Approved development would increase the number of receptors with a potential view of the Proposed Scheme by an estimated 5 residential properties. Of these, 3 would be subject to potentially moderate adverse effects in the future assessment year (2 at P-062 and 1 at P-064). The remaining receptors would be subject to no more than slight adverse visual effects in the future assessment year.
- 10.7.71 Construction impacts would be most significant at the following locations:
- Moylagh – J14 infrastructure, raised embankment, proximity of mainline construction (V11-01, V11-02, V11-04);
 - Killadroy Road and Greenmount Road – mainline overbridge and associated embankment earthworks across Killadroy Road and Greenmount Road, local road re-alignment earthworks, candidate satellite compound (V11-08, V11-10, V11-11, V11-12, V11-13); and
 - Routingburn and isolated properties north of Newtownstewart – Bridging structure across Routing Burn valley, proximity of mainline construction (V11-14, V11-15, V11-17).

V12: Newtownsaville to Errigal (Construction Phase 1)

- 10.7.72 The numbers of receptors which would be subject to visual effects in the opening and future assessment years are summarised below and sub-divided in greater detail in Appendix 10E. Refer also to Figures 10.68 – 10.73 for the location of each of the receptor groupings and approved developments referenced.

Table 10.22: Summary of visual effects, V12: Newtownsaville to Errigal

Description	Opening year						Future assessment year						Total
	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	
Receptors	0	0	14	19	24	1	0	5	28	11	14	0	58
Carleton Trail		*						*					

- 10.7.73 Comparison of effects between the opening year and future assessment year when mitigation would be established demonstrates that:
- very large adverse effects would decrease from 1 to none;
 - large adverse effects would decrease from 24 to 14; and
 - moderate adverse effects would reduce from 19 to 11.
- 10.7.74 Large adverse effects in the future assessment year would relate to:
- properties along Rockmore Road, Newtownsaville Road and Tullanafoile Road (V12-02, V12-03, V12-07 and V12-08);
 - scattered receptors properties along School Road, Newtownsaville Road, Cormore Road and Tullanafoile Road (V12-11, V12-12, V12-17 and V12-18); and
 - isolated properties along Newtownsaville Road (V12-20, V12-21, V12-22 and V12-25).
- 10.7.75 Moderate adverse effects in the future assessment year would relate to:
- scattered properties along School Road, Newtownsaville Road, Cormore Road and Tullanafoile Road (V12-08, V12-09, V12-10, V12-13, V12-15, V12-16 and V12-17); and
 - a single property along Newtownsaville Road (V12-20).
- 10.7.76 Approved development would increase the number of receptors with a potential view of the Proposed Scheme by an estimated 20 residential properties. Of these, 14 would be subject to potentially moderate adverse effects in the future assessment year (4 at P-066, an estimated 6 at P-067, 1 at P-069, 1 at P-070, 1 at P-071 and 1 at P-072). The remaining receptors would be subject to no more than slight adverse visual effects in the future assessment year.
- 10.7.77 Construction impacts would be most significant at the following locations:
- Newtownsaville – proximity of mainline construction and embankment earthworks, overbridge across Springhill Road (V12-01 to V12-07);
 - Newtownsaville Road – road construction within remote and secluded valley length, local high embankment and overbridge construction across Tullanafoile Road, deposition areas (V12-08 to V12-13, V12-15 to V12-18);
 - Tycanny – extensive cutting across hill mass (V12-20, V12-21, V12-22); and
 - Newtownsaville Road, Errigal – proximity of mainline construction to local views (V12-25).

V13: Errigal to Ballygawley (Construction Phase 1)

- 10.7.78 The numbers of receptors which would be subject to visual effects in the opening and future assessment years are summarised below and sub-divided in greater detail in

Appendix 10E. Refer also to Figures 10.72 – 10.77 for the location of each of the receptor groupings and approved developments referenced.

Table 10.23: Summary of visual effects, V13: Errigal to Ballygawley

Description	Opening year						Future assessment year						Total
	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	
Receptors	0	45	58	26	11	1	0	77	37	17	10	0	141

10.7.79 Comparison of effects between the opening year and future assessment year when mitigation would be established demonstrates that:

- very large adverse effects would reduce from 1 to none;
- large adverse effects would reduce from 11 to 10; and
- moderate adverse effects would reduce from 26 to 17.

10.7.80 Large adverse effects in the future assessment year would relate to:

- properties around the junction of Glenhoy Road and Errigal Road (V13-03, V13-04, V13-05 and V13-07); and
- scattered properties on Feddan Road and one isolated property off the A4 to the south west of Ballygawley (V13-13, V13-14 and V13-19).

10.7.81 Moderate adverse effects in the future assessment year would relate to:

- properties on Glenhoy Road (V13-04, V13-06 and V13-07);
- properties at the junction of Ballynasaggart Road, Glenhoy Road and Feddan Road (V13-09);
- a single property off Sess Road (V13-12); and
- properties close to the junction of Feddan Road with the A4 corridor (V13-14, V13-21 and V13-22).

10.7.82 Approved development would increase the number of receptors with a potential view of the Proposed Scheme by an estimated 20 residential properties and a school extension. Of these, 1 would be subject to potentially large adverse effects in the future assessment year (P-074) and 2 subject to potentially moderate adverse effects (1 at P-077 and 1 at P-079). The remaining receptors would be subject to no more than slight adverse visual effects in the future assessment year.

10.7.83 Construction impacts would be most significant at the following locations:

- Glenhoy Road, Errigal – extensive cutting excavation, proximity of mainline construction, overbridge construction for Glenhoy Road (V13-03, V13-04, V13-05, V13-07);

- Ballynasaggart – construction visible across wide field of view (V13-09);
- Feddan Road – construction within exposed valley to views from properties on Feddan Road (V3-13, V13-14, V13-19); and
- Junction 15 – junction roundabout construction, candidate main compound, cutting excavations south of the A4, re-alignment of accommodation tracks via overbridge across the A4 (V13-21, V13-22).

V14: A4 Corridor to Aughnacloy (Construction Phase 3)

10.7.84 The numbers of receptors which would be subject to visual effects in the opening and future assessment years are summarised below and sub-divided in greater detail in Appendix 10E. Refer also to Figures 10.78 – 10.81 for the location of each of the receptor groupings and approved developments referenced.

Table 10.24: Summary of visual effects, V14: Ballygawley to Aughnacloy

Description	Opening year						Future assessment year						Total
	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	
Receptors	0	4	12	14	14	6	0	9	12	15	14	0	50

10.7.85 Comparison of effects between the opening year and future assessment year when mitigation would be established demonstrates that:

- very large adverse effects would reduce from 6 to none;
- large adverse effects would remain at 14; and
- moderate adverse effects would increase from 14 to 15 (the increase would be as a result of no receptors being subject to very large adverse effects at Year 15)

10.7.86 Large adverse effects in the future assessment year would relate to:

- a group of receptors on Tullywinny Road (V14-02 and V14-03);
- properties off Lisginny Road (V14-11 and V14-12); and
- scattered properties around Old Chapel Road and Old Chapel Road Spur to the north of Aughnacloy (V14-14 and V14-17).

10.7.87 Moderate adverse effects in the future assessment year would relate to:

- a cluster of properties at the junction of Ballynany Road and Tullywinny Road (V14-01 and V14-04);
- a group of receptors off Lisginny Road (V14-08, V14-10); and

- scattered properties around Old Chapel Road and Old Chapel Road Spur to the north of Aughnacloy (V14-13 and V14-16).

10.7.88 Approved development would increase the number of receptors with a potential view of the Proposed Scheme by 3 residential properties. Of these, 2 would be subject to potentially large adverse effects in the future assessment year (P-086 and P-087). The remaining receptor would be subject to no more than slight adverse visual effects in the future assessment year.

10.7.89 Construction impacts would be most significant at the following locations:

- Lisdoart – Bridge crossing of Ballygawley Water, significant cutting earthworks north of Lisdoart Road, embankment and overbridge crossing of Tullywinny Road (V14-01 to V14-04);
- Lisginny Road – proximity of mainline construction, overbridge construction for Lisginny Road (V14-10 to V14-12); and
- Old Chapel Road – proximity of mainline construction, overbridge construction and associated earthworks for re-alignment of Old Chapel Road (V14-13, V14-14, V14-17, V14-18).

V15: Aughnacloy (Construction Phase 3)

10.7.90 The numbers of receptors which would be subject to visual effects in the opening and future assessment years are summarised below and sub-divided in greater detail in Appendix 10E. Refer also to Figures 10.80 – 10.83 for the location of each of the receptor groupings and approved developments referenced.

Table 10.25: Summary of visual effects, V15: Aughnacloy

Description	Opening year						Future assessment year						Total
	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	
Receptors	0	2	35	30	13	1	0	7	50	21	3	0	81
The Ulster Way (Link Section)		*						*					

10.7.91 Comparison of effects between the opening year and future assessment year when mitigation would be established demonstrates that:

- very large adverse effects would reduce from 1 to none;
- large adverse effects would reduce from 13 to 3; and
- moderate adverse effects would reduce from 30 to 21.

- 10.7.92 Large adverse effects in the future assessment year would relate to:
- properties off the existing A5 to the north of Aughnacloy (V15-02 and V15-06); and
 - a single property on Rehaghy Road to the east of Aughnacloy (V15-11).
- 10.7.93 Moderate adverse effects in the future assessment year would relate to:
- an isolated property off Carnteel Road north of Aughnacloy (V15-08);
 - a single property on Rehaghy Road to the east of Aughnacloy (V15-12); and
 - properties off the existing A5 and on the southern fringe of Aughnacloy (V15-14, V15-15, V15-17, V15-18 and V15-19).
- 10.7.94 Approved development would increase the number of receptors with a potential view of the Proposed Scheme by an estimated 55 residential properties and 1 other development. Of these, 5 would be subject to potentially large adverse effects in the future assessment year (1 at P-089, 1 at P-090, 1 at P-091 and 2 at P-094) and 21 subject to potentially moderate adverse effects (P-094). The remaining receptors would be subject to no more than slight adverse visual effects in the future assessment year.
- 10.7.95 Construction impacts would be most significant at the following locations:
- Junction 16 north of Aughnacloy – junction infrastructure, proximity of mainline construction (V15-02, V15-06, V15-08);
 - Rehaghy Road – Overbridge and embankment earthworks across Rehaghy Road (V15-11, V15-12); and
 - Junction 17 Caledon Road – roundabout construction, deposition area, extensive cutting formation (V15-14, V15-15, V15-18).

Visual effects associated with phased construction

- 10.7.96 The receptors which would be affected by two construction phases (Phases 1 and 2 at Junction 3 north of Strabane, Phases 1 and 2 at Junction 13 south of Omagh, Phases 1 and 3 at Junction 15 Ballygawley) are highlighted in Figures 10.24 – 10.83.
- 10.7.97 Summaries of the predicted effects on receptors for each phase of construction and the consequent implication on timescales of visual effect are provided as follows:
- Junction 3 (north of Strabane)*
- 10.7.98 A total of 27 properties (receptor groups V2-16, V2-17, V2-18, V2-19, V2-20, V2-21 and V2-22) would be subject to visual effects as a result of both Proposed Scheme phases 1 and 2.
- 10.7.99 Phase 1 of the road construction would impact on receptors primarily located to the immediate north of the junction (V2-16, V2-17, V2-18 and V2-19) such that the effects reported in the future assessment year would primarily relate to this phase of construction.

10.7.100 Properties on Spruce Road (V2-20) and those facing the Foyle valley along the existing A5 (V2-21 and V2-22) would be moderately affected by the Phase 1 junction construction in respect of oblique views; however they would be most heavily impacted upon by Phase 2 construction, such that the effects reported in the future assessment year would primarily relate to this phase.

Junction 13 (south of Omagh)

10.7.101 A total of 5 properties (receptor groups V10-01 and V10-03) would be subject to visual effects as a result of both Proposed Scheme phases 1 and 2.

10.7.102 Phase 1 of the road construction would have the greater impact on these receptors primarily located in the vicinity of the junction such that the effects reported in the Future assessment year would primarily relate to this phase of construction.

10.7.103 Phase 2 construction would be evident within views, although effects on these properties relate more to the construction of the junction and its associated earthworks, most of which would have been completed within Phase 1.

Junction 15 (Ballygawley)

10.7.104 A total of 7 properties (receptor groups V13-19, V13-20, V13-21, V13-22 and V13-23) would be subject to visual effects as a result of both Proposed Scheme phases 1 and 3.

10.7.105 Phase 1 of the road construction would include the roundabout location at the proposed junction with the A4 Annaghilla Road. Phase 1 would impact on receptors primarily located to the north of the junction (V13-19 and V13-20) and those with a direct view of the junction roundabout (V13-22 and V13-23) such that the effects reported in the Future assessment year would primarily relate to this phase of construction.

10.7.106 Phase 3 of the road construction would involve extensive cutting south of the A4 and a bridge construction across Ballygawley Water. Properties on Ballynany Road (V13-21) would be most affected by this aspect of construction, such that the effects reported in the Future assessment year would primarily relate to this phase. The farmstead adjacent to the proposed junction roundabout (V13-22) would experience additional visual effects as a result of the cutting excavation.

10.8 Conclusions and effects

Landscape character

10.8.1 The location of sections of the Proposed Scheme relative to the project specific LCSZs which it is predicted would result in the four orders of effect identified during the assessment is shown in Figure 10.17. The percentage of the Proposed Scheme corridor which it is predicted would be subject to the four orders of effect is detailed below.

- Neutral 2%
- Slight adverse 63%
- Moderate adverse 28%

- Large adverse 7%

10.8.2 There would be three localised parts of the Proposed Scheme corridor, which would be subject to a large adverse effect:

- the southern margin of the River Finn, to the west of Strabane (LCSZ U1);
- Deerpark in the vicinity of Harry Avery's Castle (LCSZ 7.1); and
- the Brougher Ridge landscape between Tycanny Hill and Errigal LCSZ 9.5).

10.8.3 It has been concluded the effects in these three localised parts of the Proposed Scheme corridor would constitute a significant environmental effect.

10.8.4 There would be three sections of the Proposed Scheme corridor where moderate impacts associated with LCSZs or groups of LCSZs would have a more extensive effect on the landscape of the assessment study area.

10.8.5 The developed, eastern margin of the Foyle Valley that accommodates the existing A5 between New Buildings and Strabane would not alter significantly. The effect on Gortmonly Hill would, however influence the perception of LCSZS 1.1 - 1.4 that constitute the Lower Foyle Valley to the west of the hill. Whilst there would not be a fundamental change in the character of the valley landscape, there would be a marked erosion of the inherent qualities and value of this part of the lower valley.

10.8.6 The Proposed Scheme would run along and within the western margin of the Sperrin AONB. The affected part of the AONB comprises the eastern slopes of Bessy Bell above the Strule Valley where the existing A5 is set low within the valley and the turbine development on the hill has a relatively wide ranging influence. The wider influence of the effects associated with the Proposed Scheme in this part of the AONB would be limited to distant views from higher ground, the road following a similar course with the existing A5 corridor, albeit at a higher and initially more exposed alignment. In the context of the AONB, the presence of the Proposed Scheme in a part of the designated landscape which is markedly influenced by the existing A5 and turbines on Bessy Bell and its containment relative to the substantial body of the designated landscape to the east would not result in it having a significant effect on the AONB.

10.8.7 Where the Proposed Scheme has a moderate adverse and large adverse effect on the Beltany and Tullanfoile Farmlands (LCSZ 9.4) and Knockmany Ridgeline (LCSZ 9.5) the effect of its presence and two deep, wide cuttings in the ridge crest at Tycanny and Errigal would have a wider significant effect on the perception of the Brougher and Slievemore Ridgeline LCZ.

Visual effects

10.8.8 The numbers of receptors it is predicted would be subject to the various orders of visual effect in the future assessment year are detailed in Table 10.26.

Table 10.26: Summary of visual effects

	Future assessment year Impacts						Total
	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse	Very Large Adverse	
Receptors	77	2667	885	285	158	0	4072

10.8.9 A total of 443 would be subject to the higher orders of impact of moderate adverse and large adverse. These affected receptors would be distributed throughout the Proposed Scheme corridor though there are a number of locations where there are distinct concentrations of receptors.

- properties along the edge of the Foyle Valley floodplain in New Buildings, Magheramason and Bready;
- the northern residential fringe of Strabane (Park Road, Spruce Road and the A5 Derry Road / Victoria Road);
- properties overlooking the River Finn, to the west of the Strabane (Urney Road, Glenfinn Park);
- properties between Lisnagirr Road and Drumlegagh Road South, to the northern fringe of Omagh;
- properties at or near Drumconnelly Road and Tattykeel Road, Doogary;
- clusters of properties and isolated properties between Tullyrush Road, Augher Point Road, Moylagh and the junction of Killadroy Road and Greenmount Road;
- Newtownsaville and isolated properties along Newtownsaville Road, at Errigal and Ballynasaggart;
- Lisdoart (Tully Road);
- properties at Lisginny Road, Old Chapel Road and the northern residential edge of Aughnacloy; and
- the southern residential edge of Aughnacloy.

11 ECOLOGY AND NATURE CONSERVATION

11.1 Executive summary

- 11.1.1 The ecology and nature conservation assessment focussed on the evaluation of the Proposed Scheme's potential impact on sites designated for nature conservation and biodiversity value, habitat and species of nature conservation value. This has allowed for mitigation to be proposed to avoid or reduce the severity of negative impacts on sensitive sites, habitats and species.
- 11.1.2 The Proposed Scheme would interact with the internationally important designated River Foyle, River Finn and Owenkillew River, as well as Tully Bog, however no significant deleterious effects are predicted.
- 11.1.3 The assessment has allowed for the scheme design and mitigation to be developed to avoid impacts arising or reduce their severity on these assets. Construction procedures have been proposed that would specify pollution control measures and the minimisation of damage to valuable habitats in the contractor's method statement.
- 11.1.4 The Proposed works would impact on a number of habitat types including Woodland, grassland, marsh, bog, watercourses and ponds. Impacts are likely to result from the permanent loss, fragmentation and disturbance of these habitats in the construction and operational phases. The Proposed Scheme would have the potential to impact upon a number of protected species of fauna. This include but are not limited to otters, bats, badger, newts, breeding birds and wintering birds. Adverse impacts would result from the loss or disturbance of breeding, resting and foraging sites, loss of habitat and potential killing/injury from the construction or operation of the Proposed Scheme. Works with the potential to impact on protected species would be carefully managed under license for the Northern Ireland Environment Agency (NIEA).

11.2 Scope of the assessments

- 11.2.1 The assessments relating to ecology and nature conservation have been focused on sites designated for their ecological / nature conservation value, and outside of such sites, aquatic habitats and fauna and terrestrial habitats and fauna.

Designated sites

- 11.2.2 Designated sites which have been considered include international, national and local designations. The international designations of relevance to the Proposed Scheme are Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar Sites. Nationally designated sites comprise Areas of Special Scientific Interest (ASSIs). Local wildlife sites include statutory and non-statutory sites.

11.2.3 The following sites have been subject to assessment:

- Lough Foyle SPA and Ramsar site
- Lough Swilly (including former Inch Lough and Levels) SPA
- River Foyle and Tributaries SAC and ASSI
- Owenkillew River SAC and ASSI
- River Finn (Republic of Ireland) SAC
- Tully Bog SAC and ASSI
- Lough Neagh and Lough Beg SPA / ASSI / Ramsar
- McKean's Moss parts I & II ASSI
- Strabane Glen ASSI
- Grange Wood ASSI
- Baronscourt ASSI
- Strabane Nature Reserve LWS

Aquatic habitats and fauna

11.2.4 The assessments for aquatic habitats and fauna have been focused on macrophytes and freshwater fish.

Macrophytes

11.2.5 The study area for macrophytes has been 13 sections of watercourse extending 250m upstream and downstream of the point at which the Proposed Scheme would cross them as scheduled below.

- Burn Dennet
- Glenmornan River
- River Mourne
- River Finn
- River Derg

- Fairy Water
- Aghnamoyle drain
- Loughmuck drain
- Drumragh River
- Froughmore drain
- Unnamed watercourse
- River Blackwater tributary
- Coolaghy Burn

11.2.6 The watercourses were selected following a review of surveys reported in the A5WTC ES 2010, which had established that many of the watercourses crossed by or in close proximity to the Proposed Scheme, do not support macrophyte assemblages of note. These are mainly heavily modified field drains, or sites subject to intense pollution from agriculture or sewage overflow resulting in high eutrophication thus severely limiting natural aquatic plant growth.

11.2.7 Access was refused for 7 of the 13 sites selected for survey. In the case of these, reference has been made to data included in the A5WTC ES 2010. This involved an assessment of the watercourses in the context of a more extensive study area adopted during the selection of the preferred alignment for the scheme proposed at that time.

Freshwater fish

11.2.8 The study area for freshwater fish has comprised 16 sections of watercourse which the Proposed Scheme would either cross or be in close proximity to. The location of the 16 sections is indicated in Figure 11.35. The 16 sections were selected following a Fisheries Habitat Survey (FHS) of 47 sections of watercourse which were, in turn, selected following a review of data obtained as part of a River Habitat Survey (RHS) completed during preliminary planning and selection of a preferred corridor for the Proposed Scheme.

Terrestrial habitats

11.2.9 The assessments for terrestrial habitats have been focused on:

- woodland and scrub;
- grassland and marsh
- bogs;

- ponds;
- hedgerows and veteran trees; and
- bryophytes.

11.2.10 The study area for the assessments has been the proposed land take as defined by the vesting line for the Proposed Scheme, land that would be temporarily required during construction, and a further 250m beyond the proposed vesting line and temporary areas.

Terrestrial fauna

11.2.11 The assessments for terrestrial fauna have been focused on:

- Otter;
- bats;
- red squirrel;
- pine marten;
- badger;
- Irish hare;
- Deer;
- wintering swan and goose;
- breeding birds;
- wintering birds; and
- smooth newt.

Otter

11.2.12 The study area adopted for otter has been focused on sections of watercourse which would be crossed by the Proposed Scheme or which are located within 500m of the land take for the Proposed Scheme. Information within a more extensive 3km study area either side of the Proposed Scheme which was adopted for the studies reported in the A5WTC ES 2010 has also been taken into account for the purposes of setting a broader context for presence of the species.

Bats

11.2.13 The study area for bats has been the proposed land take for the Proposed Scheme and land up to a further 500m from the land take boundary. Information within a more extensive study area adopted for the studies reported in the A5WTC ES 2010 has also

been taken into account for the purposes of setting a broader context for the presence of bats.

Red squirrel

- 11.2.14 The study area for red squirrel comprises 19 woodland sites located along or in close proximity to the Proposed Scheme alignment as indicated in Figures 11.44 – 11.58. Access was refused for 5 of the sites selected for survey. The 19 sites were selected following a preliminary review of woodlands within 2km of the land take boundary for the Proposed Scheme. Woodlands that were either greater than 5ha in area or smaller woodlands greater than 1ha in area, within 100m of other woodland (connected via linear habitat features) which aggregate to 5ha or more were selected. Information within a more extensive study area adopted for the studies reported in the A5WTC ES 2010 has also been taken into account for the purposes of setting a broader context for presence of the species.

Pine marten

- 11.2.15 The study area for pine marten has been 6 woodland sites located along or in close proximity to the Proposed Scheme alignment as indicated in Figures 11.59 – 11.64. The 6 sites were selected following a preliminary review of woodlands within 2km of the land take boundary for the Proposed Scheme. Blocks of woodland greater than 1km² together with smaller patches of woodland which aggregated to 5km² and were within 1 km of each other were selected. Riparian woodland greater than 10m wide which extended for more than 5km or which was located within 1km of other habitat totalling 5 km in length or 5km² in area was also selected. Information within a more extensive study area adopted for the studies reported in the A5WTC ES 2010 has also been taken into account for the purposes of setting a broader context for presence of the species.

Badger

- 11.2.16 The study area for badger has been the proposed land take for the Proposed Scheme and land up to a further 50m from the land take boundary.

Irish hare

- 11.2.17 There was no defined study area established for Irish hare, the site-based collection of data having been restricted to incidental recording of sightings during the conduct of other surveys for habitats and fauna.

Deer

- 11.2.18 The study area for deer has been the proposed land take for the Proposed Scheme and land up to a further 250m from the land take boundary.

Wintering swan and goose

- 11.2.19 The study area for wintering swan and goose has been the Foyle floodplain and land west of the existing A5 between Magheramason and the Burn Dennet and two groups of fields west of the River Foyle, one north of Saint Johnstown and one north of the Swilly Burn. The location and extent of the study area, which is indicated in Figures 11.67 and 11.68, has been informed by consultation with NIEA, RSPB and BTO.

Breeding birds

- 11.2.20 The study area for breeding birds has comprised 20 sites identified as being representative of the range of habitats along the Proposed Scheme corridor. The location of the sites is indicated in Figure 11P.1 in Appendix 11P. Access was refused for 6 of the 20 sites selected for survey. Information within a more extensive study area adopted for the studies reported in the A5WTC ES 2010 has also been taken into account for the purposes of setting a broader context for the presence of breeding birds.

Wintering birds

- 11.2.21 The study area for wintering birds has comprised 7 sites along the Proposed Scheme corridor identified as being representative of habitats favoured by wintering farmland birds and wintering waders. The location of the 7 sites is indicated in Figure 11Q.1 in Appendix 11Q. The selection of the 7 sites has been informed by a review of foraging habitat potential based on a review of Phase 1 habitat surveys and aerial photography.

Smooth newt

- 11.2.22 The study area for smooth newt has been the proposed land take for the Proposed Scheme and land up to a further 250m from the land take boundary. Following a review of information derived from site surveys undertaken in 2008 - 2009 a total of 46 ponds were identified of which 21 were subject to further survey during 2013. Access was denied for 9 ponds, 9 were considered too dangerous to survey and 6 had dried out. The location of the 21 ponds surveyed, the 18 which were not surveyed and the 6 which were dry is shown in Figure 11.69.

11.3 Statutory and planning context

- 11.3.1 Reference has been made to the following international conventions, European directives, national statutes and plans. Explanation of each and their relevance to the assessments is provided in Appendices 11A to 11R.

Directives and conventions

- Council Directive 92/43/EEC on the conservation of natural habitats and wild fauna and flora (“the Habitats Directive”);

- Council Directive 2009/147/EC on the conservation of wild birds (codified version) (“the Birds Directive”);
- Convention on Wetlands of International Importance (“the Ramsar Convention”) (1971);
- Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention) (1979);
- Convention of the Conservation of Migratory Species of Wild Animals (the Bonn Convention) (1979);
- Agreement on the Conservation of Populations of European Bats (1999) (EUROBATS);
- Council Directive 2000/60/EC, The Water Framework Directive (WFD); and
- Council Directive 2004/35/EC, The Environment Liability Directive.

Acts and Regulations

- The Foyle Fisheries Act (Northern Ireland) 1952 (as amended) which controls activities liable to harm or kill salmonids in Lough Foyle, the River Foyle and its tributaries;
- The Fisheries Act (Northern Ireland) 1966 (as amended) which sets controls on effluent discharge into rivers;
- Wildlife Order (Northern Ireland) 1985 as amended by the Wildlife and Natural Environment Act (Northern Ireland) 2011 which provides protection to those species of wild birds, animals, and plants listed in Schedules 1, 5 and 8, and which controls the introduction of non-native species listed in Schedule 9;
- The Environment (Northern Ireland) Order 2002; includes provisions for declaring Areas of Special Scientific Interest (ASSI) by reason of a site’s flora, fauna, geological, physiographical or other features and accordingly the area is afforded special protection. The Order replaces the provisions in the Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 (as amended);
- The Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended) which make provision for implementing Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive), one of the main initiatives of which is the creation of a European network of wildlife sites to be known as ‘Natura 2000’ for the protection of certain wild animals and plants (in combination with Council Directive 2009/147/EC on the conservation of wild birds);
- The Water (Northern Ireland) Order 1999 which sets out classification of water quality, and controls pollution of watercourses, as well as impoundment and abstraction from watercourses;

- The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003 which implement in Northern Ireland, Directive 2000/60/EC, The Water Framework Directive (WFD) which aims to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater;
- The Surface Waters (Fishlife) (Classification) Regulations (Northern Ireland) 2007 which prescribe a system for classifying the quality of freshwaters which need protection or improvement in order to support fish life;
- The Environmental Liability (Prevention and Remediation) Regulations (Northern Ireland) 2009 (the Environmental Liability Regulations) which implement Directive 2004/35/EC on environmental liability with regard to the prevention and remedying of environmental damage;
- European Communities (Natural Habitats) Regulations 1997 (as amended) which give effect to Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) which enable the designation of special areas of conservation (endangered species and habitats of endangered species) as a contribution to an EU Community network to be known as NATURA 2000;
- Wildlife and Natural Environment Act (Northern Ireland) 2011 which places a new statutory duty on government departments to take action to further the conservation of biodiversity. Guidance documents are not yet published.

Plans

- Northern Ireland Species Action Plans;
- All Ireland Species Action Plans (covering both Northern Ireland and the Republic of Ireland);
- Northern Ireland Priority Habitats Action Plans (Including the Peatland Action Plan);
- Road Service Biodiversity Implementation Plan;
- Londonderry Local Biodiversity Action Plan (LBAP);
- Omagh District LBAP; and
- Dungannon and South Tyrone LBAP.

11.4 Methods of assessment

Assessment guidelines

- 11.4.1 The assessments have been informed by the guidelines provided in the following two documents:

- DMRB, Volume 1, Section 3, Part 4 – Ecology and Nature Conservation as updated by Interim Advice Note (IAN) 130/10 (Ecology and Nature Conservation: Criteria for Impact Assessment); and
- Chartered Institute of Ecology and Environmental Management's Guidelines for Ecological Impact Assessment in the United Kingdom 2006 (CIEEM, 2006).

11.4.2 They have involved:

- identification and description of the baseline environment relating to the designated sites, habitats and fauna which have been subject to assessment;
- identification of impacts on the identified resources which would potentially result from the construction and future use of the Proposed Scheme;
- identification of appropriate mitigation in light of the potential impacts; and
- evaluation of the predicted impacts and effects taking mitigation into account.

Identification and description of the baseline environment

11.4.3 The identification and description of the baseline environment has involved a combination of desk-based study, consultation with environmental agencies, organisations and groups to obtain information on habitats and protected species associated with the assessment study areas, and site surveys.

Identification and evaluation of predicted impacts

11.4.4 Potential impacts have been identified by detailed consideration of the Proposed Scheme against the baseline resources leading to a description and quantification of impacts such as loss, degradation or severance of habitat or displacement and/or disruption of fauna.

Identification of appropriate mitigation

11.4.5 Mitigation measures have been identified in light of the potential impacts. Examples of mitigation include; replacement of lost habitat, relocation of fauna, provision of alternative resting places for fauna and introduction of design components to maintain wildlife corridors.

Evaluation of predicted impacts and effects

11.4.6 The evaluation has involved consideration of the importance of the resource and the magnitude, duration and reversibility of the predicted impact, taking into account mitigation.

11.4.7 Each of the identified sites, habitat types and associated species / populations has been attributed a value reflecting their geographic significance as indicated below:

- International e.g. biodiversity feature that warrants designation of an area as a SPA, SAC or Ramsar site;
- National (i.e. Northern Ireland), e.g. biodiversity features that warrants designation of an area as an Area of Scientific Interest (ASSI);
- County, e.g. biodiversity features valuable at a county (e.g. County Tyrone) level;
- District, e.g. biodiversity features of value at the district (e.g. Omagh) level;
- Local, e.g. biodiversity features of value in a local (i.e. within ~2km of the Proposed Scheme extent) context; and
- Biodiversity features of value within the immediate vicinity of the Proposed Scheme only.

11.4.8 Impacts related to loss, fragmentation or degradation of habitats, death or disturbance of animals and potential changes in species range have been defined and described taking into account:

- Magnitude – the size of an impact in quantitative terms where possible;
- Extent – the area over which an impact may occur;
- Duration – the time for which an impact is expected to last;
- Reversibility – a permanent impact is one that is irreversible within a reasonable timescale or for which there is no reasonable chance of action being taken to reverse it; a temporary impact is one from which short-term recovery is possible; and
- Timing and frequency – whether impacts are constant and ongoing, separated but recurrent or single events and whether they occur during critical seasons or life-stages of habitats and fauna.

11.4.9 In accordance with IEEM guidance, effects have been identified as being significant if it is predicted they would affect the integrity of designated sites and ecosystems and/or the conservation status of habitats and species. Where it has been predicted there would be a significant effect, the effect has been described in the context of its geographic significance. For example, an impact upon the integrity of a site of national value could be significant at a national scale or lesser geographic scale dependant on factors such as the magnitude of the impact.

11.4.10 Each impact has also been given one of four confidence ratings reflecting the likelihood that the impact would occur.

- certain / near certain – probability estimated at 95% chance or higher;
- probable – probability estimated above 50% but below 95%;
- unlikely – probability estimated above 5% but below 50%; and

- extremely unlikely – probability estimated at less than 5%.

Studies and surveys undertaken for aquatic habitats and fauna

Macrophytes

- 11.4.11 Detailed explanation of the desk-based data sources, consultations and the site surveys undertaken to inform the identification and description of the baseline environment relative to otter is provided in Appendix 11C.
- 11.4.12 Desk-based source of information was the NIEA website.
- 11.4.13 Site surveys were undertaken in June 2009, May 2010 and July and September 2013. The survey method employed was based upon the standard method for river macrophyte survey outlined in the Common Standards Monitoring Guidance for Rivers (JNCC, 2005).

Fish

- 11.4.14 Detailed explanation of the desk-based data sources, consultations and the site surveys undertaken to inform the identification and description of the baseline environment relative to fish is provided in Appendix 11B.
- 11.4.15 Desk-based sources of information have been Loughs Agency and the Agri-Food and Biosciences Institute (AFBI). The information provided includes records provided by Loughs Agency for freshwater fish species and habitat data covering the period 2009 – 2012, and including the results of electrofishing and habitat suitability assessments undertaken by the Agency for the study area.
- 11.4.16 Site surveys, comprising electrofishing and netting surveys were undertaken between March and September 2009. Assessment of the composition, abundance, and age class of fish fauna using electrofishing techniques was carried out following techniques developed by the Scottish Fisheries Coordination Centre, the Environment Agency (EA) and the EU LIFE in UK Rivers project. The methodology conformed to British Standard guidance BS EN 14011:2003 (water quality – sampling of fish with electricity), using an Electracatch International ELBP2 back pack unit (battery powered) with a single anode. Netting methods were focused on establishing catch per unit effort, and utilised seine and fyke nets in watercourses unsuitable for electrofishing.

Studies and surveys undertaken for terrestrial habitats and flora

- 11.4.17 Detailed explanation of the desk-based data sources, consultations and the site surveys undertaken to inform the identification and description of the baseline environment relative to terrestrial habitats and flora is provided in:
- Appendix 11D – Bryophytes;

- Appendix 11E – Habitats and flora;
- Appendix 11F – National vegetation classification (NVC); and
- Appendix 11G – Species rich hedgerows and veteran trees.

11.4.18 Desk-based sources of information have included:

- The Northern Ireland Environment Agency (NIEA);
- Department for Agriculture and Rural Development (DARD);
- Ulster Wildlife Trust (UWT);
- Botanical Society of the British Isles (BSBI);
- District Council Biodiversity Officers;
- National Museums and Galleries of Northern Ireland 2000-2005;
- The Woodland Trust; and
- Northern Ireland Countryside Survey 2000 (NICS, 2000).

11.4.19 The following site surveys have been undertaken:

- a habitat survey undertaken between April and July 2014 in accordance with the Handbook for Phase 1 Habitat Survey published by the Joint Nature Conservation Committee (JNCC);
- a drive through survey undertaken between April and July 2014;
- a review of aerial photography;
- NVC surveys for 20 sites identified as being of higher biodiversity interest during the Phase 1 surveys. The surveys have been conducted in accordance with the methods described in British Plant Communities (Rodwell *et al*);
- species rich hedgerow and veteran tree surveys for 38 sections of hedgerow and nine locations relative to veteran trees identified during the Phase 1 survey. The surveys were undertaken during August 2014 in accordance with the guidance provided in the Hedgerow Survey Handbook 2nd Ed. (DEFRA, 2007) and the Veteran Tree Initiative Specialist Survey Form (Treework, 1996);
- Bryophyte surveys for six locations identified as being likely host sites for NI priority species. The surveys were undertaken during June and the first two weeks in July 2014.

11.4.20 Reference has also been made to data derived from site surveys undertaken in 2009 and 2010 and reported in the A5WTC ES 2010.

Studies and surveys undertaken for terrestrial fauna

Otter

- 11.4.21 Detailed explanation of the desk-based data sources, consultations and the site surveys undertaken to inform the identification and description of the baseline environment relative to otter is provided in Appendix 11H.
- 11.4.22 Desk-based sources of information were received from the Centre for Environmental Data Recording (CEDaR).
- 11.4.23 Site surveys which were undertaken in June 2009, May 2010 and July and September 2013 involved the recording of sightings, evidence of the presence of holts, resting sites, couches and other evidence of otter presence including spraints and footprints.

Bats

- 11.4.24 Detailed explanation of the desk-based data sources, consultations and the site surveys undertaken to inform the identification and description of the baseline environment relative to bats is provided in Appendix 11I.
- 11.4.25 Data in the form of records held by statutory and non-statutory bodies/groups has been received from the Northern Ireland Bat Group and CEDaR.
- 11.4.26 Site surveys were informed by the Bat Conservation Trust Bat Surveys: Good Practice Guidance 2nd edition, and have involved
- monthly walked transect surveys centred at 32 points along the Proposed Scheme between May and September 2014;
 - monthly driven transect surveys for four defined transects between April and September 2014;
 - static automated surveys at 32 locations along the Proposed Scheme between May and September 2014; and
 - dusk and dawn emergence and re-entry surveys for known and potential roost sites during 2014.
- 11.4.27 Data derived from surveys undertaken in 2012 and 2013 within the proposed land take, for sections of the scheme proposed in 2010 between New Buildings and Strabane and Omagh and Ballygawley, has also been taken into account.

Red squirrel

- 11.4.28 Detailed explanation of the desk-based data sources, consultations and the site surveys undertaken to inform the identification and description of the baseline environment relative to red squirrel is provided in Appendix 11J.

- 11.4.29 Desk-based sources of information have been CEDaR and the North West Red Squirrel Group.
- 11.4.30 Site surveys, comprising a combination of walked transects and camera trapping were undertaken in June and July 2014. The walked transects were conducted in accordance with the guidance in Gurnell et al. (2009).

Pine marten

- 11.4.31 Detailed explanation of the desk-based data sources, consultations and the site surveys undertaken to inform the identification and description of the baseline environment relative to pine marten is provided in Appendix 11K.
- 11.4.32 Desk-based sources of information have been received from CEDaR.
- 11.4.33 Site surveys, comprising a combination of walked transects and camera trapping were undertaken at six locations close to the land take for the Proposed Scheme in June and July 2014. The selection of the survey sites was based on studies undertaken in 2009 as part of the assessments reported in the A5WTC ES 2010, records of pine marten sightings provided by CEDaR and pine marten habitat requirements as described in 'UK BAP Mammals: Interim Guidance for Survey Methodologies, Impact Assessment and Mitigation' (Cresswell et al. 2013).

Badger

- 11.4.34 Detailed explanation of the desk-based data sources, consultations and the site surveys undertaken to inform the identification and description of the baseline environment relative to badger is provided in Appendix 11L. The appendix is a confidential document which is to be made available to statutory consultees and which can be made available more generally, subject to specific request to the Department.
- 11.4.35 Site surveys were undertaken during March 2014 in accordance with the guidance in Harris et al (1989) and Badgers and Development (NIEA, 2011). Reference has also been made to surveys undertaken in 2009 and 2010 which were reported in the A5WTC ES 2010 and in 2012 and 2013 in advance of an anticipated commencement of construction for parts of the scheme originally approved for implementation in 2011.

Irish hare

- 11.4.36 Detailed explanation of the desk-based data sources, consultations and the site surveys undertaken to inform the identification and description of the baseline environment relative to Irish hare is provided in Appendix 11M.
- 11.4.37 Desk-based information has been provided by CEDaR.

- 11.4.38 No specific site surveys have been undertaken; sightings have, however been recorded by surveyors undertaking the other surveys for habitats and fauna.

Deer

- 11.4.39 Detailed explanation of the desk-based data sources, consultations and the site surveys undertaken to inform the identification and description of the baseline environment relative to deer is provided in Appendix 11N.
- 11.4.40 Desk-based sources of information and organisations consulted have been CEDaR and Forest Service.
- 11.4.41 Site surveys, which were undertaken between May and August in 2013 and 2014, involved a combination of walking and driven surveys during which sightings or signs of presence, including footprints, hairs, dung or shed antlers, were recorded. Incidental sightings within the assessment study area for the species and more widely have also been recorded by surveyors undertaking other surveys for habitats and fauna. Reference has also been made to data for deer reported in the A5WTC ES 2010.

Wintering swan and goose

- 11.4.42 Detailed explanation of the desk-based data sources, consultations and the site surveys undertaken to inform the identification and description of the baseline environment relative to wintering swan and goose is provided in Appendix 11O.
- 11.4.43 Desk-based sources of information and organisations consulted have been the Royal Society for the Protection of Birds Northern Ireland (RSPB Northern Ireland), Irish Whooper Swan Study Group and British Trust for Ornithology (BTO) Ireland.
- 11.4.44 Site surveys were undertaken between October 2009 and March 2010 and October 2013 and March 2014 in accordance with McElwaine & Spouncer (2006).

Breeding birds

- 11.4.45 Detailed explanation of the desk-based data sources, consultations and the site surveys undertaken to inform the identification and description of the baseline environment relative to breeding birds is provided in Appendix 11P.
- 11.4.46 Desk-based sources of information and organisations consulted have been the NIEA, Royal Society for the Protection of Birds Northern Ireland (RSPB Northern Ireland), Quercus, Birdwatch Ireland, British Trust for Ornithology (BTO) Ireland and UWT.
- 11.4.47 Site surveys were undertaken on a monthly basis in April, May and June 2014 in accordance with Bibby *et al* (2000). Reference has also been made to data for breeding birds reported in the A5WTC ES 2010 where the data relates to the assessment study area for the Proposed Scheme.

Wintering birds

- 11.4.48 Detailed explanation of the desk-based data sources, consultations and the site surveys undertaken to inform the identification and description of the baseline environment relative to wintering birds (excluding wintering swan and goose) is provided in Appendix 11Q.
- 11.4.49 Site surveys were undertaken on a monthly basis between October 2013 and March 2014 in accordance with the BTO standard methodology for winter farmland bird surveys and the Wildfowl and Wetland Trust (WWT) WeBS methodology for wetland winter bird surveys. Reference has also been made to data for wintering birds reported in the A5WTC ES 2010 where the data relates to the assessment study area for the Proposed Scheme.

Smooth newt

- 11.4.50 Detailed explanation of the desk-based data sources, consultations and the site surveys undertaken to inform the identification and description of the baseline environment relative to smooth newt is provided in Appendix 11R.
- 11.4.51 Site surveys were undertaken between mid-March and mid-June 2014 in accordance with requirements outlined by the NIEA (2014). The surveys involved a combination of egg searches, net searches, terrestrial searches and torch surveys. Reference has also been made to data for smooth newts reported in the A5WTC ES 2010 where the data relates to the assessment study area for the Proposed Scheme.

11.5 Baseline environment

Designated sites

- 11.5.1 Detailed description of the designated sites which have been assessed is provided in Appendix 11A other than for Strabane Nature Reserve which is provided in Appendix 11F. The location of the sites and their relationship to the Proposed Scheme is shown in Figure 11.34. The basis for their designation and any qualifying features detailed in the site data forms are summarised below along with the biodiversity value each site has been attributed.

Special Protection Areas and Ramsar sites

- 11.5.2 Lough Foyle SPA and Ramsar site and Lough Swilly (including the former Inch Lough and Levels SPA) SPA are located approximately 10km north-east and north-west of the northern section of the Proposed Scheme respectively. Lough Neagh and Lough Beg SPA, Ramsar site and ASSI is located some 40km east of the Proposed Scheme corridor.

- 11.5.3 One of the reasons for the three sites being designated is the European and internationally important populations of wintering birds they support. Two of the species noted in the data sheets for the sites include whooper swan *Cygnus cygnus* and greylag goose *Anser anser*; whooper swan in all three instances and greylag goose in the case of Lough Swilly.
- 11.5.4 Dunalong, Thorn Hill and Grange Foyle are areas within the River Foyle floodplain and along the Proposed Scheme corridor which are used by both species as a foraging habitat beyond the designated sites. Detail relating to use of these areas within the floodplain derived from desk-based studies and project specific site surveys is provided in 11.5.102 to 11.5.107 below as part of the baseline description relating to fauna.
- 11.5.5 All three SPAs are of international biodiversity value.

Special Areas of Conservation

- 11.5.6 Three of the four SACs which have been considered; the Foyle and Tributaries SAC, River Finn SAC and Owenkillew River SAC, comprise complexes of watercourses which are noted for their Habitats Directive Annex 1 and Annex 2 habitats and species. The fourth, Tully Bog SAC is an isolated raised bog designated by virtue of its status as active raised bog. Three of the four are also designated as ASSIs, the exception being the River Finn.
- 11.5.7 The Foyle and Tributaries SAC and ASSI include the River Foyle south of Magheramason, the River Finn in Northern Ireland, the Mourne River, the Strule River up to its confluence with the Owenkillew River and the Derg River and its main tributaries. Primary reasons for the site's designation are its watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation and Atlantic salmon (*Salmo salar*). The site's population of otter (*Lutra lutra*) is a qualifying feature. The Proposed Scheme is located between 1 to 2.5 km east of the designated site between Magheramason and Strabane, other than at Magheramason where it is 100m distant at its closest, and at Strabane where it crosses the Mourne River. South of Strabane the Proposed Scheme is located between 0.5 and 2 km west of the SAC before it crosses the Derg River.
- 11.5.8 The River Finn SAC comprises the whole of the river as far as its source at Lough Finn. There are 6 primary reasons for the site's designation, 4 related to Annex I habitats and 2 to Annex II species. In the context of the Proposed Scheme, the potential for impacts relative to the SAC are limited to the Annex II species, Atlantic salmon and otter. Cited Annex I habitats are all located in parts of the SAC which are upstream of the most northerly section extending from Lifford/Strabane to Magheramason and where there would be no direct or indirect relationship between them and the construction or future use of the Proposed Scheme.

- 11.5.9 The Owenkillew River SAC and ASSI extends east to west to the confluence of the watercourse with the Strule River east of Newtownstewart. Primary reasons for the site's designation are its water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation, its old sessile oak woods with *Ilex* and *Blechnum* and freshwater pearl mussel *Margaritifera margaritifera*. Qualifying features comprise its bog woodland (priority feature), Atlantic salmon and otter. The Proposed Scheme is located some 1.5km west of the confluence downstream of the designated site.
- 11.5.10 Tully Bog SAC and ASSI has been designated in light of its status as an area of active raised bog, an Annex 1 habitat under the Habitats Directive. It covers an area of some 36ha and is located 2.5km north-west of Omagh, 400m west of the existing A5 and 200m east of the Fairy Water. Approximately two-thirds of the site comprises bogs, marshes, water fringed vegetation and fens and a little less than one-third, birch woodland which is concentrated on a small drumlin at the centre of the site. The remainder of the area comprises humid grassland. Background NO_x concentrations at the site are well below the EU limit value of 30 µg.m⁻³ for the primary habitat type. At 22.9 kg N ha⁻¹y⁻¹, background nitrogen deposition rates exceed the UNECE critical limits for the primary habitat of 5-10 kg N ha⁻¹y⁻¹.
- 11.5.11 All four SAC are of international biodiversity value.

Areas of Special Scientific Interest

- 11.5.12 McKean's Moss ASSI and McKean's Moss Part II ASSI is a composite site located in the Foyle floodplain between the existing A5 as it passes west of Cloughcor and the Glenmornan River as flows it north to its confluence with the River Foyle. It is the most north-westerly example of its type in Northern Ireland. The designated site comprises some 46ha in which there is a core area of lowland raised bog surrounded by birch and willow woodland which has established on former cut-over areas to the periphery of a moderately well-defined dome. The core bog is some 400m west of the existing A5 with a 250m-wide buffer of wet woodland. Background NO_x concentrations at the site are well below the EU limit value of 30 µg.m⁻³ for the two habitat types. At 18.45 kg N ha⁻¹y⁻¹, background nitrogen deposition rates exceed the UNECE critical load for raised bog (5-10 kg N ha⁻¹y⁻¹) and woodland habitat (10-20 kg N ha⁻¹y⁻¹).
- 11.5.13 Strabane Glen ASSI is located some 200m south-west of the existing A5 where it approaches the northern fringe of Strabane at Roundhill. It comprises a narrow, steep-sided valley which follows a north to south orientation along a line of weakness between the Upper Dalradian schists and a basic igneous unit. A combination of calcareous ash / hazel woodland which is atypical for the region, species rich flora, associated fauna and geomorphological interest has resulted in its designation as a site of national importance. The ASSI is located approximately 475m from the Proposed Scheme. Background NO_x concentrations at the site are well below the EU

limit value of $30 \mu\text{g.m}^{-3}$ for the primary habitat type. At $43.48 \text{ kg N ha}^{-1}\text{y}^{-1}$, background nitrogen deposition rates exceed the UNECE critical load for the woodland habitat of $10\text{-}20 \text{ kg N ha}^{-1}\text{y}^{-1}$.

- 11.5.14 Grange Wood ASSI is located approximately 1km south-east of Newtownstewart. It covers an area of approximately 9ha immediately west of the existing A5 where it runs at a point of transition from valley floor to the lower north-east facing slopes of Bessy Bell in the Strule Valley. The site is designated for its woodland flora and fauna. The dominant woodland type comprises a multi-stooped hazel canopy with ash standards beneath which there is a base-rich ground flora. The lowest slopes above the A5 are waterlogged; alder and willow are the dominant species here. The woodland supports many animal species including breeding birds. The ASSI is located approximately 550m from the Proposed Scheme. Background NO_x concentrations at the site are well below the EU limit value of $30\mu\text{g.m}^{-3}$. At $30.83\text{kg N ha}^{-1}\text{y}^{-1}$, background nitrogen deposition rates exceed the UNECE critical load for the woodland habitat of $10\text{-}20\text{kg N ha}^{-1}\text{y}^{-1}$.
- 11.5.15 Baronscourt ASSI comprises a nationally important area of some 105ha of historic parkland habitat which has been designated for its veteran and ancient tree stock and associated invertebrates, lichens and fungi. The parkland habitat also provides an important habitat for a wide range of plants and animals including birds, invertebrates and mammals including bats and red squirrels (*Sciurus vulgaris*). The designated site is located 2.5km west of Newtownstewart below the north-west facing slopes of Bessy Bell. The ASSI is located approximately 2km from the Proposed Scheme.
- 11.5.16 All of the ASSIs which have been considered are of national biodiversity value.

Local Wildlife Sites

- 11.5.17 Strabane Nature Reserve is located between the existing A5 and River Foyle north of the Mourne River. The reserve consists predominantly of dense willow scrub with areas of standing water and ponds, with swamp vegetation beneath much of the canopy. To the east of the site there is an open grassland area, just north of an area of hard standing which has, until recently, been used as a caravan site. Strabane Nature Reserve is considered to be of county biodiversity value.

Aquatic habitats and fauna

- 11.5.18 Thirteen of 19 watercourses which constitute the study area for the assessment of macrophytes and fish are classified under the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003 (WFD Regulations). These comprise:

Burn Dennet	Drumragh River
Glenmornan River	Camowen River

Mourne River	Routing Burn
River Finn	Roughan River
River Derg	Ballygawley River
River Strule	River Blackwater
Fairy Water	

- 11.5.19 One, the Glenmornan River, has been classified as being of good surface water quality, three, the River Finn, River Strule and Roughan River as being of poor surface water quality and the remainder as being of moderate surface water quality.

Macrophytes

- 11.5.20 Information derived from the desk-based data and site surveys has demonstrated the importance of watercourses within the Foyle and Tributaries SAC and River Finn SAC relative to *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation. The site surveys highlighted the presence of the vegetation type in the vicinity of the Proposed Scheme near to the confluence of the Mourne River and River Foyle and in the vicinity of the proposed crossing of the Derg River. Those identified at the Mourne River comprises small areas of habitat which appear to have washed down from further upstream and which it is unlikely would become established, the substrate within the river channel being unstable. The vegetation at the River Derg is well established.
- 11.5.21 Eleven of the watercourses which have been subject to site survey have been classified according to the status of their aquatic flora communities as part of their wider WFD classification, the two exceptions being Loughmuck Drain and an unnamed watercourse (watercourse 11). The Burn Dennet, Glenmornan River, River Finn, Derg River and Drumragh River have been classified as high. The Mourne River, Fairy Water, Blackwater tributary and Coolaghy Burn have be classified as good, the Froughmore Drain as moderate and the Aghnamoyle drain as poor.

Fish

- 11.5.22 Thirteen of 14 watercourses which constitute the study area for the assessment relative to fish have been classified under the WFD, the exception being the Ranelly Drain. Seven of the 13 have been classified relative to their fish fauna status. Six, the Burn Dennet, Glenmornan River, River Derg, Fairy Water, Drumragh River and Camowen River have been classified as good, one the River Finn, has been classified as being moderate. Twelve of the 13 were classified as salmonid rivers under the former Fish Directive, the exception being the Roughan River.
- 11.5.23 The Mourne River, Derg River and River Strule between its confluence with the Derg River and confluence with the Owenkilleg River are part of the Foyle and Tributaries

SAC. The River Finn forms the focus of the River Finn SAC. A primary reason for the designation of both SACs is the populations of Atlantic salmon which they support. The Foyle and Tributaries are also designated as an ASSI on account of their populations of fish.

- 11.5.24 Twelve species of fish were identified during the electrofishing and netting surveys. ; Atlantic salmon, brown trout, European eel, lamprey sp., flounder *Platichthys flesus*, 3-spined stickleback *Gasterosteus aculeatus aculeatus*, minnow *Phoxinus phoxinus*, stone loach *Noemachelius barbatulus*, gudgeon *Gobio gobio*, roach *Rutilus rutilus*, pike *Esox lucius* and perch *Perca fluviatus*. The presence of one further species, European smelt, was established by virtue of historic data provided by Loughs Agency.
- 11.5.25 Certain of the species are subject to legal protection and have been classified relative to conservation status as indicated in Table 11.1.

Table 11.1: Legal and conservation status - fish

Species	Legal status	Conservation status
Atlantic salmon <i>Salmo salar</i>	Annex II & V Habitats Directive, Appendix III Bern Convention	IUCN Red Listed Northern Ireland Species of Conservation Concern (SoCC) UK Priority Species
Brown/sea trout <i>Salmo trutta</i>	N/A	Northern Ireland SoCC UK Priority Species
Lamprey <i>Petromyzon marinus</i> , <i>Lampetra</i> spp.	Annex II Habitats Directive, Appendix III Bern Convention River Lampreys Annex V Habitats Directive	UK Priority Species – river and sea lamprey only IUCN Indeterminate Status
European smelt <i>Osmerus eperlanus</i>	N/A	Northern Ireland SoCC UK Priority Species
Shad <i>Allosa</i> spp.	Annex II & V Habitats Directive, Appendix III Bern Convention	Northern Ireland SoCC UK Priority Species
European eel <i>Anguilla anguilla</i>	N/A	UK Priority Species

- 11.5.26 Of the key species listed as priority species or SoCC, the electrofishing and netting surveys established the presence of Atlantic salmon in 9 of the watercourses surveyed brown trout in 11, lamprey in 8 and European eel in 4.
- 11.5.27 Records provided by Loughs Agency and AFBI (see Appendix 6, Table 11B.6) have also confirmed the presence of Atlantic salmon in 4 of the 5 watercourses where the

presence of the species was not validated by the site surveys. The one watercourse where the presence of the species was not confirmed by past records or the site surveys was the Roughan River. The records have also confirmed the presence of brown trout in the 3 watercourse where their presence was not validated by the site surveys.

- 11.5.28 Data provided by Loughs Agency relative to the presence of salmonid habitat along 7 of the watercourses is available in Table 11B.8 in Appendix 11B. The data indicates the presence of nursery, holding and spawning habitat on the Burn Dennet, Mourne River, Routing Burn, River Strule, Derg River and Drumragh and nursery habitat on the Fairy Water.
- 11.5.29 Each of the watercourses where sections have formed the focus of the assessment for fish has been attributed a value taking into account the data received, surveys undertaken, classification under the WFD and designations. The relevant values are schedule in Table 11.2.

Table 11.2: Biodiversity value of watercourses - fish.

Value	Watercourses
International	Mourne River, River Finn, Derg River, River Strule and Camowen River
National	Burn Dennet, Glenmornan, River, Fairy Water, Routing Burn, River Blackwater
County	Drumragh River, Ranelly Drain
County / District	Roughan River, Ballygawley River

- 11.5.30 Many of the reaches within the Proposed Scheme land take are also fragmented from larger water courses due to existing culverts downstream preventing fish passage. Due to this low suitability, the fish fauna in all other watercourses throughout the Proposed Scheme are assumed to be of at most local biodiversity value.

Terrestrial habitats

- 11.5.31 Detailed information relating to the extent and status of terrestrial habitats within the assessment study area defined in 11.2.9 is provided in Appendices 11D - Bryophytes, 11E - Habitats and flora, 11F - NVC surveys and 11G - hedgerows and veteran trees. The location and relationship between habitat types is shown In Figures 11.1 - 11.30

Woodland and scrub

- 11.5.32 Broadleaved woodland is relatively sparsely represented within the assessment study area. Individual woodlands of note include McKean's Moss (Figure 11.5), Tully Bog (Figure 11.16), Grange Wood (Figure 11.13), parts of Knockmany Forest and linear woodland associated with the former Strabane Canal north of Strabane (Figure 11.6).

Locations where there are clusters of smaller woodlands include an area north of Victoria Bridge in the Mourne Valley, the Strule Valley south of Newtownstewart, Mellon Park west of Omagh, between Tycanny Hill and Errigal and east of Aughnacloy. Most of the woodland comprises mature birch and alder which has formed over modified bog. An example of the species composition of this woodland type is described in Appendix 11F at NVC area 12. Where such woodlands are over 0.5ha in area they qualify as priority habitats under the Northern Ireland Wet Woodlands Habitat Action Plan.

- 11.5.33 There are 5 locations where long-established woodland and woodland with semi-natural ancient characteristics have been identified: Mulvin Parks, Old Deerpark Wood, Routing Burn, North of Aughnacloy and Cottage Hill.
- 11.5.34 At Mulvin Parks (Figure 11.10) there is a long-established mixed planted woodland, approximately 0.5ha in area, located on the line of the Proposed Scheme. It has been classified as being of district value.
- 11.5.35 Old Deer Park Wood (Figure 11.12), a 16ha coniferous plantation edged with 20-30m wide strips of beech woodland, is located immediately adjacent to the Proposed Scheme where it joins the B84. It has been classified as being of district value.
- 11.5.36 There is a strip of ancient woodland riparian habitat where the Proposed Scheme crosses the Routing Burn (Figure 11.22 – 11.23). Some 3.6ha in area, it comprises ash and hazel coppice with areas of scrub and small patches of unimproved grassland on open areas of the stream bank. It has been classified as being of county value.
- 11.5.37 The woodland north of Aughnacloy (Figure 11.34) is a long established mixed woodland with a largely ruderal understorey located adjacent to the Proposed Scheme where it crosses the existing A5 north of Aughnacloy. It has been classified as being of county value.
- 11.5.38 Cottage Hill Wood (Figure 11.30) is a 10ha mature broadleaved woodland located adjacent to the Proposed Scheme east of where it merges with the existing A5 south of Aughnacloy. It has been classified as being of county value.
- 11.5.39 Other stands of broadleaved woodland tend to be small with more species poor ground flora than ancient woodland as described in Appendix 11E. Stands of over 0.5ha are likely to constitute ash wood or oak wood priority habitats. Due to their lower species diversity and the abundance of similar habitat within the wider landscape it is concluded that they are of biodiversity value at a local scale or within their immediate vicinities only, with the exception of the oak wood between Rarogan Road and Glenhoy Road (Figure 11.25) which is linked to a network of other valuable habitats and has been assessed as county biodiversity value.

- 11.5.40 There is an area of hazel *Corylus avellana* coppice adjacent to the Proposed Scheme (Figure 11.30) which is extensively poached by cattle, but contains a diverse woodland flora in the few areas where cattle are excluded. It also connects to an extensive area of ancient woodland and has been assessed as of district biodiversity value.
- 11.5.41 Coniferous plantation woodland has been recorded within the study area. This woodland type has a low intrinsic biodiversity value due to the poor species diversity, and presence of non-native conifer trees. These woods have been assessed as of biodiversity value in the immediate vicinity only.
- 11.5.42 Scrub is scattered throughout the study area in small patches of relatively species poor composition (predominantly hawthorn and gorse). These areas have been assessed as having a biodiversity value in their immediate vicinity only.

Grassland and marsh

- 11.5.43 Improved pasture is the most extensive habitat type within the study area. Both it and arable land have been attributed a biodiversity value within the immediate vicinity of the Proposed Scheme only.
- 11.5.44 Mudflats, saltmarsh and reedbeds found along the Foyle shoreline at the northern end of the study area are species poor (Figure 11.1). The habitat types are, however, relatively rare in Northern Ireland and have accordingly been classified as being of county biodiversity value.
- 11.5.45 Grasslands within the River Foyle (Figures 11.1 to 11.2) and Finn floodplains (Figure 11.7) qualify as coastal and floodplain grazing marsh. Most was not surveyed in detail, but the grasslands within NVC site 4 and 6 were subject to NVC surveys and habitat assessment (Phase 1 Habitat Survey). It was found to be species poor and Phase 1 habitat survey and walkover surveys would indicate that this is typical of grasslands within these habitats. However, as it may perform an ecological function, buffering the rivers from run-off and providing a flood plain resource, it has received a higher value than its flora alone would merit. They also contain a series of ditch networks which are inherent to the functioning of floodplains. The floodplain grazing marsh was therefore assessed as of biodiversity value at a local scale.
- 11.5.46 The majority of rush pasture surveyed within the Proposed Scheme corridor was found to be species poor and therefore not included in the priority habitat definition. This habitat type dominates the Proposed Scheme corridor and is classified as improved grassland on the Phase 1 Habitat mapping (Figures 11.1 to 11.30). Such sites have been assessed as being of biodiversity value in the immediate vicinity only. Two areas of rush pasture are located within the Foyle floodplain, one to the east of McKean's Moss (Figure 11.5) and one to the north-west of Ballymagorry (Figure 11.5). Both comprise relatively diverse assemblages of flora, the most northerly area being more diverse and the southerly areas larger with extensive stands of *Carex* spp. (NVC

analysis classifies this community as mire). Both areas also contain good ditch networks which are integral to the habitats and are suitable to be classified as the purple moor-grass and rush pasture priority habitat. Rush pasture of sufficient diversity to qualify as the priority habitat is rare within both the Proposed Scheme footprint and nationally. Therefore they are assessed as of biodiversity value at district and county level respectively.

Bogs

- 11.5.47 Lowland raised bog occurs at McKean's Moss (adjacent to the Proposed Scheme, to the north of Ballymagory), Tully Bog (Figure 11.16) and Tattykeel (Figure 11.19). The smaller fragments not described individually support a limited array of Sphagnum species and have been historically cut and drained. However, as all the bogs surveyed within the Proposed Scheme corridor had over 10% Sphagnum coverage they all qualify as priority habitats. Due to the degraded state and small size, the fragments of modified bogs are assessed as of biodiversity value at a local scale or within their immediate vicinities only.
- 11.5.48 The most extensive areas of lowland raised bog outside of the designated sites are located in the vicinity of Doogary, at Tattykeel (Figure 11.19). They have, however, been subject to degradation as a result of localised burning and more extensive drainage. These areas have been assessed as being of district and county biodiversity value respectively.

Ponds

- 11.5.49 Fifty-two ponds have been identified within the assessment study area. Some ponds were heavily polluted by agricultural runoff and supported little or no aquatic vegetation, others displayed a rich aquatic flora. The best examples of good quality water bodies are outside the Proposed Scheme landtake at Lough Muck, south-west of Newtownstewart and a series of ponds with abundant emergent vegetation at Bessy Bell, north-west of Omagh. Only one large water body is located within the survey area to the south-west of Strabane (Figure 11.8), where a disused quarry approx. 2ha has filled with water since being abandoned. The ponds within the survey area are assessed as of biodiversity value at a local scale or within their immediate vicinities only.

Hedgerows and veteran trees

- 11.5.50 Hedgerows are the dominant form of field enclosure. Between New Buildings and Strabane they are substantially species-poor and there are notable gaps where they have been removed or have not been maintained and managed. A relatively small proportion has standard/mature tree specimens within them. Species-rich hedgerows are sparsely represented, the most notable example being along each side of Dunalong Road south-west of Magheramason (Figure.11.7)

- 11.5.51 South of Strabane, hedgerows are generally species-poor. There are a few locations where they have been removed and four areas where localised networks of hedgerow are species-rich. These are located between Tycanny Hill and Glenhoy Road (Figure 11.30), in the vicinity of Lisginny Road (Figure 11.33), in the vicinity of Old Chapel Road and Tullyvar Road (Figure 11.34) and north of Carnteel Road (Figure 11.34).
- 11.5.52 Species-poor hedgerows have been attributed a biodiversity value within the immediate vicinity of the Proposed Scheme. Individual examples of species-rich hedgerows have been attributed a local biodiversity value. The hedgerows between Tycanny Hill and Glenhoy Road have been classified as being of county biodiversity value, those in the vicinity of Lisginny Road as being of local biodiversity value and those between Old Chapel Road and Tullyvar Road and north of Carnteel Road as being of district biodiversity value.

Bryophytes

- 11.5.53 The studies and surveys have identified 1 species currently listed on Schedule 8 of the Wildlife Order. River/Spruce's bristle moss *Orthotrichum sprucei* was recorded on trees and boulders along the banks of the north of the River Finn floodplain, at the edge of the Mourne River, near its confluence with the River Finn (Figure 11.12) in 2009 and on trees on the banks of the River Finn floodplain (Figure 11.12) in 2009 and 2014. Details of these are contained in Appendix 11D.
- 11.5.54 These rivers were two of only three sites with aquatic features specifically surveyed for these bryophytes (six sites in total were selected for the potential to support notable bryophytes). It is therefore probable that more are present in suitable habitats throughout the Foyle and Finn catchments. Nevertheless due to their legal protection, restricted known distribution, decline and likely rarity these populations of moss are of national biodiversity value.
- 11.5.55 Broadleaf grimmia *Schistidium platyphyllum* was recorded in the Mourne River during macrophyte surveys in 2009. This is a Northern Ireland priority species, though it is not included or proposed for inclusion within Schedule 8 of the Wildlife Order. The plant is already recorded within County Tyrone and is of district biodiversity value.
- 11.5.56 Non-priority habitats commonly found throughout the Proposed Scheme corridor are improved pasture, arable land, coniferous woodland plantation, broadleaf woodland under 0.5ha and scrub. Of these, improved pasture is the dominant vegetation type throughout the study area and in much of Northern Ireland. Due to their low floristic diversity, relatively intense management and/or small size these habitats are of biodiversity value within their immediate vicinities only.

Terrestrial fauna

Otter

- 11.5.57 Northern Ireland is recognised as being host to the densest populations of otter within Europe. Their status as a European protected species is recognised and secured under the Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended).
- 11.5.58 Otter are designation features of the River Finn SAC and the River Foyle and Tributaries SAC discussed in 11.5.7 and 11.5.8 above.
- 11.5.59 Information derived from the studies and site surveys undertaken relating to the presence and distribution of otter within the assessment study area is provided in Appendix 11H. The information has indicated evidence of the presence of otter at 44 of the locations surveyed within the detailed assessment study area. These are highlighted in Table 11H.2 in Appendix 11H and are shown in Figure 11.36. The results have demonstrated that otter utilise watercourses throughout the substantial length of the Proposed Scheme corridor. It has further demonstrated:
- there are no natal holts located within the land take for the Proposed Scheme;
 - there are 19 potential breeding sites within the 2008/9 survey area;
 - there are 2 confirmed holts within the land take;
 - there is one confirmed holt within 250m of the land take boundary;
 - there is one potential holt within 250m of the land take boundary;
 - there is one confirmed resting site within 250m of the land take boundary;
 - there is one potential resting site within the land take; and
 - there is one potential resting site outside of but close to the land take boundary.
- 11.5.60 The 19 potential breeding sites identified on the basis of habitat potential at the survey sites are identified in Table 11H.3 in Appendix 11H. Three are within 250m of the land take and have been identified as being of high, good or poor potential as breeding sites based on the criteria defined in Table 11H.2 in Appendix 11H. One is where the Proposed Scheme encroaches into Strabane Nature Reserve (Figure 11.36, site 5). It is a location of high potential which has been classified as being of county biodiversity value. The second, Strabane Canal (Figure 11.36, site 4), is of good potential and has been classified as district biodiversity value. The third is a poor potential site north-east of Sion Mills which has been classified as local biodiversity value.
- 11.5.61 The confirmed holts within the land take are at the proposed crossing of the Derg River (Figure 11.36, survey site 10) and at the proposed crossing of the Routing Burn (Figure 11.36, survey site 70).

- 11.5.62 The confirmed holt, outside of but close to the land take boundary, is at Strabane Nature Reserve (Figure 11.6, site 5) some 30m from the land take boundary.
- 11.5.63 There is one potential holt within 250m of the land take. The site, located between Augher Point Road and Legacurry Road near Moylagh (Figure 11.6, survey site 67), is approximately 100m from the land take boundary.
- 11.5.64 Surveys of watercourses for potential otter holts and couches recorded presence of otter on 37 watercourses in 2008/9 and on 17 watercourses in 2013. Evidence from desk based and field surveys indicates particularly high levels of activity along the Strule River and the River Blackwater.
- 11.5.65 Camera trapping surveys during 2012 at Routing Burn (Figure 11.36, survey site 70), which was classified as a moderate potential breeding site confirmed the presence of otter, but no evidence that the site was used for breeding during that period. The potential breeding site was visited by a fox and badger during the trapping period.
- 11.5.66 The location of the five high, good and moderate breeding sites and three known resting sites are scheduled in Table 11.3.

Table 11.3: Summary of otter breeding sites and resting places.

Chainage	Site ID	Site	Type of Use and Site Potential
13700-16500	4	Strabane Canal	Breeding - Good
17400-17600	5	Strabane Nature Reserve	Breeding - High
34400	W26	River Derg, west of Ardstraw	Resting - Confirmed
34400-34500	10	Mourne River and River Strule/Derg Confluence	Breeding - High
41500-42000	14	River Strule nr Beltany Lodge	Breeding - Moderate
50000	W51	Fairy Water	Resting - Confirmed
70500	W76	Stream north of Killadroy	Resting - Confirmed
71700	W79 and 41	Routing Burn	Breeding – Moderate*
*Camera trap surveys (2012) found no evidence that this site was used for breeding			

- 11.5.67 Otters have large home ranges, with males sometimes covering 70km of watercourse and so it is possible that the populations from the River Foyle & Tributaries SAC which extends to Newtown Stewart are present throughout the entire survey area.

11.5.68 Due to their status as qualifying features for selection of the SAC, and their conservation status in Europe, the other populations throughout the Proposed Scheme corridor have been assessed as being of international biodiversity value.

Bats

11.5.69 Detailed information relating to the presence and distribution of bats within the assessment study area based on the studies and surveys which have been undertaken is provided in Appendix 11I. It has demonstrated that bats are present throughout the length of the Proposed Scheme corridor.

11.5.70 Six species of bat have been identified; common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus*, Nathusius' pipistrelle *Pipistrellus nathusii*, brown long-eared bat *Plecotus auritus*, Leisler's bat *Nyctalus leisleri* and Daubenton's bat *Myotis daubentonii*. Undifferentiated species of the genus *Myotis* and *Pipistrellus* have also been recorded¹. Common pipistrelles and soprano pipistrelles are commonly found throughout NI and the UK as a whole. Leisler's, Daubenton's and brown long-eared bats are frequently found throughout much of Northern Ireland. Nathusius' pipistrelles are rarely found and are restricted in their distribution in NI.

11.5.71 The distribution of the species identified in the study area adopted for the 2014 site surveys is shown in Figures 11.37 – 11.43.

11.5.72 Common pipistrelles (Figure 11.38) and soprano pipistrelles (Figure 11.43) have been identified throughout the substantial length of the Proposed Scheme corridor, passes having been recorded in 91% and 89% of the tetrads² within the detailed study area adopted for the 2014 surveys respectively. Numbers of passes recorded for the two species, at 21,937 and 27,590 respectively, are notably larger than for any of the other species identified. Eight hundred and twelve passes for undifferentiated *Pipistrellus* species were also recorded. Nathusius' pipistrelles have been identified in three locations, one tetrad in the vicinity of Victoria Bridge, one south of Newtownstewart, and three between the A4 and Aughnacloy. The total number of passes recorded across all three locations were 23.

11.5.73 Leisler's bat (Figure 11.40) have been identified throughout the substantial length of the Proposed Scheme corridor, passes having been recorded in 83% of the tetrads within the detailed study area adopted for the 2014 surveys. The total number of passes recorded for the species was 6,394.

¹ It was not possible to identify bat species of the genus *Myotis* using Analook, as the calls of individual species are extremely difficult to differentiate (Russ, 2013). This included data from the driven transects and static surveys. *Myotis* calls from the walked transects were identified to species level where possible.

² A tetrad is a square 2km x 2km commonly used in species distribution mapping.

- 11.5.74 *Myotis* sp. (Figure 11.41) have been identified in 49% of the tetrads within the detailed study area adopted for the 2014 surveys. Figure 11.41 indicates a relatively even distribution throughout the Proposed Scheme corridor other than between Doogary and Newtownsaville. The total number of passes recorded for undifferentiated species within the genus was 686. Daubenton's bat (Figure 11.39) were recorded within five tetrads distributed along the Mourne Valley and Strule Valley. The total number of passes recorded across all five tetrads was 12 between Victoria Bridge and Mountjoy.
- 11.5.75 Brown long-eared bat (Figure 11.37) were recorded in two locations, at one tetrad in the vicinity of Victoria Bridge and one in the vicinity of Mountjoy (Figure 11.37). In the case of brown long-eared bat, it is possible that there may have been a survey bias as they were rarely recorded on bat detectors due to their low intensity echolocation calls.
- 11.5.76 Owing to their distribution, abundance and conservation status within Northern Ireland the common pipistrelle, soprano pipistrelle, Leisler's bat and brown long-eared bat populations have been attributed a local biodiversity value. Due to their conservation status and restricted distribution both within the route and nationally, the Nathusius' pipistrelle and *Myotis* sp. bat (which potentially may include the less common whiskered bat and/or Natterer's bat) populations have been classified as being of district biodiversity value.
- 11.5.77 Results from the activity surveys were used to identify 67 features in the landscape that supported higher concentrations of bat activity than other areas, such locations are likely to be of higher value to bats as commuting routes and favoured foraging habitat.
- 11.5.78 The desk study indicated the presence of four bat roosts within 500m of the Proposed Scheme, a common pipistrelle *Pipistrellus pipistrellus* roost 300m from the A5 WTC and three pipistrelle sp. roosts 100m, 250m and 400m from the Proposed Scheme.
- 11.5.79 The site surveys have identified 7 roosts within the land take for the Proposed Scheme:
- a day roost used by a small number of common pipistrelles within a stone agricultural building situated north-west of Magheramason (Ch. 3300);
 - a day roost used by individual common and soprano pipistrelles within a black poplar north of Park Road (Ch.13420);
 - a day roost used by a small number of common pipistrelles within an ash tree north of Spruce Road (Ch.14900);
 - an individual soprano pipistrelle day roost, a pipistrelle sp. day roost supporting two bats and an individual *Myotis* sp. day roost in three separate trees within an area of woodland south of Beagh Road (Ch. 56000); and
 - a day roost identified as being used by an individual pipistrelle sp. within the ivy of a bridge on Springhill Road at Newtownsaville (Ch. 73770).

- 11.5.80 Three roosts have been identified within 100m of the proposed land take:
- a day roost for soprano pipistrelles in a building adjacent to the vesting line south of Derg Road (Ch. 34000);
 - a day roost for common pipistrelles, in a building 20m from the vesting line south of West Road (Ch. 41100); and
 - a day roost for common pipistrelles, in a building 90m from the vesting line north of Routingburn Road (Ch. 71500).
- 11.5.81 The 10 roosts described above have been classified as being of local biodiversity value.
- 11.5.82 As part of a number of advanced environmental works, which were approved in anticipation of construction commencing in 2013, the roosting features of two trees supporting common pipistrelle day roosts north of Meenagh Road at Ch. 4900 (one bat) and south of Moss Road Ch. 11200 (two bats) were removed under an EPS development licence in 2012.

Red squirrel

- 11.5.83 Red squirrel are legally protected in Northern Ireland under the provisions of the Wildlife Order. They are also a Northern Ireland priority species, Derry Local priority species, RSNi priority species and the subject of an All-Ireland Priority Species Action Plan. The species is in decline throughout the UK as a result of habitat destruction and fragmentation, competition from grey squirrels and disease. Populations that have survived these pressures to date within Northern Ireland are primarily located in the north-west of the province.
- 11.5.84 Information relating to the presence and distribution of the species based on the studies and site surveys undertaken is provided in Appendix 11J.
- 11.5.85 The information has demonstrated there are five locations where it is likely that red squirrel are active in woodland within the assessment study area; north of New Buildings, Baronscourt, Seskinore Forest, Rattling Ford and east of Aughnacloy. In the wider countryside, red squirrel are well recorded within Favour Royal Forest to the west of the Proposed Scheme.
- 11.5.86 The woodland north of New Buildings comprises semi-natural broadleaved woodland at Prehen Park, part of which has housing integrated within it, and parkland-styled woodland associated with Derry City Golf Club. Survey access was refused in 2014. There are, however two records of sightings on the North West Red Squirrel Group website. The record indicates both red and grey squirrel have been sighted.

- 11.5.87 Baronscourt Forest is actively managed for red squirrels with a ‘grey squirrel control programme’ in an effort to conserve the red squirrel population. However, the most recent record of a sighting is from 2009.
- 11.5.88 Two other records, one at Strabane Glen ASSI (2006) and at New Bridge on the River Derg (2009) were provided from CEDaR. The 2014 surveys confirmed grey squirrel *Sciurus carolinensis* presence but did not confirm red squirrel presence.
- 11.5.89 The confirmation of grey squirrel within many of these areas indicates that red squirrel are likely to be displaced from the study area within 10-20 years unless active conservation measures are taken (O’Neil et al. 2003, Bryce et al. 2005). Both Favour Royal Forest and Baronscourt have active red squirrel conservation groups working within them and may, therefore sustain a population beyond this period. The population within Favour Royal Forest has, therefore, been classified as being of national biodiversity value. Although there is a lack of evidence in both official records (other than anecdotal evidence) and surveys since, a precautionary approach to the assessment has classified the population within Baronscourt Estate as being of district biodiversity value. The smaller populations are considered of local biodiversity value. The locations of red squirrel evidence are displayed on Figure 11.44 - 11.58.

Pine marten

- 11.5.90 Pine marten are fully protected under the Wildlife Order and are a Northern Ireland priority species. The current population in Northern Ireland is unknown. A conservation status assessment for pine marten in 2012 in the UK (NIEA are currently conducting a study to establish the current conservation status across NI) found that the species status is favourable, with an increasing range, population and favourable future prospects.
- 11.5.91 Information relating to the presence and distribution of the species based on the review of desk based data and project specific surveys undertaken is provided in Appendix 11K.
- 11.5.92 The studies and surveys of areas of habitat potential have identified two main area of pine marten activity within 2km of the Proposed Scheme. These are; in the woodlands west (Figure 11.60) and south (Figure 11.61) of Newtownstewart and in the woodlands west of Ballygawley (Figure 11.64). The Proposed Scheme would divide the woodlands within these survey areas forming a potential barrier to dispersal between suitable woodland blocks.
- 11.5.93 The data received from CEDaR suggest pine marten are present within the wider landscape, with records from along the River Finn near Strabane, along the River Strule and Edenderry Road 3km SE of Omagh.

- 11.5.94 Pine marten are present in low numbers within the study area and are considered as being of district biodiversity value.

Badger

- 11.5.95 Detailed information relating to the presence and distribution of badger within the assessment study area based on the studies and surveys which have been undertaken is provided in confidential Appendix 11L and Figures 11.70 – 11.72 (confidential and can be provided on request). It has demonstrated that badger are present throughout the majority of the Proposed Scheme corridor.
- 11.5.96 A total of 19 main, 3 annex, 5 subsidiary and 19 outlier setts were identified. An additional 18 setts reported in Mouchel (2010) were not re-surveyed in due to restrictions with land access; these comprised of a further 3 main setts, 3 annex setts, 1 subsidiary sett and 11 outlier setts. Over one hundred mammal paths, latrines, snuffle holes, guard hairs and footprints were found throughout the route.
- 11.5.97 Owing to their widespread distribution within the assessment study area and Northern Ireland and lack of conservation designation, the badger populations within the study area have been classified as being of biodiversity value within the immediate vicinity of the Proposed Scheme.

Irish hare

- 11.5.98 Irish hare has limited protection in Northern Ireland against certain methods of killing and capture under the Wildlife Order but are not listed under Schedule 5. However, the species is a Northern Ireland priority species and the subject of an All Ireland Species Action Plan. The overall population trend is unknown for this species, and while records indicate hare abundance in Northern Ireland has undergone a substantial decline over the last 50 years, populations are now thought to have stabilised at low densities. They are currently thought to be present in County Londonderry at densities of 0.51/km² and within County Tyrone at densities of 1.34/km², which is lower than other counties in Northern Ireland. The studies revealed twelve existing records of Irish hare and fourteen incidental sightings in other field surveys. The generalist habitat requirements of Irish hare mean that they could potentially utilise most of the habitats within and surrounding the Proposed Scheme for foraging, resting and breeding.
- 11.5.99 Detailed information relating to the presence and distribution of the species based on the review of desk-based data and incidental recordings made during other surveys undertaken as part of the assessment of the Proposed Scheme is provided in Appendix 11M. The location of recorded sightings and incidental project related sightings is provided in Figure 11.65.

- 11.5.100 Owing to their low population densities and widespread distribution of Irish hare throughout the Proposed Scheme attributed a biodiversity value of within their immediate vicinities only.

Deer

- 11.5.101 None of the three species of deer found in Northern Ireland are legally protected, and none are listed as SoCC or Northern Ireland Priority Species. It is thought that populations of all three are currently expanding in Northern Ireland. Existing records revealed the presence of fallow deer *Dama dama* and sika deer *Cervus nippon* within 3km of the Proposed Scheme, but no red deer *Cervus elaphus* had been previously recorded. All three species of deer were recorded incidentally within the survey area, with red deer being recorded c. 250m from the Proposed Scheme at Aughnacloy. Official figures for population numbers are unavailable, but the survey data along with a lack of any vehicle collisions recorded by the Police Service Northern Ireland involving deer indicate that populations are low across the scheme.
- 11.5.102 Detailed information relating to the presence and distribution of deer based on the review of desk based data and surveys undertaken as part of the assessment of the Proposed Scheme is provided in Appendix 11N. Results displayed in Figure 11.66.
- 11.5.103 Owing to their low densities and lack of conservation designation the deer within environs of the Proposed Scheme deer have been classified as being of biodiversity value within the immediate vicinity of the Proposed Scheme.

Bird assemblages

- 11.5.104 Information relating to the presence and distribution of birds identified within the assessment study area based on the review of desk based data and surveys undertaken is provided in Appendix 11O for wintering swan and goose, Appendix 11P for breeding birds and Appendix 11Q for wintering birds (excluding swan and goose).

Wintering swan and goose

- 11.5.105 Detail relating to the peak counts for whooper swan and greylag geese during the 2009 – 2010 and 2013 – 2014 surveys in the Foyle floodplain is provided in Appendix 11O. The location of the birds observed is shown in Figures 11.67 and 11.68.
- 11.5.106 Both species were observed in the same two locations within the Dunalong and Thorn Hill area during the two project specific survey periods. Peak counts were found to be higher during the 2009-2010 surveys, there being 520 and 510 whooper swan and greylag geese respectively compared to 22 whooper swan and 1 greylag goose during the 2013-2014 surveys. The two areas being utilised by the birds were between 1 and 2km distant from the existing A5.

- 11.5.107 Within the Grange Foyle part of the floodplain, the numbers of both species were also higher and found to be more widely dispersed across the area during 2009-2010 compared to 2013-2014. Both species were observed using two parts of the area during the two survey periods, a core area of fields between Grange Road and Ash Road and a group of fields north of Grange Road extending east towards the existing A5. Birds foraging in the latter area were observed using fields immediately adjacent to the existing A5 during the 2009-2010 surveys. Other parts of the area where birds were observed in the earlier surveys but not during the later surveys were a small number of fields north-west of Bready, along the riverside between Cloghboy Road and Grange Road and in a small number of fields between Ash Road and the Burn Dennet.
- 11.5.108 Survey data from the International Swan Census in January 2005 (Crowe et al. 2005) and Robinson et al. (2004) identified a total whooper swan population of 1895-3324 and greylag geese populations of 5269 individuals within the Foyle/Swilly SPA complex. The project specific surveys in winter 2013/2014 recorded peak counts of 873 whooper swan and 218 greylag geese using the Grange Foyle area, although this included those along the River Foyle, 22 whooper swan and a single greylag goose were also recorded at the land to the North of Dunaanlong Road. This data is summarised in Tables 11.11 – 11.14. The findings of the field results are summarised in Figures 11.67 and 11.68. Estimates of populations were made using data from the SPA sites. This indicates that at peak count the population of whooper swan using the Grange Foyle as a feeding ground in 2013/2014 was approximately 52.2% of the total population for the Foyle/Swilly SPA complex. The peak count total greylag geese using the Grange Foyle as a feeding ground in 2013/2014 was approximately 9.2% of the total population for the Foyle/Swilly SPA complex. This indicates that both the Grange Foyle and land to the North of Dunaanlong Road support populations of whooper swan and greylag geese which are approximately 4.2% of the total Irish wintering populations (see Tables 11.4 and 11.7).
- 11.5.109 Overall abundance of both species recorded during the 2013/14 surveys was lower than observed in 2009 however, with the lower abundance of greylag geese particularly of note. The RSPB have suggested that the fewer number of birds recorded in 2014 may be due to the birds using sites elsewhere which have a greater availability of food (e.g. the Republic of Ireland side of the Foyle or other sites within the Foyle / Swilly complex). Given the numbers observed over successive years of study, it is concluded that the River Foyle floodplain is important to the survival and, therefore, the maintenance of the conservation status of both species within the surrounding designated sites.
- 11.5.110 Wintering populations of both species have been classified as being of international biodiversity value.

Table 11.4 Whooper swan desk study data

Site	Whooper Swan 2005 Census Count (Crowe <i>et al</i> , 2005)	Whooper Swan 5 Year Mean Peak Count 1995 – 2000 (Robinson <i>et al</i> 2004)	Lough Foyle WeBS Whooper Swan 5 Year Mean Peak Count 2004 – 2009
Lough Foyle SPA	950	917	869
Lough Swilly / Inch Lough SPA Complex	501	1673	-
River Foyle (incl. Grange Foyle)	444	734	-
Total Foyle / Swilly Complex Counts	1895	3324	-

Table 11.5 Whooper swan field survey data

Chainage/Irish Grid Reference	Site	A5WTC ES 2010	Peak Count Grange Foyle 2013/2014 Field Survey Data	Peak Count North of Dunnalong Road 2013/2014 Field Survey Data
Ch.4500 - 10500	Grange Foyle	1594	873	22
36009 13265 (BTO Tetrad C31R)	Donegal Flood Plain (West of the Foyle)	-	0	

Table 11.6 Greylag geese desk study data

Site	Greylag National Census Count 1999 (Colhoun, 2001)	Greylag 5 Year Mean Peak Count 1995 – 2000 (Hearn & Mitchell, 2004)	Lough Foyle WeBS Greylag 5 Year Mean Peak Count 2004 – 2009
Lough Foyle SPA	-	-	972
Lough Swilly / Inch Lough SPA Complex	-	1218	-
River Foyle (incl. Grange Foyle)	-	181	-

Site	Greylag National Census Count 1999 (Colhoun, 2001)	Greylag 5 Year Mean Peak Count 1995 – 2000 (Hearn & Mitchell, 2004)	Lough Foyle WeBS Greylag 5 Year Mean Peak Count 2004 – 2009
Rol and NI Combined Wintering Population	5269	-	-

Table 11.7 Greylag geese field survey data

Chainage/Irish Grid Reference	Site	A5WTC ES 2010	Peak Count Grange Foyle 2013/2014 Field Survey Data	Peak Count for North of Dunalong Road 2013/2014 Field Survey Data
Ch. 4500 - 10500	Grange Foyle	1700+	218	1
36009 13265 (BTO Tetrad C31R)	Donegal Flood Plain	-	0	

Breeding birds

- 11.5.111 All breeding birds receive legal protection in Northern Ireland, those listed on Schedule 1 of the Wildlife Order are subject to enhanced protection.
- 11.5.112 Details of the findings of the field surveys are contained in Appendix 11P.
- 11.5.113 Three Schedule 1 bird species were recorded during the surveys, although none of these species was exhibiting behaviour associated with breeding. Grey heron was recorded as single individuals at sites 2, 3 and 6, and 2 individuals were recorded at site 13 (Figure 11P.1). Common buzzard was recorded as single individuals at sites 5, 8, 11 and 18; 2 individuals at sites 2, 6, 12 and 13, 3 individuals at site 20 and 4 at site 3 (Figure 11P.1). Sparrowhawk was recorded as a single individual at site 14 (Figure 11P.1). No evidence of barn owl nesting was recorded during surveys of structures within the land take for the Proposed Scheme. No evidence of heronries were found in field surveys, however anecdotal evidence from local residents indicate possible presence at McKean’s Moss.
- 11.5.114 Twenty five notable bird species (SoCC or Northern Ireland BAP) were recorded potentially breeding within the study area (see Table 11P.4), with all sites recording between 9 and 16 notable species.
- 11.5.115 Twenty seven other bird species were recorded during the surveys.

- 11.5.116 Studies and surveys has indicated that species diversity is highest in sites in the northern end and southern end of the Proposed Scheme, these being the sites had the highest diversity of habitats and therefore opportunities for different species. Sites in the north of the survey area support riparian woodland, and are close to wetlands along the Foyle floodplain. Sites in the south of the survey area are close to mature woodland and bogs.
- 11.5.117 The Grange Foyle area of the Foyle Floodplain supports a high diversity of breeding birds and is attributed a biodiversity value at a county scale.
- 11.5.118 The conservation status of bird species and assemblages is used in various publications to determine the ecological value of a site. For instance, the Nature Conservancy Council (NCC) (1989) state numerous criteria for which lands could be selected for Site of Special Scientific Interest (analogous with ASSI) and SPA designation, such as: population size (i.e. >1% of national resource); assemblages of seventy or more breeding species; and/or an assemblage that exceeds threshold expectations for a certain habitat type (this expectation considers conservation status of species and number of species to calculate threshold scores for a certain habitat types e.g. scrub requires a score of fifteen in accordance with Fuller (1982)).
- 11.5.119 The total potential breeding assemblage of fifty five recorded species across the entire survey area falls somewhat short of the assemblage of seventy species suggested above as being an indicator of national value. None of the breeding assemblages associated with the individual habitat types identified during the 2014 BBS score highly enough using the relative threshold values to be of individual national value either. Nevertheless diverse potential breeding assemblage, incorporating PSoCC/SoCC, national and LBAP species, within a 250m buffer around the Proposed Scheme is at least of biodiversity value at a local scale in all habitats except those specified below.
- 11.5.120 When considering the individual habitats discussed above, it is clear that several habitat types are relatively scarce within the confines of the proposed route yet support a disproportionately rich species assemblage or list of 'notable' species. With this in mind it is considered both mature semi-natural and plantation woodland (separate from small and/or isolated copses), and areas of swamp and semi-improved grassland are assessed as of biodiversity value at a district scale.
- 11.5.121 Both hedgerows and man-made structures have also been identified as representing habitat for breeding birds. Nevertheless, both of these habitats are widespread within the survey area and beyond and no single stretch/property is considered likely to support the full array of recorded species in a single situation. These habitats types are therefore assessed as of biodiversity value at a local scale.
- 11.5.122 The expansive areas of improved grassland (forming the dominant habitat type within the Preferred Corridor) sampled during the BBS were found to support an assemblage

of only three species (nevertheless including both meadow pipit and skylark, which are notable species). However, meadow pipits are widespread across a variety of habitats and skylark was recorded from only two of the thirty two transects incorporating improved grassland habitats. This habitat is therefore considered to be extremely limited with respect to its breeding bird assemblage and is assessed as being of biodiversity value within the immediate survey area only. The heronry at Farm Hill near McKean's Moss at Ch. 12000 is assessed as being of biodiversity value at a district scale.

- 11.5.123 Of the twenty five notable species identified during the breeding bird surveys, four species (swallow, meadow pipit, dunnock and starling) were found throughout the survey area. These species breed in a wide variety of habitats in the survey area, or in common habitats (for example, swallows in agricultural buildings), and are attributed biodiversity value at the local scale. House martin is a notable species that can also be attributed local scale biodiversity value as, although it was not found throughout the survey area, it was associated with agricultural buildings in the north and south of the survey area.
- 11.5.124 House sparrow is a notable species, which was recorded in the vicinity of agricultural buildings in the north and middle of the survey area. This species was not represented in the south as habitat grades towards more woodland. It has been attributed a biodiversity value at the local scale.
- 11.5.125 Skylark, tree sparrow, yellowhammer and reed bunting are notable species also associated with agricultural land. These species utilise arable field margins and hedgerows in the north and south of the survey area, and were rarely observed in the middle of the survey area. These species have also been attributed value at the local scale. Linnet is a notable species which showed a similar habitat association, but was only found in agricultural land in the north of the survey area on the Foyle floodplain. It has been attributed value at the local scale.
- 11.5.126 Whitethroat are associated with scrub habitat, and were recorded in low numbers, predominantly in the middle and south of the survey area, with four individuals recorded further north at site 8.
- 11.5.127 The remaining seven notable species (grasshopper warbler, willow warbler, goldcrest, lesser redpoll, song thrush, mistle thrush and bullfinch) were associated with semi-natural woodland in the north and south of the survey area. Willow warbler was found throughout the survey area but numbers of singing males were lower in the middle, where available woodland habitat is scarcer, and with higher numbers in floodplain woodland in the north and mature woodland in the south. A single singing grasshopper warbler was observed at a single site (site 6, Figure 11P.1) in riparian woodland habitat on the Foyle floodplain. Lesser redpoll (sites 2, 3, 5 and 6) and bullfinch (site 5) were also found associated with this habitat in the north of the Proposed Scheme with no

records from the middle or south. Song thrush were recorded throughout the survey area in low numbers, with more individuals recorded in the south of the Proposed Scheme where mature woodland was more prevalent. Mistle thrush were recorded in very low numbers, mainly in the middle and south of the survey area. Lastly, goldcrest observations came predominantly from mature/plantation woodland in the south of the survey area. All these species have been attributed value at the district scale.

- 11.5.128 The barn owl scoping identified one property within 500m of the vesting line, which had the potential to support this species. The building was examined and no signs of barn owl were found. Nevertheless, as barn owl can fly several kilometres to hunt and disperse it is not possible to state with certainty whether the Proposed Scheme corridor is used by this species, however desk study data confirms their presence within the area of the Proposed Scheme. Therefore, barn owl are assessed as of county biodiversity value.
- 11.5.129 A single kingfisher was recorded on the River Strule during other ecological surveys. No other records of kingfisher were noted indicating that they are not common or widespread in the Proposed Scheme corridor. Pre-construction surveys would be undertaken on all watercourse crossings with suitable habitat and mitigation would be agreed with NIEA prior to works commencing at these locations. Due to their relative scarcity in the area, kingfisher are assessed as district biodiversity value.

Wintering bird

- 11.5.130 Findings relative to winter birds are provided in Appendix 11Q.
- 11.5.131 Three Schedule 1 species were recorded: fieldfare was recorded at sites 2, 3, 4, 5, 6 and 7 (Figure 11Q.1); redwing was recorded at sites 2, 3, 4, 5 and 6 (Figure 11Q.1); and brambling was recorded at site 3 only (Figure 11Q.1).
- 11.5.132 Eighteen notable species were recorded, with skylark, house sparrow, meadow pipit and dunnock recorded at all sites except site 1 (Figure 11Q.1). Starling and mistle thrush were recorded at sites 2 to 6 (Figure 11Q.1). Tree sparrow, linnets and yellowhammer were recorded at sites 2, 3, 6 and 7 (Figure 11Q.1). Song thrush was recorded at sites 3, 5 and 7, and mallard was recorded at sites 1, 6 and 7 (Figure 11Q.1). Snipe was recorded at sites 2 and 3, lesser redpoll at sites 5 and 6, and reed bunting at sites 6 and 7 (Figure 11Q.1). Little grebe was only recorded at site 1, kestrel at site 2, black-headed gull at site 3, and bullfinch at site 4.
- 11.5.133 Twenty-one other species were recorded during the surveys.
- 11.5.134 Of all species recorded, the majority were located in arable and hedgerow habitats, with improved grassland supporting a less diverse assemblage. Two species; snipe (sites 2 and 3, Figure 11Q.1) were restricted to the bog and wet woodland habitats

surveyed. The disused quarry (site 1, Figure 11Q.1) supported very few bird species with mallard and little grebe the only notable species recorded.

- 11.5.135 Six general habitat types (arable winter stubble, hedgerows, bog, improved grassland, wet broadleaved woodland and standing water) were included within the wintering bird survey sites. As a result of the land use (arable and stock farming), areas of arable winter stubble, grazed pasture and hedgerows are abundant both in and outside the survey areas. The remaining habitats surveyed are less common.
- 11.5.136 The arable winter stubble, hedgerows are of high suitability for wintering passerines. However, as they are very common in the local and national context, they are evaluated as being of no more than biodiversity value at a local scale for wintering passerines.
- 11.5.137 The wet broadleaved woodland and bog areas do not support such an abundant wintering passerine assemblage, but are known to offer high value habitat for wintering pipits, woodcock and snipe. Due to their less common nature they are evaluated as being of biodiversity value at the district scale for these species.
- 11.5.138 Site 1, the disused quarry is of little value to wintering birds as it is stagnant, and has a lack of shallow marginal habitat, favoured by waders. As such, it is considered to be of biodiversity value within its immediate vicinity only for wetland birds.
- 11.5.139 Owing to the assemblage recorded within the bog and wet woodland habitats, their conservation status and the relative rarity of these habitats, the wintering birds within them are assessed as of biodiversity value at a district scale. Arable fields and hedges supported a slightly less diverse assemblage and are far more common habitats so the wintering bird assemblages in those areas surveyed are assessed as of biodiversity value at a local scale.

Smooth newt

- 11.5.140 The smooth newt is legally protected in Northern Ireland. It is widespread across the country and is not currently listed as a SoCC or priority species. There is concern their habitat is being destroyed by agricultural intensification and that they may become scarcer in the future.
- 11.5.141 Detailed information relating to the presence and the distribution of smooth newt in the assessment study area is shown on Figure 11.69 and provided in Appendix 11R.
- 11.5.142 Smooth newt was found at 18 of the 21 ponds surveyed. It has also been assumed they are present at the 18 where access was denied or survey was deemed to be too dangerous.

- 11.5.143 Of the populations identified two, ponds P17 and P72, have been attributed a county biodiversity value, four, P25, P37, P47 and P65 a district biodiversity value and twelve, P24, P31, P34, P38, P42, P46, P48, P52, P53, P59, P77 and P101, a local biodiversity value. The 18 which were not surveyed have been attributed a biodiversity value at a district scale following the precautionary principle.

11.6 Predicted impacts and mitigation

Designated sites

Lough Foyle, Lough Swilly (including former Inch Lough and Levels and Lough Neagh and Lough Beg SPAs

- 11.6.1 The Proposed Scheme would not involve any direct impacts on the 3 SPAs. The construction and future use of the Proposed Scheme within and in close proximity to the Foyle floodplain west of the river would, however, potentially disturb or displace whooper swan and greylag geese which forage within the area and reduce the extent of the habitat available to the two species. None of the potential impacts would affect the available habitat in the ROI west of the river.

Disturbance during construction

- 11.6.2 Movement of construction plant and workers and noise associated with construction activity could disturb and temporarily displace foraging birds.
- 11.6.3 The Proposed Scheme would generally involve construction more than 250m from those parts of the area of functional habitat where the presence of the species has been recorded east of the river during surveys. There are, however, two locations where there would be construction activity within 250m of identified foraging areas. The first is where the realignment of Donagheady Road would bring the works within 50m of an area of recorded use (Figure 11.67 and 11.68). In this location the works would be separated from any foraging birds by the existing A5. The second is where the proposed introduction of a new link road between Ash Road and Drumenny Road would involve work within 200m of a part of an area where whooper swans were recorded in 2009-2010 (Figure 11.68).
- 11.6.4 There are two locations where construction would involve noise levels above those associated with the general activities associated with movement and activity of plant and vehicles. The first is at Bready where the establishment of a deep cutting along the western facing slopes of Gortmonly Hill would involve breaking out of rock. The second is where piling would be required for bridge abutments at the Burn Dennet. The Bready cutting is 500m from the closest recorded whooper swans and over 1km from the closest greylag geese. The Burn Dennet crossing is 500m from the closest recorded whooper swans and over 2.5km from the closest recorded greylag geese.

- 11.6.5 Following discussion with the geotechnical advisors and contractor advisors for the project it has been confirmed that blasting is not likely to be required at Gortmonly Hill. Should further information come to light as the Proposed Scheme design is finalised which demonstrates a need for blasting, there would be a limitation placed on the timing of the activity to exclude the period between October and March when the birds are present.
- 11.6.6 There would also be a requirement under the contract that should it be the intention to undertake breaking out of rock at Bready and piling at the Burn Dennet within the period when the birds are present, trial breaking out and piling must be undertaken with monitoring by an appropriately qualified ecologist. The trials would involve short periods of breaking out and piling at prescribed intervals to establish if the activity results in disturbance which could prove detrimental should the more prolonged periods of the activities which would be required to complete the cutting and bridge abutments be progressed. Should the trials indicate this would be likely to be the case; the activities would be suspended until the birds have left the area.
- 11.6.7 Taking into account the proximity of working areas and the mitigation measures which would be adopted at locations of higher sensitivity, it has been concluded:
- impacts associated with construction activity would not result in displacement of the two species from the foraging habitat associated with the Foyle floodplain; and
 - construction activity would not have a significant effect on whooper swan and greylag geese in the context of the foraging habitat within the Foyle floodplain or the SPAs with which the two species are associated.

Loss of foraging habitat

- 11.6.8 The implementation of the Proposed Scheme would result in the permanent loss of approximately 40ha of land within the area of potential functional habitat utilised by whooper swan and greylag geese in the Dunalong, Thornhill and Grange Foyle areas of the Foyle floodplain. The lost habitat represents some 2% of the total area of foraging habitat east and west of the river. None of the land which would be taken affects parts of the area identified during the project specific surveys undertaken in 2009-2010 & 2013-2014 as ones which are utilised by swans or geese.
- 11.6.9 Taking into account the small extent of potential foraging habitat which would be permanently lost in the context of the approximately 2010ha of available habitat within the Foyle floodplain and the location of the land take outside of areas which the project specific surveys have indicated are not used by whopper swan and greylag geese, it has been concluded:
- the loss of foraging habitat would not have a detrimental effect on the use of the Foyle floodplain by the two species; and

- the loss of foraging habitat would not have a significant effect on whooper swan and greylag geese in the context of the SPAs with which the two species are associated.

Disturbance by traffic during use of the road

11.6.10 A number of factors have influenced the assessment of the potential for disturbance by traffic during use of the road. Firstly, evidence derived from the project specific site surveys has demonstrated that whooper swan use parts of the foraging habitat which extend to the existing A5 boundary, whereas the nearest parts of the habitat used by greylag geese are located some 600m from the existing road. Secondly, the implementation of the Proposed Scheme would displace a substantial proportion of traffic using the existing A5 south of Bready some 250m further east, hence at greater distance from the most easterly of the foraging habitat used by whooper swans. Thirdly, the alignment of the Proposed Scheme north of Bready and south of Willow Road to the west of the existing A5 would bring a substantial proportion of traffic using the existing A5 nearer to areas used by both species. North of Bready the nearest areas where use has been identified would be some 700m. South of Willow Road the nearest areas where use has been identified would be some 150m. Fourthly, experience of a similar situation following construction of the Toome bypass has demonstrated that whooper swan quickly habituate to continuous traffic movements and work undertaken by Keller (1989) identified greylag geese avoided roads in agricultural land in Scotland, avoidance behaviour being noted for distances of 100m from roads.

11.6.11 Taking the above factors into account and noting the predicted proximity of foraging swan and geese to the Proposed Scheme in light of the findings of the project specific surveys, it has been concluded:

- impacts associated with traffic movement and noise during use would not result in displacement of the two species from the foraging habitat associated with the Foyle floodplain; and
- there would be no consequent significant effect on whooper swan and greylag geese in the context of the SPAs with which the two species are associated.

River Foyle and Tributaries SAC and ASSI, Owenkillew River SAC and ASSI and River Finn (Republic of Ireland) SAC

11.6.12 Potential impacts identified relative to primary habitats and fauna which form the basis for the designation of the three sites and on qualifying habitat and fauna comprise:

- loss of primary or qualifying habitat as a result of construction of the Proposed Scheme;

- harm to Atlantic salmon and loss or deterioration in supporting habitat within the SACs as a result of release of sediments or other pollutants, such as oils and petrochemicals, into watercourses within or outside and upstream of the SACs during construction;
- loss of primary or qualifying habitat and harm to Atlantic salmon within the SAC as a result of the release of sediments or other pollutants associated with road related run-off at drainage outfalls into watercourses within or outside and upstream of the SAC once the Proposed Scheme is open to use;
- loss of primary or qualifying habitat where the proposed bridges over the River Mourne River and Derg River would shade marginal and aquatic habitats beneath the structures;
- accidental spillage resulting in contamination of watercourses within or associated with the SACs and consequent detrimental impact on primary or qualifying habitats and fauna and their supporting habitats;
- harm to Atlantic salmon as a result of loss or deterioration in supporting habitat;
- obstruction of existing passage along watercourses for Atlantic salmon;
- disturbance and harm to otter as a result of construction;
- loss of habitat and a reduction in available food resources for otter;
- fragmentation associated with obstruction of existing access along watercourses resulting in potential mortality or harm where otters seek to cross carriageways; and
- deterioration in water quality resulting in harm to otter and consequent impacts on supporting habitat.

Removal of primary or qualifying habitat within the SAC

- 11.6.13 There are no works proposed within the Owenkillew River SAC and ASSI. There would accordingly be no requirement for removal of primary or qualifying habitats within the designated site.
- 11.6.14 There are two locations where the Proposed Scheme would be located within the Foyle and Tributaries SAC and one where it would be on the margin of the SAC. These are where the dual carriageway would be bridged over the Mourne River and Derg River and where it passes west of Strabane along the margin of the River Finn and the SAC designation is shared with the River Finn SAC west of the mid-stream national boundary with the ROI. The project specific surveys have established the presence of small areas of *Ranunculion fluitantis* and *Callitricho-Batrachion* habitat at both crossing points but none in the section of the River Finn west of Strabane.

- 11.6.15 The proposed bridges crossing over the Mourne River and Derg River would be open-span structures which would not require working within the channel of the watercourse or disturbance to the primary habitat identified.
- 11.6.16 Taking into account the small extent of habitat at risk relative to the SACs as a whole and the adoption of open span structures which would avoid the need for work within the watercourses it has been concluded there would be no significant effect associated with the removal of primary habitats within the SACs.

Release of sediments or other pollutants during construction

- 11.6.17 The Water Framework Directive identifies a requirement for suspended solids levels to be kept below 25mg/l for fish species to thrive. However, Loughs Agency have raised concerns that the risks associated with sediments relative to Atlantic salmon would be greater during construction rather than during use of the Proposed Scheme upon completion of construction. The Agency's concern particularly relates to the proximity of work activities to where sediments would be generated and potentially released into parts of the watercourses where there is spawning and nursery habitat and has stipulated a requirement for a maximum increase of 10mg/l of total suspended solids (TSS) during construction above background levels in such locations.
- 11.6.18 Mitigation measures have accordingly been discussed with Loughs Agency focused on the achievement of both thresholds in accordance with the status of the watercourses as ones used for fish passage and ones where salmonid nursery and spawning habitat is present. The measures would be a mandatory requirement of contract-specific silt management plans (SMPs) which contractors would be required to prepare and agree with the Loughs Agency prior to the commencement of works and which would be incorporated into the CEMP(s) for the construction contracts.
- 11.6.19 Construction activities which would give rise to the potential release of sediments or construction-related pollutants into watercourses and could consequently have an impact on primary or qualifying habitats, Atlantic salmon and supporting spawning, nursery and resting habitats and otter comprise:
- localised in-stream works and works on the bankside of watercourses required for the construction of temporary and permanent bridges, culverts, watercourse diversions and drainage outfalls;
 - construction of filter drains, ditches, swales, grassed channels and wet and dry ponds required to attenuate and carry road related run-off to drainage outfalls; and
 - earthworks occurring within 50m of watercourses within or upstream of the SACs; and

- release of pollutants such as cement and hydrocarbons associated with working activity close to watercourses and storage areas within site compounds and materials storage areas.

- 11.6.20 Temporary bridges over the Burn Dennet, Glenmornan River Derg River and Fairy Water would be clear span structures that would be installed at a level which allows for flood water to pass underneath, and does not block movement of animals along the watercourse corridor.
- 11.6.21 Construction of the abutments for the permanent bridges over the Burn Dennet, Glenmornan River, Mourne River, Derg River and Fairy Water would involve the installation of sheet piling coffer dams at the water edge to enable works behind to proceed unhindered by potential ingress of water. The piling would also serve to protect the watercourses from inadvertent release of sediment as the works proceed. There would be a small release of sediment as the piling is removed. It would also be likely that there would be small quantities of sediment released into the watercourses as the banks below the abutments are graded to receive gabion mattress protection at the foot of the abutments. In both instances the volume of short-term sediment released would be near to negligible relative to the volumes of water in the watercourses. Contractors would also be required to ensure imported rock does not contain invasive species of plant.
- 11.6.22 Where culverts would be introduced on the line of an existing watercourse, temporary sections of diverted watercourse would be provided to maintain continuity of flow and reduce potential introduction of sediments into the watercourses to a minimum. There would be a small volume of sediment released as material is removed to re-establish the original alignment.
- 11.6.23 Where watercourse diversions are proposed, the new section of watercourse would be constructed in advance of the existing sections being abandoned. There would be a small volume of sediment released as material is removed to effect the connection between the existing watercourse and the new section at each end of the diversion.
- 11.6.24 There are 6 proposed discharges into the River Finn SAC for road related run-off which would issue either directly into the river or into tributaries which in turn flow into the main river. They would discharge at a point where the river is the subject of designation as the River Foyle and Tributaries SAC and the River Finn SAC either side of the national boundary which is mid-stream. There are 9 proposed discharges into the River Foyle and Tributaries SAC for road related run-off which would issue directly into watercourses within the SAC and 29 which would discharge into tributaries/headwaters within the River Foyle Catchment. The 44 discharges within the SACs or tributaries and headwaters which eventually feed into watercourses within the designated sites are highlighted in Table 16E.1 in Appendix 16E. The volumes of soils which would be excavated to facilitate the installation of each outfall would be small. Excavated soils

would be temporarily set aside a minimum of 3m from the top of the bankside and any not required for reinstatement of the bankside would be removed from site once reinstatement of the bankside profile is completed. The activity is one which would be of short duration. The risk would be greater where outfalls are required on smaller tributaries and headwaters with relatively low volumes of flow. In these locations the works would be programmed for implementation at times of lowest flow between May and September.

- 11.6.25 Construction of the drainage networks which would feed into the outfalls would involve the release of sediments as filter drains, swales, ditches and pipe trenches are excavated. Potential release into receiving watercourses would be controlled by the advanced construction of permanent retention ponds with penstocks at the outfall from the ponds or the introduction of temporary settlement ponds pending completion of the permanent works.
- 11.6.26 The risk of release of sediments into watercourses within or upstream of the SACs where earthworks are required within 50m of watercourses would be managed by way of a comprehensive range of mitigation measures. These are scheduled in paragraph 16.5.5 in Chapter 16. There is one location, other than at the proposed crossings of the Mourne River and Derg River, where the Proposed Scheme would be within 50m of watercourses within an SAC. This is on the western margin of Strabane where the River Finn flows north to its confluence with the River Foyle. Here, the works would involve the introduction of embankments along the river margin for a distance of some 800m. The potential for release of sediment into the watercourse in this location would be controlled by the introduction of a lined barrier at the water edge.
- 11.6.27 Risk associated with spillage of fuels and oils associated with machinery required for earthworks and installation of the structures, use of harmful materials such as cement where works close to watercourses are required and the presence of harmful materials such as cement or fuels in storage within compounds would be managed by way of a comprehensive range of mitigation measures. These are scheduled in paragraph 16.6.5 in Chapter 16.
- 11.6.28 Taking into account the protocols and mitigation measure which have been agreed with NIEA and Loughs Agency and which would form a mandatory requirement of contracts for the construction of the Proposed Scheme, it has been concluded:
- risks relating to release of sediments and other construction-related pollutants would be appropriately managed; and
 - potential impacts associated with the relevant construction-related activities would not have a significant effect on the primary or qualifying habitats, Atlantic salmon and supporting spawning, nursery and resting habitats within the SACs.

Release of sediments or other pollutants associated with road related run-off

- 11.6.29 There are no proposed drainage outfalls which would discharge to any of the watercourses or upstream of watercourses which are included within the Owenkillew River SAC. There is accordingly no risk relative to release of sediments or other pollutants associated with road related run-off.
- 11.6.30 There are 44 outfalls which would discharge into the Foyle and Tributaries SAC, River Finn SAC or tributaries and headwaters which eventually feed into watercourses within the designated sites. These are highlighted in Table 16E.1 in Appendix 16E.
- 11.6.31 Management of the risk of release of sediments or other pollutants associated with road-related run-off for each of these discharges has been built into the proposed drainage design following detailed discussions with NIEA and the Loughs Agency and the agreement of design measures involving the use of SUDS as detailed in Chapter 6. The objective has been to ensure that potential release of sediments and pollutants carried in soluble or suspended form associated with run-off would pass the HAWRAT (see Chapter 16) taking into account the sensitivity of the receiving watercourses within the designated sites and that in-stream concentrations relative to the passage of fish would be below the 25mg/l recommended in the Water Framework Directive. The results of the assessments as summarised in Table 16E.1 demonstrate that all 44 of the discharges within the SACs or tributaries and headwaters which eventually feed into watercourses within the designated sites pass the HAWARAT and would be under the 25mg/l threshold recommended in the WFD relative to the passage of fish. It has accordingly been concluded the Proposed Scheme would not result in any significant environmental effects relative to discharge of sediments and other pollutants associated with road related run-off in the context of the SACs.

Shading at the Mourne River and Derg River crossings

- 11.6.32 Taking into account the small extent of *Ranunculion fluitantis* or *Callitriche-Batrachion* habitat which could potentially be affected by shading at the two crossings, and the adoption of open span structures, which reduce the intensity of the shading, the risk that this would have a detrimental effect on the habitat in these locations is low. Should deterioration occur in these small areas, the effect on a combination of unstable substrate and good examples of the habitat type in the context of the habitat relative to the designated site as a whole would be slight / negligible and the effect would not be significant.

Accidental spillage

- 11.6.33 The risk of accidental spillage during use resulting in unspecified materials being deposited into watercourses has been investigated as part of the assessments undertaken into impacts on surface waters. The findings, reported in Chapter 16, have demonstrated the worst case for any of the proposed outfalls is that the risk would

relate to a 1 in 1100 year return period. This is a risk which is substantially lower than the threshold level of a 1 in 200 year return period recognised in the DMRB as one which would require consideration being given to mitigation measures beyond the design measures which have been subject to the initial assessment where discharges are within or in the vicinity of sites recognised for their nature conservation value.

- 11.6.34 Notwithstanding the very low levels of risk, the design for all drainage outfalls, including the 44 which would discharge within the SACs or tributaries and headwaters which eventually feed into watercourses within the designated sites provides for the introduction of a valve / penstock prior to discharge to facilitate routine or emergency maintenance of the drainage network. This would also serve to provide a facility for closing off any of the drainage catchments as part of an emergency action plan for future maintenance of the Proposed Scheme should an accidental spillage occur.
- 11.6.35 Taking into account the proposed design measures and findings of the assessment, it has been concluded potential impacts associated with accidental spillage would not have a significant effect on the primary or qualifying habitats, Atlantic salmon and supporting spawning, nursery and resting habitats within the SACs.

Harm to Atlantic salmon as a result of construction-related noise, vibration and lighting within the SAC and wider catchments

- 11.6.36 Atlantic salmon are capable of detecting the pressure and particle motion components of sound. The potential impacts of exceeding their hearing threshold can be hearing impairment or death, either directly from noise generation or indirectly as a result of hearing impairment. Construction activities associated with the Proposed Scheme likely to pose such a risk are blasting or piling, particularly within watercourses.
- 11.6.37 The proposals do not involve blasting or piling within watercourses. The establishment of abutment foundations at the proposed Fairy Water, Mourne River and Derg River crossings would, however, involve piling close to the top of the bankside slopes at both watercourses. In light of this, discussions have been held with the Loughs Agency and appropriate mitigation measures have been identified.
- 11.6.38 A working window of May to September would be adhered to for the Derg River crossing to avoid the critical salmonid migration period.
- 11.6.39 Continuous Flight Auger (CFA) piles would be used at the Mourne River crossing. In the case of the foundations for the abutment walls at other bridges, either CFA or drilled piles would be used; both of these forms of piling do not produce significant vibration.
- 11.6.40 A soft-start method would be adopted for all locations where piling would be undertaken in the immediate vicinity of salmonid watercourses. This would involve a gradual increase in force and intensity of drilling, and hence, noise and vibration, over a

30 minute period to allow Atlantic salmon to move outside of the area of influence. The method would be employed each time the machinery is started following a 30 minute rest period. Once the piling is in full operation, associated noise and vibration from the machinery would keep the fish outside of the area of influence and thus equipment can be switched off.

- 11.6.41 Artificial lighting at night has the potential to disrupt and disorientate fish, increase exposure to predation, alter light-sensitive endocrine systems and disrupt crepuscular and nocturnal mating, signalling and dispersal (Rich and Longcore, 2006). With regards to Atlantic salmon, the main impacts resulting from artificial lighting are disruption to migration behaviour and increased mortality rates due to increased efficiency of predators. Night working in the vicinity of watercourses identified as being of salmonid interest would not generally be allowed. However, circumstances may arise which require emergency works outside of daylight hours, in these cases lighting would be positioned / cowled to minimise light spill onto the watercourse and the duration would be kept to a minimum.

Loss of supporting habitat for salmonids

- 11.6.42 The introduction of bridges, culverts, watercourse diversions and drainage outfalls within the designated sites and on salmonid watercourses outside of the designated sites would involve temporary and permanent loss of marginal habitats with overhanging vegetation and reduced flows and in-stream habitat including boulders and gravels. These are important for fish migration as they provide areas of cover under which to rest and protection from predators and direct sunlight.
- 11.6.43 There would be a need to remove bankside vegetation to enable protection to be introduced at the base of the abutment walls required to support the proposed open-span bridges over the Mourne River and Derg River within the Foyle and Tributaries SAC and to facilitate the implementation of drainage outfalls into the River Foyle west of Magheramason (S1 OF 26), into the River Finn west of Strabane (S1 OF 22, S1 OF 36, S1 OF 37 and S1 OF 42) and into the Derg River in the vicinity of the proposed bridge over the river (S2 OF 5 and S2 OF 6). The total area of bankside vegetation which would be removed in the 11 locations affected would be some 0.04ha. None of the vegetation which would be affected comprises habitat which is cited as a primary or qualifying reason for designation of the Foyle and Tributaries SAC or River Finn SAC. The loss of such small areas of bankside vegetation would not have an impact of note on the availability of marginal and riverside vegetation as a habitat which, in part, supports Atlantic salmon as primary and qualifying species within the two SACs.
- 11.6.44 The introduction of open span bridges on watercourses outside of the SACs but which constitute tributaries and headwaters which eventually feed into watercourses within the designated sites would similarly involve the permanent loss of bankside vegetation beneath the open span structures. The loss would include grassy banks, scrub and

overhanging trees. In the context of each of the watercourses crossed, the length and scale of the watercourses and extent of salmonid habitat associated with each watercourse, the loss would be negligible. To ensure that in stream vegetation habitat loss is minimised, pre-planted coir rolls of suitable native emergent and marginal vegetation would be inserted into the rip-rap during construction. In addition, suitable bankside planting would be undertaken. The Proposed Scheme provides for the introduction of culverts at 64 locations on watercourses outside of the designated sites which eventually feed into watercourses within the designated sites and which Loughs Agency has confirmed are salmonid. In line with the precautionary approach adopted during this assessment, these are currently assumed to be of importance to Atlantic salmon and would comprise box culverts. The proposed culverts vary in length from 25m to 110m. Most do not exceed 60m. The total length of culvert, and hence the length over which bankside, marginal and in-stream habitat would be permanently lost is some 3.4km. Two of the watercourses would have 3 culverts, 12 would have 2 culverts and 30 would have one culvert.

- 11.6.45 In the context of some 300km of watercourse where salmonid presence / potential has been established, the permanent loss of some 6.8km of marginal and bankside habitat across 44 watercourses within the catchments would constitute a small and non-significant impact on the total habitat available and the habitat available along each watercourse. Notwithstanding the low level of impact, proposed mitigation provides for the introduction of bankside planting reflecting that which would be lost within the vested land upstream and downstream of each culvert. This would, in some instances, enhance the tree, scrub and grassland habitats as sources of food and shade at resting places.
- 11.6.46 Initial loss of in-stream habitat, primarily comprising gravels and boulders where culverts are proposed, would be mitigated by the embedding of culvert bases, introduction of gravels and boulders, provision for natural sedimentation and location of boulders upstream and downstream of the structures.
- 11.6.47 The 55 proposed watercourse diversions of watercourses with salmonid interest would involve the permanent loss of supporting habitats along some 10km of existing sections of watercourse which would be abandoned. The lost habitat would be re-established as part of the construction of the new sections. This would involve the replication of bed and channel characteristics of the watercourses and planting of marginal and bankside habitat which would reinstate the ecological characteristics of the original watercourse along the diversions on which they are located. It would also be a specific requirement of the contracts that construction of the new sections is completed prior to the closure and abandonment of the diverted section. The de-watering of the abandoned sections would be carried out under supervision of an ecological clerk of works to ensure fish which may be present, including salmon, are safely removed.

Harm to Atlantic salmon as a result of obstruction to movement along existing watercourse channels and margins

- 11.6.48 The introduction of bridges, culverts and watercourse diversions as permanent features along watercourses used by Atlantic salmon could potentially obstruct or discourage passage of the fish as they seek to return to spawning areas and migrate to sea. The following design and mitigation measures, which include advice detailed in River Crossings and Migratory Fish: Design Guidance (Scottish Executive 2000), have accordingly been incorporated into the proposals:
- provision of oversized box culverts along watercourses identified as being of importance to salmonids;
 - diversion of watercourses to facilitate the introduction of a shorter culvert, with lower flow velocity downstream and better light penetration, at or close to right angles to the Proposed Scheme carriageways where the angle of crossing would otherwise be overly long or steep;
 - avoidance of steps in the vertical profile through culverts and along associated diverted watercourses;
 - avoidance of bends in culverts which could initiate the deposition of debris and obstruct passage;
 - adoption of vertical profiles through the culverts relative to length in accordance with Table 5.1 of the guidance; and
 - provision of resting areas upstream and downstream of the culverts.
- 11.6.49 The proposals recognise that during periods of low flow many of the smaller watercourses which feed into the main rivers and principal tributaries and in the upper parts of the catchment have little depth of water. The design proposals which require embedding of culvert bases, introduction of gravels and boulders, provision for natural sedimentation and location of boulders upstream and downstream of the structures, make specific provision for these locations, but would also be required wherever box culverts are proposed in light of salmonid presence / potential.
- 11.6.50 Taking into account the proposed design and mitigation measures which would form a mandatory requirement of the design for the Proposed Scheme, it has been concluded:
- risks relating to fragmentation and obstruction would be appropriately managed; relative to Atlantic salmon; and
 - fragmentation and obstruction associated with future use of the Proposed Scheme would not have a significant effect on Atlantic salmon as a qualifying species for the SACs.

Disturbance and harm to otter as a result of construction

11.6.51 Sources of potential impact during construction include:

- disturbance to movement along watercourses where work is being undertaken along or close to watercourses;
- disturbance in the vicinity of breeding habitat which could lead otter to abandon cubs or to move them too early causing harm to the cubs; and
- harm should an otter become trapped in open steep sided excavations

11.6.52 Night time working would not be permitted adjacent to watercourses where the presence of otter is confirmed by way of further surveys which would be undertaken in advance of construction.

11.6.53 Mitigation measures which have been identified include:

- location of compounds and storage of materials a minimum of 50m away from watercourses;
- fencing off of riparian habitat to be retained within working areas;
- installation of suitable fencing to exclude otters from works areas near watercourses where use by the species has been established;
- fencing or covering of excavations in excess of 2m depth over-night in the vicinity of watercourses where use by the species has been established;
- provision of a suitable ramp within all uncovered excavations during non-working hours; and
- inclusion of a contractual requirement for contractors to provide details for temporary means of continued passage along relevant watercourses during construction in location specific method statements pending the incorporation of permanent means of passage in the completed works.

Taking into account the proposed protocols and mitigation measures which would form a mandatory requirement of contracts for the construction of the Proposed Scheme, it has been concluded:

- risks relating to disturbance or harm of otter during construction would be appropriately managed; and
- potential impacts would not have a significant effect on otter as a qualifying species in the context of the SACs.

Loss of habitat and a reduction in available food resources

- 11.6.54 Two holts confirmed as in use either during the 2008/9 or 2013 surveys lie within the Proposed Scheme boundary. In addition, 1 confirmed holt and 1 potential holt are within 250m of the land take. Furthermore, 1 potential resting place is within the land take, and 1 confirmed and 1 potential resting place are within 250m of the land take.
- 11.6.55 In addition to the holts and breeding habitat identified, the construction of the Proposed Scheme would involve the loss of localised and small areas of marginal and bankside habitat along some 14 watercourses within the wider catchment associated with the SAC where use by otter was confirmed in the 2013 surveys, a further 12 watercourses could not be surveyed due to access restrictions. The extent of riparian habitat lost is not likely to be significant when considering the extent of otter home ranges, which can extend over tens of kilometres (Chanin, 2003), and the fact that the loss is spread out over a number of sites in a wide geographical area. In the context of the extent of the habitats as they are represented throughout the relevant parts of the catchment, these localised and small losses would not constitute a risk to the species by virtue of a material deterioration in the availability and continuity of supporting habitat.
- 11.6.56 Mitigation measures which have been identified include:
- construction of artificial holts near the River Derg and Routing Burn crossings;
 - riparian habitat that is to be retained would be fenced off and clearly marked to prevent contractors accessing these areas;
 - measures to protect fish as identified in 11.6.36 to 11.6.50 and 11.5.105 to 11.5.112; and
 - night working would not be permitted adjacent to watercourses where the presence of otter is confirmed by way of further surveys which would be undertaken in advance of construction.
- 11.6.57 Artificial holts would be located in the vicinity of the proposed crossing of the Derg River and Routing Burn to replace the existing holts located on the line of the Proposed Scheme. Mammal fencing would be installed along the road boundary at this location. The artificial holt would be located at the edge of the construction site and would be fenced off from the works with close-board fencing.
- 11.6.58 The artificial holts would consist of a number of chambers (up to 1m²) and would be constructed from breeze blocks or log piles for walls and covered in logs with brash for the ceiling. There would be at least one chamber that has no external opening. There would be at least two concealed entrances, one into the river and one onto the bank.
- 11.6.59 Vegetation in confirmed or suspected breeding/resting areas would be cleared under the supervision of a suitably experienced ecologist. Toolbox talks would be provided to site staff which would provide information on where this species may be found and how

to avoid impact to them. If otters are at risk of injury from the works, site staff would be instructed to cease working and contact the ecological supervisor.

11.6.60 Taking into account the proposed protocols and mitigation measures which would form a mandatory requirement of contracts for the construction of the Proposed Scheme, it has been concluded:

- risks relating to loss of habitat and reduction in food availability would be appropriately managed; and
- potential impacts would not have a significant effect on otter as a qualifying species in the context of the SACs.

Fragmentation associated with obstruction of existing access along watercourses resulting in potential mortality or harm where otters seek to cross carriageways

11.6.61 The fragmentation of habitats is a common threat to otter, but of greater concern where associated with roads (Harris et al., 1995; Kruuk, 1995). Death of otter as a result of road death is thought to be the predominant cause of non-natural mortality in the species (Green, 1991; O'Sullivan and FitzGerald, 1995; Philcox et al., 1999; Chanin, 2006), with the number of deaths as a result of road traffic accidents thought to be increasing (Körbel, 1994; Green & Green, 1997).

11.6.62 The Proposed Scheme crosses a number of watercourses where otter presence has been confirmed, which if inappropriately managed would sever otter territories and could cause otter to attempt to cross the carriageway. The Proposed Scheme incorporates forty-four tunnels or ledges for otter passage adjacent to culverts across the Foyle catchment (see Figures 6.18-45). These locations represent watercourses where otter have been found to be utilising habitat either side of the route, with the provision of safe passage being important to reduce the significance of a potential impact. Further to these, all of the major watercourses within the Foyle catchment have clear-span structures proposed which provide for suitable and safe passage beneath the Proposed Scheme.

11.6.63 Tunnels would be 600mm diameter pipes if less than 20m long and 900mm pipes if over this length, with suitable fencing to guide otter into the tunnel entrance, and ensure that otter do not access the mainline at the watercourse crossing point.

11.6.64 Otter ledges would be installed with a clearance that is 150mm above the 1 in 25 return period flood level whilst allowing for 600mm of headroom (however where this is not possible with culvert design the headroom can be lowered to 300mm). The ledges would either be pre-cast into the culvert or would be a bolt on design using metal brackets and wooden planks or mezzanine flooring sections. The ledge would be of 500mm width and positioned so as to be accessible from the bank and the water.

- 11.6.65 Taking into account the proposed design and mitigation measures which would form a mandatory requirement of the design for the Proposed Scheme, it has been concluded:
- risks relating to fragmentation and obstruction would be appropriately managed; relative to otter; and
 - fragmentation and obstruction associated with future use of the Proposed Scheme would not have a significant effect on otter as a qualifying species for the SACs.

Deterioration in water quality resulting in harm to otter and loss or deterioration in supporting habitat.

- 11.6.66 In common with Atlantic salmon, sediments and other construction related pollutants associated with construction, road related run-off during use and accidental spillage could result in harm to otter and loss or deterioration in supporting habitat. In common with Atlantic salmon the design and mitigation measures proposed to control sediment and other potentially polluting materials, such as fuels, oils and cement would serve to avoid such impacts or limit them such that the effect would be negligible relative to the species and its supporting habitat.
- 11.6.67 Taking into account the proposed design and mitigation measures which would form a mandatory requirement of contracts for the design and construction of the Proposed Scheme, it has been concluded:
- risks relating to sediments and other pollutants would be appropriately managed; relative to otter and
 - potential impacts associated with construction and future use of the Proposed Scheme would not have a significant effect on otter as a qualifying species for the SACs.

Tully Bog SAC

- 11.6.68 The Proposed Scheme would not have a direct impact on Tully Bog SAC and ASSI. Potential impacts identified by virtue of the location of the Proposed Scheme some 200m east of the designated site comprise:
- deterioration in habitat quality by virtue of dust deposition during construction;
 - deterioration in habitat quality by virtue of nitrogen deposition following opening of the Proposed Scheme to use; and
 - deterioration in habitat quality by virtue of changes in hydrological regimes which currently support the raised bog habitat.

Dust deposition

- 11.6.69 At their nearest, the working areas required for construction of the Proposed Scheme would be located 100m north-east of the SAC whilst larger-scale earthworks would be located some 200m to the north-east where the grade separated junction (J11) north of Omagh would be located. At these distances, upwind of the prevailing winds, the risk of dust deposition which could have a material impact on the bog habitat would be very low. Notwithstanding the low level of risk, progress of the works would be monitored to determine if measures such as damping down of earthworks would be required should extended dry periods of weather coincide with winds from a non-prevalent easterly, north-easterly or south-easterly direction.
- 11.6.70 It has accordingly been concluded that construction-related dust would not have a significant effect on the designated site.

Nitrogen deposition

- 11.6.71 At Tully Bog the NO_x concentrations are predicted to be less than 8µg/m³ (1/3 of the EU limit value) at all locations with the Proposed Scheme in place.
- 11.6.72 Predicted rates of nitrogen deposition at the SAC for the Do-minimum and Do-Something scenarios based on the anticipated opening year for the fully completed scheme, 2028, has indicated that deposition rates would be in the order of 20.4 kg N ha⁻¹yr⁻¹ on the eastern boundary of the SAC should the Proposed Scheme be implemented compared to 20.2 kg N ha⁻¹yr⁻¹ should it not be implemented. These rates compare to a baseline rate for 2013 of 30.14 kg N ha⁻¹ yr⁻¹. The data demonstrates that deposition rates would fall in 2028 should the Proposed Scheme be built or not and that the difference with and without the Proposed Scheme would be marginal. In all instances the rates would exceed the UNCE critical load for the habitat of 5-10 kg N ha⁻¹ yr⁻¹ to a substantial degree.
- 11.6.73 The increased deposition of nutrients upon the bog could present a significant effect. However, the differences of input resulting from the Proposed Scheme are very low (0.2kg N ha⁻¹ y⁻¹), a small proportion of the SAC would experience these slightly elevated levels, and detailed field surveys demonstrate a lack of competitive species, such as purple moor grass, on the bog surface that would take advantage of the increased nitrogen levels to supplant the existing vegetation (see Appendices 11D and 11F). The flora assemblage present would be therefore not expected to alter as a result of the change in nutrient input. It is concluded that the slight increase in nitrogen deposition presented by the Proposed Scheme would not have a significant effect on the SAC.

Changes to hydrology

- 11.6.74 The bog occupies the lowest point in the local terrain. The nearest proposed works are the tie-ins to Todds Rd and Drumlegagh Rd. They would not involve any work to the west side of Drumlegagh Rd. The main line works would involve a range of low height embankments and cuttings. The cuttings would not extend below the level of the bog, so would not be expected to depress the local groundwater level. There are areas of soft ground between Junction 11 and Drumlegagh Rd which would need to be removed and replaced with sound material during the construction of the earthworks. However, that excavation is not expected to be more than 2m deep and, therefore, not significantly below the level of the Tully Bog. Given the distance and temporary nature of the works, the impact upon the groundwater regime is expected to be negligible. The embankments would result in a surcharging of the ground around junction 11, which would result in a minor reduction in the permeability of the clay soils in that area. That may locally result in a minor increase in the groundwater level up-gradient of that location. However, the nature of the local soils is such that its significant permeability would not be reduced by the construction of the embankments as such soils are largely incompressible. The construction of the Proposed Scheme is not expected to affect the hydrological regime either by decreasing the input or increasing the output of water. No drainage features of the bog would be affected as a result of the Proposed Scheme.
- 11.6.75 Groundwater flow has not been considered important for raised bogs as they were thought to lie on top of other geological and soil strata (Lindsay 1995), however NIEA have indicated that ongoing research has demonstrated that raised bogs can be hydrologically linked to the groundwater regime in the area surrounding them.
- 11.6.76 The lowest part of Tully Bog is at approximately 62mAOD. There is a natural clay ridge to the east of Tully Bog which is at approximately 64mAOD, and which does not have any groundwater seepage in evidence. As the works would not interfere with this geological feature, and would be at a lower level in the terrain, there is no significant risk of altering the hydrology of the bog.
- 11.6.77 In light of the above considerations, it has been concluded the Proposed Scheme would not have a significant effect on the SAC / ASSI by virtue of changes to the current hydrological regime within the designated site and wider area.

McKean's Moss ASSI

- 11.6.78 The Proposed Scheme would not have a direct impact on McKean's Moss ASSI. Potential impacts identified by virtue of the location of the Proposed Scheme some 100m east of the designated site comprise:
- deterioration in habitat quality by virtue of dust deposition during construction;

- deterioration in habitat quality by virtue of nitrogen deposition following opening of the Proposed Scheme to use; and
- deterioration in habitat quality by virtue of changes in hydrological regimes which currently support the raised bog habitat.

Dust deposition

- 11.6.79 At their nearest, the working areas required for construction of Proposed Scheme would be located 100m north-east of the ASSI. At these distances upwind of the prevailing south westerly winds, the risk of dust deposition which could have a material impact on the bog habitat would be very low. Notwithstanding the low level of risk, progress of the works would be monitored to determine if measures such as damping down of earthworks would be required should extended dry periods of weather coincide with winds from a non-prevalent easterly, north-easterly or south-easterly direction. It has accordingly been concluded that construction-related dust would not have a significant effect on the integrity of the designated site.

Nitrogen deposition

- 11.6.80 At Tully Bog the NO_x concentrations are predicted to be less than 8µg/m³ (1/3 of the EU limit value) at all locations with the Proposed Scheme in place.
- 11.6.81 Predicted rates of nitrogen deposition at the ASSI for the Do-minimum and Do-Something scenarios based on the anticipated opening year for the fully completed scheme, 2028, has indicated that deposition rates would be in the order of 16.51 kg N ha⁻¹yr⁻¹ on the eastern boundary of the ASSI should the Proposed Scheme be implemented compared to 16.0 kg N ha⁻¹yr⁻¹ should it not be implemented. These rates compare to a baseline rate for 2013 of 22.72 kg N ha⁻¹ yr⁻¹. The data demonstrates that deposition rates would fall in 2028 should the Proposed Scheme be built or not and that the difference with and without the Proposed Scheme would be marginal. In all instances the rates would exceed the UNCE critical load for the habitat of 5-10 kg N ha⁻¹ yr⁻¹ to a substantial degree.
- 11.6.82 The increased nutrient deposition upon the bog could present a significant effect. However, the differences of input resulting from the Proposed Scheme are low (0.51kg N ha⁻¹ y⁻¹), a small proportion of the ASSI would experience these slightly elevated levels, and the fact that detailed field surveys demonstrate a lack of competitive species, such as purple moor grass, on the bog surface that would take advantage of the increased nitrogen levels to supplant the existing vegetation (see Appendices 11D and 11F). The flora assemblage present would be therefore not expected to alter as a result of the change in nutrient input. It has been concluded the marginal increase in nitrogen deposition should the Proposed Scheme be implemented would not constitute a significant effect on the ASSI.

Changes to hydrology

- 11.6.83 McKean's Moss lies on the Foyle floodplain at approximately 2m AOD. In this location the groundwater level is close to the ground level, although it may be affected by seasonal variation in the water level associated with the River Foyle. The Proposed Scheme at this point would be approximately 8m AOD and thus significantly higher than the bog. There could be groundwater flow from east to west which may contribute to the water levels within the ASSI, however, the drift geology at this point is sands and gravels, and water would be expected to find its way through these layers and continue to flow. Any spring lines which are encountered during construction would be piped under the road. In light of the above considerations, it has been concluded the Proposed Scheme would not have a significant effect on the ASSI by virtue of changes to the current hydrological regime within the designated site and wider area.

Grange Wood and Strabane Glen ASSIs

- 11.6.84 No direct impacts would occur at these sites.
- 11.6.85 Potential for air quality impacts on the sites are:
- Dust deposition during construction; and
 - Nitrogen deposition during operation of the road.

Dust deposition

- 11.6.86 At their nearest, the working areas required for construction of Proposed Scheme would be located 550m south-west of Grange Wood ASSI and 475m north-west of Strabane Glen ASSI. Strabane Glen ASSI is downwind from the Proposed Scheme and therefore at slightly greater risk of dust deposition than Grange Wood ASSI which is upwind of the works. At 550m upwind of the prevailing south-westerly winds, the risk of dust deposition, which could have a material impact on the woodland habitat of Grange Wood ASSI, would be very low. At 475m downwind of the prevailing south westerly winds, the risk of dust deposition which could have a material impact on the woodland habitat of Strabane Glen ASSI would be low. Notwithstanding the very low to low level of risk, progress of the works would be monitored to determine if measures such as damping down of earthworks would be required should extended dry periods of weather coincide with winds from a non-prevalent easterly, north-easterly or south-easterly direction. Taking the low levels of risk and proposed mitigation measures into account it has been concluded that construction-related dust would not have a significant effect on the integrity of the designated sites.

Nitrogen Deposition

- 11.6.87 Predicted rates of nitrogen deposition at Grange Wood ASSI for the Do-minimum and Do-Something scenarios based on the anticipated opening year for the fully completed scheme, 2028, has indicated that deposition rates would be in the order of 25.07 kg N ha⁻¹yr⁻¹ should the Proposed Scheme be implemented compared to 25.06 kg N ha⁻¹yr⁻¹ should it not be implemented. These rates compare to a baseline rate for 2013 of 35.18 kg N ha⁻¹ yr⁻¹. The data demonstrates that deposition rates would fall in 2028 should the Proposed Scheme be built or not and that the difference with and without the Proposed Scheme would be negligible.
- 11.6.88 Predicted rates of nitrogen deposition at Strabane Glen ASSI for the Do-minimum and Do-Something scenarios based on the anticipated opening year for the fully completed scheme, 2028, has indicated that deposition rates would be in the order of 35.36 kg N ha⁻¹yr⁻¹ should the Proposed Scheme be implemented compared to 35.33 kg N ha⁻¹yr⁻¹ should it not be implemented. These rates compare to a baseline rate for 2013 of 48.83 kg N ha⁻¹ yr⁻¹. The data demonstrates that deposition rates would fall in 2028 should the Proposed Scheme be built or not and that the difference with and without the Proposed Scheme would be very low.
- 11.6.89 In all instances the rates would exceed the UNCE critical load for the habitat of 5-10 kg N ha⁻¹ yr⁻¹ to a substantial degree.

Strabane Nature Reserve

- 11.6.90 Approximately 1.3ha (43%) of Strabane Nature Reserve would be taken for construction of the Proposed Scheme.
- 11.6.91 The proposals provide for the introduction of 0.7ha of wet woodland, based on the mix scheduled in Table 6.6 in Chapter 6, adjacent to the site and the northbound carriageway of the proposed dual carriageway (Figure 6.23).
- 11.6.92 The remaining loss of 0.6ha (approximately 20%) of the nature reserve is considered to be a significant effect at a county scale.

Aquatic habitats and fauna

River habitats and flora

- 11.6.93 Potential impacts on river habitats and flora would be:
- permanent loss of habitat due to culverting and installation of drainage outfalls;
 - temporary impacts at crossing points and in re-aligned sections of watercourses;
 - the loss of bank side vegetation, shading and/or probable degradation to water quality affecting macrophyte assemblages; and

- permanent changes to hydrology and river morphology due to installation of structures on watercourses.

11.6.94 These impacts could affect the WFD status of several rivers within the Proposed Scheme corridor. River 2, Blackstone Burn, river 12, river 13, The Black Burn, river 26, river 33, Letfern Burn, Roughan river, river 43 and river 45 would be subject to realignments, diversions/ and or culverts affecting the physical characteristics of stretches of water course up to 750m long.

11.6.95 The Rivers Derg, Drumragh, and Fairy Water have priority habitat species associated with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation. However, due to the clear span nature of the crossing, the limited loss of bankside vegetation and the small areas shaded, these impacts alone would not be expected to affect the conservation status of any assemblage present. The macrophytes within other water courses would receive greater levels of impact, due to the construction of culverts. Due to the lower biodiversity values of the macrophyte assemblages recorded these would not constitute a significant effect.

11.6.96 Operational impacts upon habitats and flora from shading and changes to hydrology in non-designated rivers would be similar to those at construction stage.

11.6.97 Mitigation measures which have been identified include:

- Working practices controlled by a Construction Environmental Management Plan (CEMP) to control release of sediment and other construction related pollutants;
- Adherence to relevant Pollution Prevention Guidance (PPG);
- Offline construction of culverts where practicable; and
- Sensitive construction and habitat creation within realigned watercourses.

11.6.98 Working practices at all crossing points would be focused on the avoidance and control of sediments, other construction related pollutants and accidental spillages. They would be formalised in the contracts for the implementation of the project by the way of a CEMP. The contractors would be required to prepare these documents which would include; the CEMP and the principle method of controlling works via site specific method statements as well as any other requirements dictated by local conditions. These documents would include as a minimum management roles and responsibilities, protocols, method statements and mitigation measures as described in the draft CEMP.

11.6.99 Working practices at all crossing points would also adhere to relevant PPGs produced by NIEA which would reduce the likelihood of degradation to water quality. A specific emergency procedure and suitable equipment would be in place to reduce the extent of any accidental spillage that does occur.

- 11.6.100 Culverts would be constructed off line, where practicable with the original channel diverted once the new crossing is completed. This would reduce the likelihood of degradation to water courses from sediment and accidental spillage occurring. The culverts of importance to fish would allow a 150mm additional depth for natural substrate to either be deposited during construction or to fill naturally from stream bed movement. Re-aligned sections of water courses would also be constructed, lined with suitable substrate and planted with suitable vegetation prior to diversion of the original channel.
- 11.6.101 Taking into account the proposed design and mitigation measures which would form a mandatory requirement of contracts for the design and construction of the Proposed Scheme, it has been concluded that impacts would be no significant effect.

Fish

- 11.6.102 The potential impacts on salmonid species, the mitigation and significance of effect are discussed in 11.6.36 to 11.6.50. Other fish species which form part of the fish assemblage are European eel, lamprey species, flounder, 3-spined stickleback, minnow, stone loach, gudgeon, pike, perch and roach.
- 11.6.103 Potential impacts on fish would be :
- fragmentation or degradation of habitats at crossing points or in culverts, watercourse diversions and drainage outfalls and other locations where working areas would be within 50m of watercourses and where temporary degradation of water quality is possible;
 - temporary disturbance from noise, light and vibration which could affect migratory fish at crossing points; and
 - permanent loss of habitat within those sections culverted or re-aligned.
- 11.6.104 Habitat fragmentation would occur if culverts were installed at watercourse crossings which impede the free movement of fish. Degradation of habitats could occur through release of sediment or other pollutants during construction works, and through the operation of the Proposed Scheme. Outside of watercourses classified as salmonid watercourses through discussion with Loughs Agency and DCAL, culverts provided would be pipes, sized to accommodate the flows required by the flood model.

Culvert design

- 11.6.105 Culverts on non-salmonid watercourses would be concrete pipes with roughened internal surface which would create lower flow velocities adjacent to the pipe walls and aid fish passage.

Lighting

- 11.6.106 Night working adjacent to watercourses would be minimised on non-salmonid watercourses. Where night working is required lighting would be cowled and directed to minimise light spill into the watercourse, and the duration of night working would be kept to a minimum.

Translocation

- 11.6.107 The dewatering process of existing channels would be supervised by ecologists.
- 11.6.108 Where lamprey ammocoetes are present in marginal habitats in close proximity to proposed river crossing structures it would be necessary to translocate them into a suitable habitat nearby. This would be required on the Burn Dennet, Routing Burn and Roughan River where lamprey ammocoetes were captured. This would need to be undertaken in the months of June to September due to license restrictions on electrofishing operations and should be completed prior to the commencement of construction activities.

Avoidance of disturbance

- 11.6.109 Construction within channels or within 50m of sensitive water courses would adhere to a specific contractor method statement for working near water to reduce impacts upon fish. This would involve measures to reduce degradation to water quality (such as silt and pollution management methods), reduce vibration via appropriate siting and maintenance of machinery and the use of non-impact piling where appropriate. Reduction of light spill onto the water courses via appropriate location and shielding of lighting, in order to keep levels below those likely to impact fish. It would also incorporate emergency measures in the event of a spillage into sensitive water courses and provisions for monitoring during construction. Temporary crossings over the most sensitive water courses would be clear span.

Channel re-alignment

- 11.6.110 Where channel realignment is undertaken, the new channel would fulfil the habitat requirements of local aquatic fauna including measures such as the use of natural substrate and boulders to create pools. In-stream works and bankside landscaping would be undertaken using localised/excavated/natural material wherever possible.

Protection of water quality

- 11.6.111 Water quality protection measures for non-salmonid watercourses during construction would follow PPG guidance and would be enforced by the CEMP which would be agreed with Loughs Agency, NIEA and DCAL prior to works commencing. In stream sediment levels would be kept to a maximum of 25mg/l during construction. All run-off

from the completed road would be through a drainage network which passes HAWRAT assessments.

- 11.6.112 Taking into account the proposed design and mitigation measures, it is concluded that no significant effect would occur.

Terrestrial habitats

Woodland and scrub

- 11.6.113 Approximately 2.9ha of plantation broadleaved woodland, and 142ha of semi-natural broadleaved woodland fall within the land take of the Proposed Scheme. Approximately 3.1ha of coniferous plantation, and 0.75ha of recently felled coniferous plantation woodland also fall within the land take of the Proposed Scheme. Approximately 124ha of dense scrub fall within the land take of the Proposed Scheme. In addition, small areas <0.1ha of mixed woodland and mixed plantation woodland fall within the land take. Removal of these woodland areas would be reduced where possible.
- 11.6.114 Of particular note would be the loss of 0.6ha of the long-established woodland at Mulvin Parks (representing 55% of the woodland) and 0.5ha of the ancient woodland at Routing Burn (representing 5% of the woodland). There would be no direct loss of woodland in any of the other three locations where there is ancient or long standing woodland; Old Deer Park Wood, North of Aughnacloy and Cottage Hill.
- 11.6.115 There would be a risk during construction of degradation of the remaining 0.5ha of woodland at Mulvin Parks and 1ha of the remaining 2.1ha of woodland at the Routing Burn by virtue of their location within 200m of the dual carriageway and increase in airborne pollutants associated with construction and operation of the road. The risk is one which would also apply to 2ha of the woodland at Cottage Hill which would be located within 200m of earthworks activity during construction. The risk of construction dust covering foliage would be mitigated by damping down of the construction area in periods of dry weather.
- 11.6.116 Following the opening of the Proposed Scheme to use, there would be a risk of deterioration of the remaining woodland within 200m of the dual carriageway and its associated traffic as a result of nitrogen deposition.
- 11.6.117 Approximately 5ha of woodland priority habitat would be lost including birch/alder wet woodland and mixed ash/oak woods. These habitats are also susceptible to temporary degradation in air quality from construction related activities. In addition 4.4ha of conifer plantation (of which 1.5ha is recently felled) would be permanently lost under the Proposed Scheme footprint with 4ha within 200m of the Proposed Scheme which could be affected by temporary degradation to air quality. This represents approximately 5.4%, 7.4% and 2% of the available resource of each of these habitats locally.

- 11.6.118 Operational impacts on woodland would be limited to increased nitrogen deposition. Air quality modelling shows that the woodlands within 200m of the Proposed Scheme would experience between an 11% decrease and a 65% increase in N-deposition rate in 2028 with the scheme in place, compared to N-deposition rates without the scheme.
- 11.6.119 No specific mitigation for loss or degradation of ancient woodland would be possible. However approximately 1.3ha of native broadleaved woodland would be planted in road verges and land specifically vested at Mulvin Parks Ch. 32600 - 33600, 1.81ha at Routing Burn Ch. 71700 - 72200 and 1.12ha at Wood Hills Ch. 91200 - 92700 to compensate for losses and degradation. This planting would reflect the species composition of the existing woodlands as detailed below. There would remain a significant effect at a district scale.
- 11.6.120 An approximate 122ha of woodland planting (classified as non-priority habitat due to the planting block sizes being less than 0.5ha) would be created. In addition, 36ha of scrub habitat would be created.
- 11.6.121 The aggregate loss of priority woodland habitats across the Proposed Scheme represents approximately 1% of the total within 3km of the Proposed Scheme (Appendix 11E) and as such would not be significant when assessed together.

Grassland and marsh

- 11.6.122 The main habitats lost would be limited to improved grassland and arable fields with approximately 895ha and 125ha respectively under the Proposed Scheme footprint. Neither habitat has a significant biodiversity value.
- 11.6.123 Approximately 17.5ha of the Proposed Scheme footprint could be considered floodplain grazing marsh within the floodplains of the Rivers Foyle and Finn in Co. Londonderry. This represents approximately 10% of the habitat present within the local area and as such would be likely to affect the conservation status when considered together beyond the individual sites. Although the percentage of loss in the district cannot be calculated, it is considered that 17.5ha is likely to represent a significant proportion of this habitat based upon a visual study of aerial photography and flood maps. The rush pasture qualifying as a priority habitat is limited throughout the Proposed Scheme. Approximately 1.4ha of this habitat would be lost, 5% of the local resource.
- 11.6.124 Due to their specific hydrological conditions the grazing marsh and rush pasture habitats are not easily re-created so the majority of grassland created would be dry and more similar to lowland hay meadow priority habitats. The permanent loss of grazing marsh and rush pasture therefore remains a significant effect at a local - district scale. However there would be a positive impact through the creation of 33ha of species rich grassland and approximately 700ha of general grassland which would be of probable

significance within the immediate vicinity of each location, but at a local scale when considered together.

Bog

- 11.6.125 The Proposed Scheme would result in the loss of approximately 7ha of modified bog. In addition a further 7ha are within 200m and therefore has an increased risk of impacts through degradation in air quality and changes to drainage regimes. All bogs within the construction area are currently declining in value and without conservation action are likely to succeed to scrub or grassland habitats over the coming decades. The loss and degradation related to the Proposed Scheme would be very likely to accelerate this decline and would affect the conservation status of those remaining bog fragments adjacent to the Proposed Scheme. However, due to their limited biodiversity values at most sites this would not be a significant effect. However the bogs at Mountjoy Ch. 46400 - 47900 are of higher value and the impacts upon these sites would be a significant effect at a local scale. The aggregate loss of habitat represents 3% of the total bog within the local area (Appendix 11E) and 1% of the total bog within the Omagh district (Omagh District Council Biodiversity Audit of Omagh District). As such the aggregate loss would a significant effect at a local scale only.

Ponds

- 11.6.126 Eight small ponds are located within the land take.
- 11.6.127 Two ponds would be created during construction of the scheme as mitigation for lost aquatic habitat. Owing to their low intrinsic biodiversity values the loss of these ponds would not be a significant effect. This represents approximately 6% of the local resource and as such would not affect the conservation status cumulatively at any larger scale than the individual sites.

Hedgerows and veteran trees

- 11.6.128 Approximately 7km of species rich hedgerows and 170km of species poor hedgerows would be removed to facilitate implementation of the Proposed Scheme (some 0.5km and 25km have already been cut back in 2013 in anticipation of removal). Hedgerow habitat is widespread within the vicinity of the Proposed Scheme and in the surrounding countryside with the NICS 2000 website stating 20826km in Co. Tyrone and 13653km in Co. Londonderry/Derry, though data was not available to enable differentiation of species-rich from species-poor hedgerows. Thus the loss of hedgerows represents approximately 0.5% of the local resource. The impact would be offset by the planting of some 190km of new hedgerow along the Proposed Scheme boundary. The new planting would comprise species-rich mixes as indicated in Table 6.7 to 6.9 in Chapter 6. This would result in the maintenance of the extent of the habitat type and enhancement of its quality and value relative to the Proposed Scheme

corridor as the planting establishes and begins to mature over a period of some 10 years following implementation. Therefore, there would be a temporary significant effect at a maximum of the local scale, with a medium term positive significant effect at a local scale.

- 11.6.129 Two veteran trees are located within hedges along the proposed vesting line at Ch. 29350 and Ch. 30150. Where possible within construction requirements they would be retained with works potentially affecting them complying with BS 5837:2005. The advice contained in the Ancient Tree Guide No.3 (Woodland Trust, 2007) would be followed when working near any notable, veteran or ancient trees. Should these trees be lost through the Proposed Scheme there would be a significant effect at a local scale.

Bryophytes

- 11.6.130 The construction of the proposed open span bridge over the Mourne River at Ch. 18000 would require the removal of trees and boulders upon which River/Spruce's bristle moss, a bryophyte listed under Schedule 8 of the Wildlife Order, has established. This would affect approximately 74m of riverside habitat.
- 11.6.131 Update surveys for plants listed under Schedule 8 of the Wildlife Order would be undertaken along those sections of the River Finn and River Mourne within 500m of the Proposed Scheme land take. This would provide an accurate location for each plant and provide details of the local abundance each species.
- 11.6.132 Works at the Mourne crossing at Ch. 18000 would be set back as far as possible from the banks of the river. Toolbox talks would also make construction staff aware of the presence of the species and take care to avoid accidental damage. This would avoid the loss of the majority of the plants present and reduce the severity of the impacts identified in the previous section.
- 11.6.133 It may be necessary to apply for a licence from NIEA to allow the killing of any plants still remaining within the works area. Translocation of material which supports these plants would be considered in consultation with NIEA.
- 11.6.134 Detailed surveys for *Orthotrichum sprucei* would be carried out at the crossing point of the River Mourne, Ch.18000, to identify the exact location of individual plants in relation to the construction zone.
- 11.6.135 It may be necessary to translocate trees and rocks supporting this species away from the construction zone into nearby stretches of the Rivers Finn and/or Mourne. Due to the specialised habitat required by the species, trees would be re-planted in locations with similar periodic inundation and at a similar height above the water level. However, this requirement would be dependent upon the terms of any NIEA licence and would be informed by the local abundance of the species gained from the update surveys.

- 11.6.136 It is not known what percentage of the local or national population this would constitute due to insufficient historic recording of these species. It would be certain to affect their conservation status at that site, but it is not possible to state with certainty the level of any impact above this scale. Owing to their high biodiversity value this impact would be a significant effect at a national scale. The population on the Finn would be unlikely to be impacted upon as they are outside of the construction zone. Degradation to water quality is the most likely impact pathway, but this would only affect the bryophytes if there were a combination of flooding and toxic material stored in the floodplain.

Terrestrial fauna

Otter

- 11.6.137 Otter are discussed in 11.6.51 to 11.6.67 in relation to the SAC designated sites. Due to the large territory size of otter, it has been assumed that otter associated with the SAC are potentially present throughout the Proposed Scheme.
- 11.6.138 The temporary disturbance of the breeding site at Strabane Nature Reserve could have a localised impact on otter. However, the works would follow a strict protocol with a significant pre-construction survey period at this location, which would enable sensitive timing of works under ecological supervision. Taking into account other suitable breeding habitat nearby it is extremely unlikely that this disturbance would have a negative effect on the conservation status of otter in the Foyle catchment, therefore no significant effect is attributed to the Proposed Scheme.
- 11.6.139 Taking into account the Proposed Scheme design and mitigation described in those sections, a temporary significant effect is predicted for otter in the vicinity of Strabane Nature Reserve.

Bats

- 11.6.140 Identified impacts include:
- loss of bat roosts;
 - disturbance of bats using roosts;
 - loss of foraging habitat;
 - fragmentation of commuting routes;
 - increased light spill affecting foraging habitat; and
 - possible killing or injury of individuals as a result of construction or future use of the Proposed Scheme.
- 11.6.141 Implementation of the Proposed Scheme would involve demolition of the building and bridge and removal of the five trees confirmed as day roosts and scheduled in Tables 11I.10 to 11I.12. This is in addition to two trees which were identified as roosts in 2012

and which were removed under a licence issued by NIEA as part of pre-construction works the Department was given leave to proceed with prior to consideration of the legal challenge heard in February 2013. One of these two trees was located near Meenagh Road, Bready (Figure 6.21), and the other was located near Moss Road, Cloghcor (Figure 6.23).

- 11.6.142 Mitigation for the loss of the two roosts removed in 2012 was provided for at the time by the installation of two bat boxes in close proximity to the each of the trees which were removed (Figures 6.21 and 6.23) Mitigation for the loss of the seven additional roosts confirmed during the 2014 site surveys has been provided for by the inclusion of a bat house and bat box at Magheramason and bat boxes at the other four locations.
- 11.6.143 The proposals also provide for the introduction of bat boxes at 17 other locations within the land take for the Proposed Scheme as shown on Figures 6.18 to 6.45.
- 11.6.144 Consideration would be given to the need for the installation of further bat boxes following pre-construction surveys which would be conducted in advance of works proceeding should the Proposed Scheme be approved for implementation. The surveys would be focused on the confirmation of the presence of roosts identified to date and the presence or likely presence of roosts in trees and structures within the proposed land take which include features which are conducive to their use as roosts but where surveys to date have not confirmed use. The information would be used to finalise proposals for the siting and installation of bat boxes. It would also inform the preparation of applications to NIEA for European Protected Species (EPS) licences for the exclusion of bats for development purposes.
- 11.6.145 The licence applications would include detail relating to measures to be adopted during the removal of roost sites. These would include:
- the programming of removal to exclude the period of likely occupation (e.g. November to April for hibernation roosts, May to October for maternity roosts and May to September for non-maternity summer roosts);
 - provision of alternative roost sites prior to works commencing;
 - supervision of all works by a suitably licensed ecologist;
 - the use of excluders where practicable; and
 - careful step by step demolition/felling of the structure/tree housing the roost.
- 11.6.146 Disturbance of 3 known roosts containing low numbers of bats adjacent, or close to the Proposed Scheme would be possible during construction, through light spill, noise and vibration. These roosts are a roost within a residential building at a farm (near Derg Road, north of the River Derg) adjacent to the route supporting <10 soprano pipistrelle bats, a roost within a stone agricultural building near West Road, south of Newtownstewart, 20m from the Proposed Scheme supporting 5 common pipistrelle bats, and a roost within a stone agricultural building between Greenmount Road and

the Routing Burn, 90m from the Proposed Scheme supporting 3 common pipistrelle bats. Light spill is discussed later in this section, noise and vibration could occur during the works close to these roosts, however works in close proximity to each roost would not be continual through the construction period.

- 11.6.147 Berthinussen *et al* (2012) showed bats may avoid busy roads, with activity reducing within 1.6km of the study road (the M6 in Cumbria), however survey work undertaken for the A5WTC indicates that reduced activity associated with the existing A5 is correlated with lack of suitable habitat rather than the presence of the road, as bats were frequently recorded in close proximity to the existing A5. Most of the bat species recorded are associated with woodland, hedgerows and watercourses or waterbodies (common and soprano pipistrelle, brown long-eared bat and *Myotis* species), however, some of the bats (Leisler's and Nathusius pipistrelle) are associated with more open habitats.
- 11.6.148 Bat flight paths would be temporarily disturbed along severed hedge/tree lines adjacent to 3 known roosts containing low numbers of bats adjacent, or close to the Proposed Scheme. A roost within a residential building at a farm (near Derg Road, north of the River Derg) adjacent to the route supporting <10 soprano pipistrelle bats, a roost within a stone agricultural building near West Road, south of Newtownstewart, 20m from the Proposed Scheme supporting 5 common pipistrelle bats, and a roost within a stone agricultural building between Greenmount Road and the Routing Burn, 90m from the Proposed Scheme supporting 3 common pipistrelle bats.
- 11.6.149 The Proposed Scheme would cause the fragmentation of commuting routes, including c. 50 temporary and c. 40 permanent severances, including the severance of 67 features in the landscape that supported higher concentrations of bat activity that would be severed by the route. The higher value commuting features include hedgerows, treelines, woodland strips, watercourses and minor roads that are well distributed along the Proposed Scheme.
- 11.6.150 Lighting used during construction or permanently in the road design has three potential effects relating to bats. The use of some types of lighting can attract insects, which then attract bats to concentrations of easy prey items. If such lighting was adjacent to the carriageway, it could lead to increased risk of bat mortality on the road. The second possible effect is fragmentation of habitat through light spill on to features bats use for foraging which can lead to bats avoiding those areas. The final potential impact from lighting would be direct lighting of roost causing disturbance to bats within the roost, and possible abandonment of the roost.
- 11.6.151 Killing and injury of bats is unlikely to occur during construction as good working practice and ecological supervision would control this risk. Bats are at risk of collision with vehicles once the road is in use, this would be primarily where commuting and foraging habitat is severed by the road.

Mitigation

- 11.6.152 Buildings and bridges with bats roosting within the structure would be subject to emergence and re-entry surveys to confirm if bats are still present and to locate where they are currently roosting. Cavities which bats are seen leaving would be fitted with excluders to prevent bats re-entering. Following the re-entry survey a search of the building/structure would be undertaken checking for any roosting bats. Features suitable for roosting bats would then be removed by hand and the building would be made open to the elements. The building/structure should be left for a further 24hrs to permit any bats inaccessible cavities to leave. Once the ecologist is satisfied that it is unsuitable to support bats it can then be demolished.
- 11.6.153 Trees which support known bat roosts or with high or moderate potential to support bats (as bats can move roosts regularly) would be inspected for bats. Where access is safe and achievable, suitable roosting features would be inspected for bats by a suitably licensed ecologist. If after a thorough search bat presence can be ruled out then the tree would be felled. If features remain which cannot be fully inspected or are inaccessible then the tree would be soft felled. This entails cutting each tree/limb section (with cuts made away from any roosting features) then lowering it carefully to the ground and inspecting it by an ecologist named under a bat EPS development licence for the Proposed Scheme. Any bats found would be captured and moved into a bat box. Felled trees would then be left for 24hrs to allow any unobvious bats to fly away unharmed before the tree is cleared away.
- 11.6.154 Bat boxes would be placed in suitable locations such as woodland fragments and around settlement ponds throughout the Proposed Scheme as shown on Figures 6.18 – 6.45 to enhance the value of the areas to bats.
- 11.6.155 As part of the pre-construction vegetation clearance works in 2012, four bat boxes, two at each location, have already been installed near Meenagh Road, Bready and near Cloughcor to compensate for the loss of roosting features from two trees which supported common pipistrelle day roosts.
- 11.6.156 Tree and scrub planting (approximately 65ha) and grassland re-creation (approximately 700ha) would mitigate the loss of suitable foraging habitat for bats.
- 11.6.157 During construction bat flight paths along severed hedge/tree lines adjacent to known roosts and where major flight paths have been identified would be maintained by using tall trees planted in barrels and placed at intervals along the former hedge/tree line.
- 11.6.158 In addition where temporary artificial lighting is required during construction, for health and safety purposes, the light would be aimed to illuminate only the immediate area required by using as sharp a downward angle as possible. This lit area would avoid

being directed at, or close to, any roost access points or flight paths from the roost. A shield or hood would be used to control or restrict the area to be lit.

- 11.6.159 Road lighting would only be introduced near and at junctions, and the potential effects of this lighting would be mitigated through the use lighting with UV filters attached or lighting with a low UV component, which attracts relatively few insects, and thus less bats would be brought into contact with the road corridor. Where necessary, cowling of the lighting to direct light at an angle of 70 degrees, and optimising the height of light columns would ensure that light spill onto potential or actual roosts and into commuting and foraging habitat would be reduced to below 1 Lux at 10m from the road.
- 11.6.160 To mitigate against the potential for road schemes to increase mortality in bats through collision with vehicles using the road, a number of options have been used on previous schemes, including: underpasses, over bridges, wire bat bridges, elevated verges and hop-overs. Underpasses have been found to be effective (Berthinussen et al., 2012, Bach et al., 2004 and Boonman, M. 2011) although success is dependent on bats not needing to alter their course or flight height (Berthinussen et al., 2012), and the minimum cross sectional area of the underpass required for bats to use them varying between species (Boonman, M. 2011). The effect of elevated verges has not been tested but there is concern that increased verge height results in a wider gap to cross. The effectiveness of hop-overs is also untested but is likely to only work on narrow roads where the tree crowns can bridge the gap created by the road (Berthinussen et al., 2012). From this research correctly sited underpasses are likely to be the most successful measure suited to the Proposed Scheme.
- 11.6.161 Bats would be encouraged to cross the road safely by using unlit underpasses that are located on or as close as possible to original commuting routes. Underpasses include: clear span bridges over the larger watercourses, under bridges for minor roads and farm access and culverts for minor watercourses and drainage. Landscape planting and/or fencing would be used to direct bats to the underpass and to deter bats from crossing over the road. The sustained presence of a watercourse within the underpass at many of these locations is likely to encourage bats to use the underpasses. When underpasses are not possible for engineering reasons over bridges have been used with landscape planting used to direct bats to the over bridges and to encourage bats to fly as high as possible. The locations and types of crossing points are shown in Table 11.8.

Table 11.8: Locations and types of crossing points

Chainage	Structure type
1350	Culvert
3050	Culvert

Chainage	Structure type
3375	Culvert
3950	Culvert
5800	Over bridge and Culvert
7900	Over bridge
8240	Culvert
9100	Under bridge
10980	Culvert
11650	Over bridge
13000	Culvert
15200	Under bridge
16650	Culvert
19500	Under bridge
21990	Culvert
27250	Over bridge
29100	Over bridge
29900	Culvert
30150	Culvert
30400	Under bridge
30800	Culvert
30950	Under bridge
31500	Culvert
34400	Clear span bridge
36300	Under bridge
38600	Over bridge
39250	Culvert
39950	Over bridge
41100	Under bridge

Chainage	Structure type
42600	Culvert
43780	Culvert
43950	Culvert
44990	Over bridge
46950	Over bridge
49600	Culvert
50450	Culvert
51290	Over bridge
52000	Over bridge
53200	Culvert
54320	Culvert
55900	Over bridge
56450	Over bridge
57000	Over bridge
61850	Culvert
62550	Culvert
64000	Under bridge
65890	Culvert
66050	Culvert
67630	Culvert
68750	Culvert
71100	Under bridge
71350	Culvert
71650	Clear span bridge
73750	Under bridge
78400	Under bridge
80420	Culvert

Chainage	Structure type
81700	Over bridge
82000	Over bridge
83880	Culvert
84300	Under bridge
86450	Over bridge
87800	Culvert
88220	Culvert
90300	Over bridge
90850	Culvert
91300	Culvert
900 Ballygawley Spur	Under bridge

11.6.162 Taking into account the Proposed Scheme design and mitigation proposed it is concluded that a significant effect on bats at a local level would remain.

Red squirrel

11.6.163 Identified impacts include:

- loss of dreys;
- loss of foraging habitat;
- fragmentation of habitat; and
- possible killing or injury of individuals as a result of construction or future use of the Proposed Scheme.

11.6.164 There are five areas in which red squirrel are known to be present (near New Buildings, east of Aughnacloy (including the Favour Royal Forest), Baronscourt, Seskinore Forest and at Rattling Ford, none of which fall within the works area. The population east of Aughnacloy is of national biodiversity value, with the other populations being of district biodiversity value. However, outside of the main areas of red squirrel presence, occasional dreys could exist. The loss of such dreys is unlikely to significantly impact on the conservation status of red squirrel as their main habitat areas would not be reduced by the Proposed Scheme.

- 11.6.165 Red squirrel feed on a variety of seeds, fruits, nuts and fungi, although there is a preference for pine nuts stripped from pine cones. As squirrel would range widely while foraging, any of the wooded, scrub or hedgerow habitats within the vicinity of the red squirrel populations could be used for foraging.
- 11.6.166 Red squirrel can move significant distances where habitat is suitable for their passage. They are reluctant to cross open ground, and are therefore reliant on hedge and tree networks to move between woodland blocks. The Proposed Scheme would sever many hedgerows and tree lines throughout the corridor, and certainly within the vicinity of the known red squirrel populations. Such fragmentation of habitat could contribute to the decline of the species and would affect the conservation status of the species in Londonderry and Tyrone. The most significant fragmentation effect is at Baronscourt, where Old Deer Park Wood would be severed from the main portion of the estate by the road, leading to 5% of the available red squirrel habitat being cut off from the remaining 95%.
- 11.6.167 Direct killing or injury of red squirrel could occur during vegetation clearance, or in the longer term through the future use of the road, should red squirrel attempt to cross the carriageway. However, it is known that red squirrel road casualties are generally associated with quieter country roads with woodland to either side, which would not be the case with the Proposed Scheme.

Mitigation

- 11.6.168 Pre-construction surveys would be undertaken for all suitable habitat which would be removed as part of the Proposed Scheme. Should any drey be confirmed as having red squirrel present, works would cease in the vicinity of the drey, and discussion would be held with NIEA to determine the most appropriate course of action including possible erection of artificial nesting sites within suitable retained vegetation.
- 11.6.169 Loss of foraging habitat would be mitigated through the provision of over 120ha of woodland and scrub planting and the inclusion of 190km of species rich hedgerow within the Proposed Scheme. In the vicinity of Baronscourt the planting scheme would contain a higher proportion of conifer species to benefit red squirrel.
- 11.6.170 Fragmentation of red squirrel habitat would be reduced by the introduction of significant tree/scrub and hedgerow planting (over 120ha of wood/scrub and 190km of species rich hedgerow), although these habitats would take time to mature to a state where they are of value to red squirrel. In addition, the Proposed Scheme has many agricultural underpasses, badger tunnels and otter ledges/tunnels which serve to reconnect suitable habitat either side of the road, although red squirrel are not known to use mammal tunnels with frequency. Therefore, the fragmentation effect cannot be fully mitigated.

- 11.6.171 Although red squirrel are known to avoid crossing open habitat and particularly busy roads without woodland directly to either side, the risk of animals crossing the road have been further reduced through the provision of agricultural underpasses and through provision of badger tunnels and otter ledges/tunnels along the Proposed Scheme although red squirrel are not known to use mammal tunnels with frequency. Therefore, the potential killing or injury of red squirrel cannot be fully mitigated.
- 11.6.172 Taking into account the Proposed Scheme design and mitigation measures above, it is concluded that a significant effect at a district scale remains.

Pine Marten

- 11.6.173 Identified impacts include:
- loss of breeding or resting places;
 - fragmentation of habitat; and
 - possible killing or injury of individuals as a result of construction or future use of the Proposed Scheme.
- 11.6.174 No breeding or resting places have been recorded within the Proposed Scheme during any of the surveys undertaken for the A5WTC, however, the population is known to be expanding in Northern Ireland, den sites could be established prior to construction commencing.
- 11.6.175 The barrier effect of roads on pine marten is not well understood, and most mortality related to roads appears to be associated with minor roads. However, the potential for the Proposed Scheme to sever routes which pine marten use to commute through the landscape or as dispersal routes for the expanding population remain due to this uncertainty. The severance of suitable commuting or dispersal habitat within the vicinity of Baronscourt and Favour Royal Forest would pose the highest potential risk to pine marten.
- 11.6.176 Construction work is very unlikely to threaten pine marten as no den sites were recorded within the study area. The potential for pine marten to be killed or injured on the road, once open is lessened by the fact that pine marten would cross the road at night when traffic volumes are lowest. In addition, minor roads appear to be the cause of most pine marten road deaths.

Mitigation

- 11.6.177 Pre-construction survey would be undertaken in any areas with habitat suitable for pine marten resting or breeding sites. If any pine marten resting or breeding sites are recorded, works would not be permitted within that habitat block, and NIEA would be consulted to determine appropriate mitigation, possibly including the provision of artificial den boxes in suitable adjacent habitat.

- 11.6.178 Habitat fragmentation and potential road mortality would be addressed through the provision of 88 mammal tunnels/ledges under the road, and through suitable planting schemes to guide pine marten to these and the 22 agricultural underpasses provided in the Proposed Scheme. In addition, planting near to these features would not extend toward the carriageway to reduce the risk that pine marten would continue on to the carriageway.
- 11.6.179 Taking into account the Proposed Scheme design and the mitigation measures above, it is concluded that no significant effect remains.

Badger

- 11.6.180 Identified impacts include:
- sett destruction;
 - sett disturbance;
 - loss of foraging habitat;
 - fragmentation of territories; and
 - possible killing or injury of individuals as a result of construction or future use of the Proposed Scheme.
- 11.6.181 The construction of the Proposed Scheme would involve the destruction of at least twenty outlier setts, six subsidiary setts, four annex setts and fourteen main setts. More may be discovered in update surveys where access could not be obtained due to lack of land owner permission. Badgers readily create new setts, other than main setts, and so the impacts of this loss are temporary. Main setts are less easily replaced and badger may not be able to re-create these within a short period of time thereby affecting the clan's chances of survival. Badger sett locations are confidential due to persecution of the species, therefore no location data is provided here, however where access was permitted for survey, badger appear to be ubiquitous, and are distributed throughout the Proposed Scheme and are of biodiversity value in the immediate vicinity only.
- 11.6.182 Disturbance could also arise to any sett within 25m of the works area affecting a further four outlier setts, one annex sett and five main setts. Disturbance of setts occupied by badger can impact on the animal's health and ability to survive, however, with the exception of main setts, badger usually have numerous setts within their territory and move between them regularly, they are also able to create a new outlier sett overnight, and thus disturbance would only be a significant if it impinged on a main sett, or on a sett containing a breeding sow or recently born badgers.
- 11.6.183 The loss of foraging habitat would reduce the potential of some badger clans to feed and may displace populations into neighbouring territories. Bait marking was carried out in 2012 for 8 potential main setts to confirm their status, to map their territory and to

verify appropriate locations for replacement main setts. In areas of suitable habitat, the size of a badger territory in Ireland is between 15 and 300ha with the mean around 80ha. A significant loss of foraging habitat would take place at any main sett within the Proposed Scheme and a 100m buffer. This affects one known additional main sett to those subject to destruction or disturbance, other main setts may exist outside the study area whose territory may overlap with the Proposed Scheme. While loss of foraging habitat would have a localised impact on specific badger clans, the loss of foraging habitat would not be expected to affect the conservation status of the badger population in the wider landscape.

- 11.6.184 The Proposed Scheme could lead to an increased number of badgers killed and injured as traditional paths would be severed by a wider, busier road than the existing infrastructure. This would be likely to occur throughout the route in all locations where badger have been identified. There would likely be a permanent fragmentation of badger territories where setts of the same clan are on either side of the route, from the bait marking study undertaken in 2013 there would be 3 instances where main setts, or their replacements would be severed from known territory by the road. This impact would be common throughout the Proposed Scheme.
- 11.6.185 Where the road corridor severs badger territories, particularly where it severs well used badger paths, animals may attempt to cross the road. In addition, the landscape planting for the Proposed Scheme would develop high value badger foraging areas, with grassland, scrub and tree planting providing a range of food types for the species. Where badger attempt to cross the road they are at risk of injury or death from collision with vehicles. Road traffic is the single largest cause of death for badgers in Britain, though no data was found relating to Northern Ireland.

Mitigation

- 11.6.186 Pre-construction surveys would be carried out to maintain the validity of species data. The results of these would inform the decision as to whether to close a sett through exclusion or to destroy it if it is no longer active. Locations for artificial setts would also be assessed in these surveys. Surveys may involve bait marking or comprehensive surveys of an area c.500m from the sett to be destroyed. Surveys would be carried out in accordance with best practice guidance contained in the Badgers and Development (Environment and Heritage Service, 2004) guidance document. The pre-construction survey would be particularly important in areas where access for survey has not been permitted to date.
- 11.6.187 Despite a low biodiversity value, badgers and their setts are legally protected. Any setts under the route would require closure in accordance with a NIEA licence which can only take place between July 1st and November 30th. This would require replacement of main setts with an artificial structure, a process which can take up to 6 months preceding closure.

- 11.6.188 All active badger setts within the works area would be closed in a manner that seeks to avoid harm to the animals. Sett closure would only be carried out with the permission of and under licence from the NIEA. This would involve the use of one way gates over sett entrances which would remain in place until it can be established that a sett is no longer active. This may take several weeks and for main, subsidiary or annex setts can only be carried out July-November inclusive when cubs are not likely to be present. Outlier setts can be closed at any time of year.
- 11.6.189 Artificial setts would be created at least 6 months prior to the planned destruction of the original main sett to allow time for the badgers to find and begin using it. Once badger are confirmed entering the sett the original main sett would be closed using one way gates and once confirmed as no longer active it would be destroyed.
- 11.6.190 The new sett must have good access across the new road during construction and under it during operation. In most cases an underpass with fencing guiding badger to the entrances would be essential close to a new sett and possibly further afield.
- 11.6.191 Disturbance of setts would be reduced by careful control of working practices close to identified setts which are either to be retained, or are not yet closed and destroyed. This may also require an NIEA licence and may be subject to time restrictions on works.
- 11.6.192 Toolbox talks would be provided to site staff which would provide information on where this species may be found and how to avoid impact to them.
- 11.6.193 Foraging habitat loss cannot be fully mitigated by the Proposed Scheme, as encouraging badger to forage on the roadside could lead to higher mortality.
- 11.6.194 Fragmentation effects and road mortality would be mitigated by the use of underpasses under the route and badger resistant fencing to prevent access to the road and guide badgers to suitable crossing points.
- 11.6.195 The provision of badger tunnels, badger resistant fencing and suitable roadside planting would reduce the magnitude of impacts on this species. However, where the road is in cutting it would not be possible to re-connect badger habitats by the use of underpasses.
- 11.6.196 The design of badger underpasses would adhere to the guidance contained in the COST 341: Habitat Fragmentation due to Linear Transport Infrastructure handbook. As the road is over 30m wide, any underpass would be at least 600mm in diameter. The location of underpasses are shown on Figures 6.18 – 6.45 and would also form the crossing points for other species, so are referred to as multi-species crossing points. Badgers would be guided to the entrances using suitable fencing or hedge planting.

- 11.6.197 Chain link fencing attached to concrete post is the proposed boundary treatment for the Proposed Scheme. This would be suitable as a badger deterrent across the whole scheme. Where badger fencing is specifically required (i.e. in areas close to setts or around crossing points), the fencing would, as a minimum standard, be at least 1m high above ground with a lower section of 600mm buried below ground; 300mm down into the soil and a further 300mm turned away from the fence in the direction from which badgers would approach. Where the fencing would be placed on undulating ground, or where it would not be possible to provide crossing points close to pre-existing pathways, it would be necessary to provide fencing buried to depths of up to 500mm with an equal length turned outwards. Badger fencing would be required at either side of each crossing point to a distance of at least 100m and on both sides of the road.
- 11.6.198 Potential mortality during construction would be mitigated by a permit to work system where badger would be at risk from construction activities. Ecological supervision would be provided where appropriate. The potential for badger to be trapped, injured or killed within deep excavations would be controlled by either: erection of exclusion fencing around the excavation at night; or covering the excavation each night.
- 11.6.199 Taking into account the Proposed Scheme design and mitigation measures above it is considered that no significant effect remains.

Irish hare

- 11.6.200 Identified impacts include:
- direct mortality during vegetation clearance;
 - loss of habitat which provides feeding and resting opportunities;
 - fragmentation of habitat;
 - increased mortality through collision with vehicles during future use of the Proposed Scheme; and
 - disturbance to Irish hare using habitats during construction or future use of the Proposed Scheme.
- 11.6.201 Irish hare are likely to be distributed throughout the Proposed Scheme at low densities and are of biodiversity value within the immediate vicinity only. While present in almost all habitats Irish hare are particularly dependant on undisturbed grassland and good hedgerows for shelter. The Proposed Scheme would involve the loss of 896ha of grassland (although much of this is regularly disturbed by livestock and farm machinery) and 173km of hedgerow. Irish hare present during clearance of this vegetation could be at risk of being injured or killed.
- 11.6.202 The construction of the Proposed Scheme in areas inhabited by Irish hare would sever territories of some animals. However, Irish hare are present at very low densities within

Counties Londonderry and Tyrone, and thus the number of individuals subject to such an impact would be low (estimated at 90 individuals).

- 11.6.203 Due to severance of habitat, there is a risk that the Proposed Scheme could lead to Irish hare mortality when animals cross the road. However, the Proposed Scheme has been designed with 22 agricultural underpasses and 88 mammal tunnels which could serve to reduce this impact. The effectiveness of tunnels for Irish hare passage are however unknown.
- 11.6.204 Reid et al (2007) indicate that Irish hare do not seem to be disturbed by traffic, thus the future use of the road is unlikely to have an effect. Construction activities would involve both machinery and human activity in a sporadic fashion which is more likely to cause temporary disturbance to Irish hare in the vicinity of the works.

Mitigation

- 11.6.205 Ecological supervision and pre-vegetation clearance checks of suitable laying up habitat would reduce the risk of Irish hare being injured or killed during these operations.
- 11.6.206 Habitat loss would not be fully mitigated, as though there is over 700ha of grassland being created within the Proposed Scheme, this would lie within the highway boundary fence, and thus cannot be counted as ideal replacement habitat. The establishment of over 190km of hedgerow along the highway boundaries would provide additional laying up opportunities once the hedgerows have established.
- 11.6.207 The inclusion of agricultural underpasses, badger tunnels and otter ledges/tunnels may reduce the effect of habitat severance, though this is unproven at present.
- 11.6.208 Highway boundary fences would reduce the likelihood of Irish hare entering the road corridor, but would not provide an exclusion barrier.
- 11.6.209 Taking into account the Proposed Scheme design and the mitigation above it is concluded that a significant effect remains at a local scale.

Deer

- 11.6.210 Identified impacts include:
- loss of foraging habitat;
 - fragmentation of habitat which provides commuting opportunities; and
 - increased mortality through collision with vehicles during future use of the Proposed Scheme.
- 11.6.211 As the three species of deer recorded in Northern Ireland have an average home range of 5km, and all have been recorded within 1.5km of the Proposed Scheme (sika deer

near Errigal, Grangewood and west of Omagh; fallow deer near Mountjoy; and red deer near Errigal, Tully Bog; and Aughnacloy; unknown species of deer were recorded near Ballymagory and Coolaghy), it is certain that the construction of the road would result in the loss of some foraging habitat and would sever some deer territories. Deer are assessed as of biodiversity value in the immediate vicinity only.

- 11.6.212 Deer records, and the lack of accident data relating to deer impacts with vehicles indicate that deer are at a low density within the area surrounding the Proposed Scheme, however, the severance of habitat suitable for deer foraging and commuting may lead to deer crossing the highway.

Mitigation

- 11.6.213 The Proposed Scheme has 25 minor roads passing under the dual carriageway, and 22 agricultural underpasses. These would provide some measure of connectivity across the Proposed Scheme for deer.
- 11.6.214 Due to the low density of deer within the vicinity of the Proposed Scheme, mitigation measures are restricted to ensuring that tree and scrub planting leaves a clear zone at the carriageway edge, thus giving drivers greater chance to see deer and avoid collision.
- 11.6.215 Taking into account the Proposed Scheme design and the status of deer in Northern Ireland, no significant effect is predicted.

Breeding birds

- 11.6.216 Identified impacts include:
- loss of nesting and foraging habitat;
 - increased mortality through collision with vehicles during future use of the Proposed Scheme; and
 - disturbance to birds using habitats during construction or future use of the Proposed Scheme.
- 11.6.217 The majority of breeding bird habitat which would be lost to construction of the Proposed Scheme are common and widespread habitats in the study area (hedgerows, woodland and scrub) and are of local biodiversity value for breeding birds. One area of county biodiversity value and two of district biodiversity value for breeding birds have been identified which are lost to the Proposed Scheme, these are 0.3ha of reedbed at the far north of the Proposed Scheme between New Buildings and Magheramason, 2.2ha of diverse grassland, reedbed and wood between Grangefoyle Road and the Burn Dennet and 0.6ha of woodland in the area west of Newtownsaville Road, between Errigal Road and Glenhoy Road. No barn owl, kingfisher or grey heron breeding sites have been recorded within the proposed works areas, although the heronry at

McKean's Moss ASSI has been assessed using a precautionary principle as anecdotal records of recent breeding were noted.

- 11.6.218 Collision with vehicles is a risk for breeding birds, the risk of collision is dependent on many factors, including the species, time of year, weather, speed of vehicles and the layout of the road (straightness, width of verges, type of central reservation, types of planting along the road etc.). Given the wide variety of birds recorded in the breeding bird surveys it cannot be concluded that vehicular collisions would not have an effect on species, however, as the Proposed Scheme has large sections of straight road and relatively wide verges it is unlikely that this risk would be significant for most bird species. Barn owl are particularly sensitive to road mortality, with young birds dispersing to find new territories at greatest risk, research by the Barn Owl Trust indicates that new major road schemes have a high level of impact on barn owl populations, often leading to loss of resident barn owl populations within at least 0.5km either side of the road³.
- 11.6.219 Most of the habitats assessed as above local value do not have significant proportions of the available habitat within 300m of the Proposed Scheme. However, the areas assessed as being of county or district biodiversity value to breeding birds in paragraph 11.5.217 are also likely to be subject to disturbance during construction. The reedbeds between New Buildings and Magheramason would be subject to a relatively short construction disturbance period, anticipated to be one year for works within the drainage channels and for shorter periods throughout the three year construction of the main carriageway and associated works. The grassland, reedbed and woodland between Grangefoyle Road and the Burn Dennet would be subject to disturbance for longer periods over the three year construction programme, due to the Burn Dennet crossing construction, and the woodland area west of Newtownsaville Road would be subject to periods of disturbance throughout the three year construction programme.
- 11.6.220 The heronry at McKean's Moss ASSI would be subject to disturbance during the three year construction programme, although disturbance events would not be continuous during this period.
- 11.6.221 No barn owl or kingfisher breeding sites have been recorded which would be subject to disturbance.

Mitigation

- 11.6.222 Pre-construction surveys would be undertaken for barn owl breeding sites, kingfisher breeding sites within watercourses and of the heronry at McKean's Moss ASSI. If barn

³ Barn owls and major roads: results and recommendations from a 15 year research project. www.barnowltrust.org.uk accessed 25/11/14

owl are found breeding at the farm complex at Dunnalong Road, a licence application would be made to NIEA to allow works to proceed. Potential for a replacement nesting site within a property removed from the road with landowner consent would be investigated if breeding was recorded.

- 11.6.223 All watercourses affected by the works would be surveyed prior to the kingfisher nesting season (march-august), and any potential burrows within 50m of works would be covered with netting to stop them being used. During re-instatement works artificial nesting burrows would be included within stream banks where any nesting burrows were lost.
- 11.6.224 The heronry at McKean's Moss ASSI would be subject to monitoring during construction. If any grey heron attempt to nest at this location, and appear to be experiencing disturbance effects, discussion of appropriate mitigation would be undertaken with NIEA and RSPB. This may involve ceasing work in the disturbance area agreed with NIEA until the nesting season is finished.
- 11.6.225 Vegetation clearance in potential nesting bird habitat would be undertaken outside of the nesting bird season (March-August) and would be undertaken under ecological supervision. Should any active nest sites be found, works in close proximity to the nest would cease until the nest is no longer active. This approach would remove the risk of direct harm or disturbance of breeding birds.
- 11.6.226 Mitigation to offset the temporary disturbance to breeding birds outside the works area would be regular checks by the site ecologist for any evidence of Schedule 1 birds breeding close to the works area. Should such species be recorded they would be observed and if any indication of disturbance is recorded, disturbing activities would be suspended until discussions are held with NIEA and appropriate mitigation agreed and is in place.
- 11.6.227 Planting of over 190km of species rich hedgerow, 700ha of grassland, including tussock and rush pasture areas and over 180ha of woodland and scrub, along with a restriction of the use of pesticides during soft estate maintenance would create a significant resource for foraging and nesting birds once the habitats establish.
- 11.6.228 The planting of hedgerows along both boundaries of the Proposed Scheme may encourage barn owl to fly above the road height, once these hedges establish.
- 11.6.229 Taking into account the Proposed Scheme design and mitigation detailed above it is considered that for most species, no significant effect is predicted. However, barn owl are likely to experience a significant effect at a county scale.

Wintering birds

- 11.6.230 Identified impacts include:

- loss of habitat which provides feeding and roosting opportunities;
- increased mortality through collision with vehicles during future use of the Proposed Scheme; and
- disturbance to birds using habitats during construction or future use of the Proposed Scheme.

11.6.231 Direct loss of 131ha of high value winter bird habitat (comprising 83ha arable fields, 33ha woodland, 8ha of wet grassland and 7ha of bog) would occur, these habitats are less well represented through the study area and are of district biodiversity value for winter birds. The loss of 2.5ha of bog habitat and 8ha of wet grassland between Seskinore Road and Tattykeel Road is of particular note. Lower value habitats would also be lost to the Proposed Scheme (comprising 895ha improved grassland and 173km hedgerow), these habitats are widely scattered throughout the Proposed Scheme and are of local biodiversity value for winter birds.

11.6.232 Collision with vehicles is a risk for wintering birds, the risk of collision is dependent on many factors, including the species, time of year, weather, speed of vehicles and the layout of the road (straightness, width of verges, type of central reservation, types of planting along the road etc.). Given the wide variety of birds recorded in the winter bird surveys it cannot be concluded that vehicular collisions would not have an effect on species, however, as the Proposed Scheme has large sections of straight road and relatively wide verges it is unlikely that this risk would be significant.

11.6.233 Wintering birds are at risk of disturbance through the construction and future use of the Proposed Scheme when within 300m of the vesting line. Disturbance is more likely during construction, with the feeding behaviour of birds being affected in the short term, this is likely to be important at McKean's Moss ASSI where approximately 10% of the site is within 200m of the vesting line; at Strabane canal and Strabane Nature Reserve where 11ha of scrub and woodland, and 20ha of grassland would be subject to disturbance; around Mountjoy, where approximately 10ha of wet woodland and bog habitat would be subject to disturbance; between Gillygooley Road and Mullaghmena Park where approximately 5ha of wet woodland and bog habitat would be subject to disturbance; and where approximately 2.5ha of bog and 8ha of wet grassland habitat would be subject to disturbance between Seskinore Road and Tattykeel Road. Species recorded during the surveys are thought to habituate to traffic noise and are therefore unlikely to have their feeding behaviour affected in the long-term.

Mitigation

11.6.234 The impacts of loss of foraging habitat would be mitigated through the planting and recreation of grassland, hedges, woodland and scrub. Such planting would comprise species mixes which favour farmland birds in Northern Ireland and are based on publications from the UWT Guides and DARD. This would include grass and rush species likely to form tussocks which may be used for shelter. The avoidance of the

large scale use of pesticides would encourage invertebrates, with roadside planting providing a food source for many species.

- 11.6.235 The planting of hedgerows along both boundaries of the Proposed Scheme would encourage many birds crossing the road to fly at a higher level, above that of vehicles using the road.
- 11.6.236 Taking into account the Proposed Scheme design and mitigation measures, most birds would experience at most a local negative effect, however in the vicinity of the bog between Seskinore Road and Tattykeel Road (Chainage 62300 to 63800) a significant effect at a district scale is predicted as the bog habitat would not be recreated.

Smooth newt

- 11.6.237 Identified impacts include:
- the loss of existing ponds used by the species;
 - loss of habitat which provides for hibernation, rest and shelter;
 - loss of foraging habitat;
 - fragmentation of meta-populations; and
 - possible killing or injury of individuals as a result of construction or future use of the Proposed Scheme.
- 11.6.238 The Proposed Scheme would require the infilling of three ponds, P77, P45 and P65, where there are established populations of smooth newt. P77, located in the vicinity of the proposed junction 7, is a pond which has been identified as supporting a low population of the species and as being of local biodiversity value. P45, located at proposed junction 10, is a pond where access was not granted and thus has been assigned a precautionary good population and as being of district biodiversity value. P65, located between Doogary Road and Tattykeel Road south of Omagh, is a pond which has been identified as supporting a good population of the species and as being of district biodiversity value.
- 11.6.239 The proposed dual carriageway would sever a group of ten ponds, P30-34, P37-39 and P102-104, north of the Derg River. P37 currently supports a good population of the species and is of district biodiversity value, ponds P30, P33, P39 and P102-104 were not permitted to be surveyed and have also been assigned a precautionary good population and a district biodiversity value, whilst ponds P31, P34 and P38 support low populations and are of local biodiversity value.
- 11.6.240 Some 48.5ha of supporting habitat would be removed during site clearance from ponds either with known or presumed newt presence which lie within 200m of the proposed works. There would also be a risk of harm where ponds would be located within 200m

of the proposed working areas required for construction of the Proposed Scheme and the completed scheme once it is open to use.

Mitigation

- 11.6.241 The in-filled P77 would be replaced with a new pond located south of the proposed roundabout at J7 (Figure 6.23). The in-filled P65 would be replaced with a new pond to the west within the vested land (Figure 6.34). The ponds would be created according to the guidance contained in the 'Ulster Wildlife Trust Guide to the Creation of New Wildlife Ponds'. Proposed planting associated with the establishment of the new ponds comprises a combination of semi-natural grassland, scrub and tree planting to ensure that appropriate supporting habitat relative to foraging, resting sites and shelter is available. Grassland and other terrestrial habitat would be restored by recreating the correct soil profile (i.e. not mixing sub-soil and top-soil) and leaving it to naturally regenerate from the retained seed bank or through the use of specific seed mixes.
- 11.6.242 The new ponds would be created at least 1 year prior to the infilling of the existing ponds. Construction of the new ponds, trapping and translocation of newts from the existing ponds and supporting habitat and infilling of the existing ponds would be undertaken under licence which would be sought from NIEA. Trapping and translocation would be undertaken between February and October to avoid the hibernation period for the species. Newt fencing would be erected around the construction works in the vicinity of the two existing ponds to prevent access to the working areas following translocation. Permanent newt fencing would also be introduced within the land take to deter access by newts using the new ponds onto the proposed carriageways.
- 11.6.243 Where existing ponds would be located within 200m of the required working areas, newt fencing would be provided to exclude access by the species as the works proceed. Trapping and translocation would then be undertaken within the working area prior to commencement of the works. Permanent newt fencing would also be introduced along the road boundary once construction is complete and the Proposed Scheme is open to use to deter access onto the carriageways with its associated traffic.
- 11.6.244 Where the Proposed Scheme severs the existing relationship between the pond cluster north of the River Derg (P30-34, P37-39 and P12-104) access across the road corridor would be available via a proposed 300mm diameter tunnel. Fencing would be introduced to direct movement to the tunnel.
- 11.6.245 Notwithstanding the measures which would be adopted during construction and which form part of the design proposals, pre-construction surveys would be undertaken to determine presence and use by newt. The objective would be to ensure that statutory obligations relating to the conservation and protection of the species are fully accorded

with. Any changes in patterns of use or presence to those described in this ES and identified during the pre-construction surveys would be taken into account in order that method statements for construction activities in specific locations and design measures relating to the provision of new ponds, newt fencing, refugia and supporting habitat can be appropriately finalised to ensure statutory obligations are met. The finalised measures would be subject to discussion with NIEA and would form the basis of applications for licences to permit works which would otherwise not be permitted to proceed. In addition to the construction and design measures described in the license applications, measures relating to the timing and nature of monitoring and maintenance checks of design features to ensure the integrity and effectiveness of the measures would be maintained.

- 11.6.246 Taking into account the Proposed Scheme design and mitigation measures it is concluded that smooth newt would experience a positive local effect.

11.7 Conclusions and effects

Designated sites

SPA and Ramsar sites

- 11.7.1 The Proposed Scheme design and mitigation avoid impacts from construction disturbance. If breaking out of rock is required at Bready or piling at the Burn Denet during the period when whooper swan or greylag geese are present, a trial would be undertaken under ecological supervision, with works being suspended if disturbance is recorded.
- 11.7.2 Loss of foraging habitat for birds associated with the SPA would be limited to 2% of the available resource within the Foyle floodplain and would not adversely affect the bird populations.
- 11.7.3 The Proposed Scheme design and the distance from recorded foraging habitat indicate that whooper swan and greylag geese would be unaffected by road traffic during operation of the road.
- 11.7.4 A negative effect on the integrity of the sites would therefore be extremely unlikely.

River SAC

- 11.7.5 The mitigation avoids impacts of fragmentation for Atlantic salmon and otter. It also reduces the likelihood of degradation to water quality affecting the conservation status of either population. Road mortality would be unlikely to affect the conservation status of otter, with ongoing monitoring of casualties and suitable remedial works, further reducing this likelihood.

- 11.7.6 The damage or disturbance of potential otter breeding sites would be mitigated by the creation of suitable replacement holts within adjacent land. The risk of a legal offence would be reduced by the specific site clearance method statement to be developed for Strabane Nature Reserve. The risk of damage and destruction of resting sites at any of the water courses where a potential has been highlighted would be lessened by the pre-construction surveys and specific clearance procedure.
- 11.7.7 Negative effects upon water quality would be extremely unlikely. However, if an accident were to occur, the effects could be significant at up to an international scale. The pollution response plan would effectively control this risk.
- 11.7.8 A negative effect on the integrity of these sites would therefore be extremely unlikely. The implementation of the mitigation described above would reduce any effect on otter breeding to a local scale during construction. Any damage or destruction to a breeding site or resting place is an offence under current legislation, unless carried out under licence from NIEA.

Tully Bog SAC

- 11.7.9 The mitigation avoids potential for dust deposition effects on the bog. Nitrogen deposition levels are slightly elevated with the Proposed Scheme in place, though lower than currently experienced by the bog. The elevated levels are experienced by a small proportion of the bog, and no competitive plants have been recorded, indicating that these levels are extremely unlikely to cause a change in the bog vegetation. The Proposed Scheme design avoids potential effects on the bog hydrology.
- 11.7.10 No significant effect is attributed to the Proposed Scheme.

McKean's Moss ASSI

- 11.7.11 The mitigation avoids potential for dust deposition effects on the bog. Nitrogen deposition levels are slightly elevated with the Proposed Scheme in place, though lower than currently experienced by the bog. The elevated levels are experienced by a small proportion of the bog, and no competitive plants have been recorded, indicating that these levels are extremely unlikely to cause a change in the bog vegetation. The Proposed Scheme design avoids potential effects on the bog hydrology.
- 11.7.12 No significant effect is attributed to the Proposed Scheme.

Strabane Nature Reserve

- 11.7.13 The effects of 1.3ha of habitat loss cannot be fully mitigated. Some 0.7ha of wet woodland habitat would be created adjacent to the site, but this would take time to establish and may not develop the same characteristics as the lost habitat. A significant effect is predicted at a county scale.

Aquatic habitats, flora, and fish

Table 11.9 Summary of residual effects on aquatic receptors

River	River number	Significance of probable residual effects on aquatic receptors
Unnamed river	2	Immediate vicinity only
Blackstone Burn	3	Immediate vicinity only
Unnamed river	12	Local
Unnamed river	13	Local
The Black Burn	17	Local
Unnamed river	26	Local
Unnamed river	33	Local
Letfern Burn	37	District
Roughan River	41	District
Unnamed river	43	District
Unnamed river	45	District

11.7.14 The mitigation avoids or reduces the severity of the impacts upon the most sensitive aquatic receptors; primarily the designated sites and large rivers. However, many of the smaller water courses would be subject to impacts from re-alignments and culverting which it would not be possible to fully mitigate. The loss of riparian habitat cannot be avoided or reduced and some change to flow regimes would be probable. There would also be a residual risk of degradation through accidental spillage and road run off in all water courses throughout the Proposed Scheme. The predicted impacts would be:

- all water courses, macrophyte assemblages and fish at crossing points would be subject to certain residual effects within their immediate vicinities only; and
- there would be certain cumulative loss of 6.8km of river habitat. This would be approximately 2% of the available resource within the catchments surveyed and so would be not considered significant beyond the scales of the individual effects.

Legal implications

11.7.15 The residual effects identified for aquatic receptors are unlikely to give rise to legal implications. No water courses are identified as at risk of a reduction in WFD biological status. Nevertheless any accidental spillage into water courses may constitute an offence and significant damage, although unlikely could give rise to liability under the Environmental Liability Regulations.

11.7.16 No significant effect is attributed to the Proposed Scheme.

Terrestrial habitats and fauna

Long established ancient woodland

- 11.7.17 The loss and degradation of ancient woodland would be a significant effect at a district scale at Mulvin Park Ch. 33200, and at a county scale at Routing Burn at Ch. 71700.
- 11.7.18 These effects would be compensated for by the creation of native woodland with species lists corresponding to priority habitat action plans at each location. The increase in overall woodland area at Mulvin Parks, Routing Burn and Cottage Hill would provide positive effects in their own right, but ancient woodland cannot be recreated.

Priority habitats

- 11.7.19 The loss of many priority habitats cannot be mitigated as the original habitats would be permanently lost. The loss of bog habitats, rush pasture, mature broadleaved woodland and marshy grassland could not be compensated for due to the specific hydrological requirements and time taken to re-create each. There would be significant effects at a local scale for most locations, but at a district scale at Ch. 12000, 31500, 62300-63500 and 79500.
- 11.7.20 The creation of approximately 122ha of native broadleaved woodland, along with 33ha of species rich grassland would be positive effects in their own right. These would provide partial compensation for these losses by the creation of potentially valuable habitats of similar types close to the areas of loss. However, the loss of lowland raised bog and blanket bog cannot be replaced.
- 11.7.21 Some losses of priority habitats can be compensated for. In particular the loss of approximately 170km of species poor hedge and 7km of species rich hedge would be compensated for the creation of over 190km of species rich hedge, nearly half of which would include trees. The residual effect on hedges would be positive within the immediate vicinity of any single location, but an aggregate significant effect at a local scale is attributed to the Proposed Scheme.

Non-priority habitats

- 11.7.22 The loss of non-priority habitats, woodland scrub and grassland would be compensated for by the creation of more species rich habitats in the landscape planting. For example the creation of 122ha of woodland equates to an increase of approximately 20% of the resource available within the Proposed Scheme. This would result in a positive effect within the immediate vicinity of any one site, but an aggregate significant effect at a local scale for the entire Proposed Scheme.

Otter

- 11.7.23 The mitigation would be anticipated to remove the road mortality and fragmentation impacts probable to arise from the Proposed Scheme. There would nevertheless be residual, albeit unlikely risk of road casualties.
- 11.7.24 The replacement of the known holts being destroyed would remove the temporary loss of identified resting sites. Nevertheless, the probable temporary disturbance to otter throughout the Proposed Scheme during construction cannot be mitigated. Given the relatively small extent of these impacts when compared to the abundance of suitable resting sites and the large territories of otter, it would be anticipated that this would not affect the conservation status of the species at any location and therefore a significant effect of local scale is assessed only at any resting site.
- 11.7.25 The temporary disturbance to the potential otter breeding site at Strabane Nature Reserve Ch. 17400-17500 would probably prevent otter breeding at that location during the construction period. However, due to the suitable nearby habitat at Strabane Canal and McKean's Moss ASSI it is not thought that this would affect the species' conservation status within the Foyle catchment. However, a significant effect is attributed at a local scale.
- 11.7.26 Obtaining a licence from NIEA to close any confirmed breeding or resting site would comply with legislation for these activities. Adherence to the mitigation would also ensure legal compliance during operation.

Bats

- 11.7.27 The limited research into bat mitigation measures designed to enable bats to cross roads safely has highlighted the essential need for monitoring post construction to determine the effectiveness of measures. Monitoring must be robust and comparable to the pre-construction surveys undertaken (Berthinussen et al., 2012). A five year monitoring scheme would be set up to monitor the effectiveness of the underpasses, with surveys of the underpasses installed for bats undertaken commencing one year post construction and then being repeated every two years. In the same years all the bat boxes would be monitored for the presence of roosting bats and any required box cleaning and maintenance would be undertaken.
- 11.7.28 The severity of the effects on bat roosts would be reduced by the provision of replacement roosts and following a detailed licensed method statement which would include pre-destruction surveys/inspections and the slow methodical removal of features suitable for roosting bats. Disturbance of roosts adjacent to the Proposed Scheme would be minimised by maintaining flight paths and restricting the use of artificial light during both construction and when the road is operational.

- 11.7.29 The A5WTC has been designed to be a permeable road with a variety of underpasses in the form of clear span bridges, under bridges and culverts and where these are not possible the use of over bridges. Where possible these crossing points have been aligned with major flight paths, otherwise they are located as close as possible to such routes with landscape planting and/or fencing used to direct bats to the crossing points. These measures would be likely to reduce the effects of long term fragmentation and road mortality. The use of temporary crossing points along the major flight paths would be likely to reduce the effects of short term fragmentation on commuting routes.
- 11.7.30 There would be a loss of foraging habitat. However, the effect of this would be reduced as where possible the route of the A5WTC has been selected to avoid the most ecological sensitive areas in the wider area, including valuable habitat to bats such as large blocks of woodland. In addition, only a small amount of habitat would be lost temporarily or permanently in comparison to that available immediately adjacent to the Proposed Scheme within any bats home range. In the long term the landscape planting of the road verges would replace the habitat lost.
- 11.7.31 Taking these factors into account, there remains a possible significant effect at a local level as uptake or artificial roosts is not guaranteed, and some bats may still cross the road and be killed by vehicles.

Red squirrel

- 11.7.32 The Proposed Scheme would sever many hedgerows and tree lines throughout the corridor, and certainly within the vicinity of the known red squirrel populations. Such fragmentation of habitat could contribute to the decline of the species and would affect the conservation status of the species in Londonderry and Tyrone. The most significant fragmentation effect is at Baronscourt, where Old Deer Park Wood would be severed from the main portion of the estate by the road, leading to 5% of the available red squirrel habitat being cut off from the remaining 95%. A significant effect at a district level.

Irish hare

- 11.7.33 The highways boundary fence would significantly reduce the access of Irish hare to the carriageway. Whilst this greatly reduces the potential for road fatalities for this species it also stops the animals from accessing foraging along the road corridor and thus the foraging habitat lost to these animals would remain as a negative impact. Connectivity across the road would be provided through clear span bridges, oversized culverts and dry tunnels provided for multi-species crossings (although there is little evidence of hare using small culverts). A significant effect at a local level is attributed to the Proposed Scheme.

Wintering birds

- 11.7.34 The temporary impacts associated with the loss of foraging habitat during construction would be likely to affect the conservation status of the assemblages using the arable land, rush pasture and mire throughout the Proposed Scheme. This would be of significance at a local scale for most sites, although they would be likely to be of significance at a district scale between Seskinore Road and Tattykeel Road Ch. 62300 – Ch. 63800 due to the large area of mire permanently lost.

Breeding birds

- 11.7.35 The potential for road mortality of breeding bird species could have a significant local effect on some species. However, barn owl are particularly sensitive to this form of impact, and new major road schemes can lead to wide corridors which do not support barn owl. Therefore this impact is considered to be significant at a county level.

Smooth newt

- 11.7.36 Taking into account the proposals relating to the replacement of ponds which would be in-filled, the introduction of 5.4km of hedgerow and 12ha of high value supporting habitat, within 200m of the ponds with newt presence confirmed or potential, to mitigate the loss of 45.5ha of predominantly lower value supporting habitat, the availability of extensive supporting habitat where ponds would be close to but outside of the land take, and the reconnection of the meta-population north of the River Derg (ponds P30-34, P37-39 and P12-104), the Proposed Scheme would be expected to have a positive permanent local effect.

12 GEOLOGY AND SOILS

12.1 Executive summary

12.1.1 The assessment has investigated the impacts of the Proposed Scheme on statutory and non-statutory geological sites, evaluated the risks associated with existing areas of contamination and assessed existing ground conditions to determine the suitability of soils to be re-used within the works.

12.1.2 The assessment has concluded that the Proposed Scheme would not impact on any areas designated for the protection of geological interest. Several sites have been identified where the ground is known to be contaminated, mostly in brownfield areas around Strabane. Background testing has identified areas of elevated levels of contaminants where soils cannot be incorporated into the works. Additionally, the contractors would undertake sampling and testing of soils in these areas and prepare detailed plans for avoiding handling, removal and disposal to ensure that site staff and the public would not be exposed to any potential hazard. Where soils have been found to be acceptable, it would be reused in the works.

12.2 Scope of the assessments

12.2.1 The assessments and studies relating to geology and soils have been focused on:

- consideration of potential impacts specific to statutory and non-statutory sites designated for their geological value;
- a review of geological, geotechnical and soils information prepared by the geotechnical and contaminated land team to identify potential impacts on geological resources;
- evaluation of contaminated areas and sites relative to potential impacts / risks on environmental receptors in the vicinity of the Proposed Scheme; and
- an assessment of the background greenfield conditions to determine whether or not soils would be suitable for re-use within the works.

12.2.2 Statutory designated sites which have been considered include Areas of Special Scientific Interest (ASSIs) where geological value is integral to the designation. Non-statutorily designated sites include Earth Science Conservation Review Sites (ESCRS). These are sites identified as having national or international importance for earth science conservation by virtue of their geology, palaeontology, mineralogy or geomorphology.

12.2.3 In relation to contaminated sites, the assessment identified sites where construction is likely to involve disturbance which could result in the release of contaminants into the environment and could result in impacts on sensitive environmental receptors including people, nature conservation resources and aquatic resources. Potential impacts related to human health are described in this chapter. Impacts on the aquatic environment and

nature conservation resources, are described in Chapter 11 (Ecology and Nature Conservation) and Chapter 16 (Road Drainage and the Water Environment).

- 12.2.4 Contaminated sites include brownfield sites which are defined as previously developed sites with a range of former industrial uses which have been or are associated with industrial or other potentially contaminative activities. Former and active landfills have also been considered.
- 12.2.5 The study area for the assessment includes designated and contaminated sites either under or directly adjacent to the Proposed Scheme and new or modified side roads.
- 12.2.6 More distant sites which may also be impacted by the road construction, such as large landfills, have also been considered.

12.3 Statutory and planning context

- 12.3.1 Reference has been made to the following statutes, policies and plans.

The Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 (as amended)

- 12.3.2 The main provisions include powers for the Department of the Environment Northern Ireland (DOE) to designate National Parks, and to declare statutory Nature Reserves or Marine Nature Reserves.

The Environment (Northern Ireland) Order 2002

- 12.3.3 This legislation requires Northern Ireland Environment Agency (NIEA) to identify and designate ASSIs. ASSIs are nationally important sites which are designated for their important flora, fauna or geological features.

Planning Policy Statement 2 (PPS 2) Planning and Nature Conservation

- 12.3.4 PPS 2 details DOE policies relative to nature conservation as part of the Department's responsibility for securing orderly, consistent and sustainable development. Geological features and landforms are included as important components which form the focus of the conservation policies within the document.

The Waste and Contaminated Land (Amendment) Act (Northern Ireland) 2011

- 12.3.5 The Waste and Contaminated Land Order was made in November 1997. It came into operation in March 1998 (with amendments to Part 2 & Part 3 of the order completed in 2011) and implements the European Commission (EC) Framework on Waste in Northern Ireland. The Order makes a number of provisions such as:

- transfer of responsibility for waste regulation from the district councils to the Department of Environment (DOE), focused within the Northern Ireland Environment Agency (NIEA);
- introduction of measures designed to increase control over the processing and handling of waste including Waste Management Licensing, Controlled Waste and

Duty of Care, Registration of Carriers, Special Waste and Producer Responsibility;
and

- introduction of measures relating to the identification of contaminated land, designation of special sites, duties of enforcing authorities to require remediation, determination of appropriate persons to bear responsibility for remediation, liability of contaminating substances which escape to other land and contaminated land registers.

12.3.6 Some parts of the order with respect to waste management have yet to be implemented, for example, waste licensing is operating under the provisions of the Pollution Control and Local Government (Northern Ireland) Order 1978 until regulations for the transfer of responsibility to the DOE can be introduced.

12.4 Methods of assessment

12.4.1 The assessments have been informed by the guidance detailed in the DMRB, Volume 11, Section 3, Part 11 – Geology and Soils.

12.4.2 They have involved the following tasks:

- establishment of the baseline environment relative to the location, form and status of designated sites and contaminated sites and the key geological characteristics associated with the Proposed Scheme corridor and its wider setting;
- evaluation of the form and magnitude of impacts on designated sites and the potential for impacts associated with contaminated sites which would be, or are, likely to be disturbed during construction of the Proposed Scheme;
- identification of appropriate mitigation where impacts on designated or other important geological features or contaminated sites have been identified; and
- description of the predicted residual impacts and their effects.

Establishment of baseline environment

12.4.3 Identification of areas designated for their geological value, contaminated sites and the geological characteristics of the Proposed Scheme corridor has involved reference to the following documents and data sources (see Appendix 12A for further detail):

- current and historical, geological and hydrogeological mapping;
- walkover surveys;
- aerial photography;
- datasets held by the Geological Survey of Northern Ireland and the Geological Survey of Ireland;
- datasets held by the Northern Ireland Environment Agency (NIEA);
- datasets held by the Northern Ireland Executive and Local Authorities;

- datasets held by the Public Records Office;
- A5 Western Transport Corridor, Environmental Statement, Mouchel, November 2010;
- A5 Western Transport Corridor Section 1 Preliminary Sources Study, Mouchel, June 2009;
- A5 Western Transport Corridor Section 2 Preliminary Sources Study, Mouchel, June 2009;
- A5 Western Transport Corridor Section 3 Preliminary Sources Study, Mouchel, June 2009;
- A5 Western Transport Corridor Section 1 Factual report on Ground Investigation, Phases 1-4, Glover Site Investigation Ltd, 2010;
- A5 Western Transport Corridor Section 2 Factual report on Ground Investigation, Phases 1-4, Soil Mechanics Ltd, 2010;
- A5 Western Transport Corridor Section 3 Factual report on Ground Investigation, Phases 1-4, Soil Mechanics Ltd, 2010;
- A5 Western Transport Corridor Section 1 Ground Investigation Report, Phases 1-4, Volumes 1-13, Mouchel, June 2012;
- A5 Western Transport Corridor Section 2 Ground Investigation Report, Phases 1-4, Volumes 1-10, Mouchel, June 2012;
- A5 Western Transport Corridor Section 3 Ground Investigation Report, Phases 1-4, Volumes 1-11, Mouchel, June 2012;
- A5 Western Transport Corridor Section 1 Ground Investigation Report Supplement, Phase 5, Arup Atkins, November 2013; and
- A5 Western Transport Corridor Section 3 Ground Investigation Report Supplement, Phase 5, Volumes 1-13, URS Halcrow, January 2014.

12.4.4 The principal sources of information specific to geological characteristics, contaminated sites and contaminated land have been the Geotechnical Preliminary Sources Study Reports prepared by Mouchel in 2009 and Ground Investigation Reports prepared by Glovers Site Investigation Limited and Soil Mechanics in 2010. A review of ground based information and chemical data prepared by Arup Atkins in 2013 and URS Halcrow in 2014 has also been undertaken, the assessment of which is presented as Addenda to the Ground Investigation Reports. The assessment of chemical data collated as part of the additional works has been included as part of this ES.

12.4.5 The three reports referred to in paragraph 12.4.4 describe the data sources referred to by the geotechnical and contaminated land team, visual surveys which have been undertaken to verify information from the desk-based data sources and the site

investigations which have been undertaken to establish more detailed knowledge specific to the areas which would be required for construction of the Proposed Scheme.

Identification of impacts and risk

- 12.4.6 The evaluation of impacts on geological sites has involved consideration of the sensitivity of the specific site or area and the magnitude of impact taking into account direct impacts on designated features.
- 12.4.7 The identification of risk specific to the contaminated sites considered during the assessment has been based on a combination of established experience of the potential type and extent of contaminants which might typically be associated with each type of site and information derived from the ground investigation reports scheduled in 12.4.3 above. The assumption has been that all sites would be subject to disturbance. Where this would be the case, an assessment of the potential for impact on human health or consequent impacts on other environmental receptors has been undertaken as described in 12.2.3.

12.5 Baseline environment

Designated sites

- 12.5.1 There are three statutorily designated sites located in close proximity to areas required for construction of the Proposed Scheme. McKean's Moss ASSI and McKean's Moss Part 2 (Figure 12.2) are located to the south west of Cloghcor. Tully Bog SAC/ASSI (Figure 12.4), is located some 8kms to the north west of Omagh. All are lowland raised bogs designated for their physiographical and biological value.

Non designated geologically / geomorphologically important sites

- 12.5.2 There are three areas of deglacial complexes included in the current schedule of ESCRS which are associated with the Proposed Scheme corridor.
- 12.5.3 The Artigarvan Moraines and Outwash deposits (Figure 12.2) and the Deer Park and Strule / Mourne Valley Moraines (Figure 12.3) form part of the Foyle Valley Glacial Complexes. The complexes consist of formations related to ice-margin retreat and comprise a variety of ice marginal and subglacial landforms including moraines, flat topped terraces and eskers of hummocky and ridged ice-contact morphology.
- 12.5.4 The Clogher Valley Complex, Kilgreen (Figure 12.5 and 12.6) is characterised by sand and gravel deposited by a temporary realignment of the hydraulic gradient from the retreating ice sheet. This has resulted in a number of north-east to south-west trending esker-like ridges, and also ice marginal moraines.

Geology and soils

Solid geology

- 12.5.5 The relationship of the underlying solid geology to the Proposed Scheme corridor is shown in the geological long section illustrated in Figure 12.7. This shows that there are

two distinct provinces north and south of the Omagh Thrust Fault (OTF), a sub-horizontal thrust fault located to the south of Omagh.

- 12.5.6 North of the OTF the corridor is generally underlain by Precambrian strata which are Dalradian in age and which have been thrust southwards over younger, Devonian and Carboniferous rocks by the OTF, to form a large overturned fold known as the Sperrin Nappe.
- 12.5.7 The Devonian and Carboniferous rock south of the OTF largely comprise sandstones and limestones.
- 12.5.8 This sequence is disturbed by a number of major north-east to south-west trending faults which divide the strata of this area into 3 distinct fault blocks defined by 2 major faults groups; The Tempo – Sixmilecross Fault and Killadeas – Seskinore Fault to the north and the Clogher Valley Fault to the south. These form a central up-thrust block known as the Slievemore Ridge.
- 12.5.9 A stratigraphic column of the solid geology to the north and south of the OTF is provided in Tables 12A.1 and 12A.2 in Appendix 12B.

Drift geology

- 12.5.10 Drift deposits associated with the Proposed Scheme corridor are primarily glacial in origin. They comprise glacial till, glacial sands and gravels and glacio-fluvial sands and gravels interspersed with alluvium, lake alluvium and peat. The extent of the various deposits travelling north to south is shown in Figures 12.8 to 12.13.
- 12.5.11 Appendix 12C provides a summary of stratigraphy encountered in the main ground investigation.

New Buildings to South of Strabane

- 12.5.12 Glacial tills make up the principal deposits between New Buildings and the northern margins of the Burn Dennet Valley, other than at Gortmonly Hill and in the vicinity of Bready, where the bedrock is at or close to the surface.
- 12.5.13 Between the Burn Dennet Valley and Strabane there are extensive areas of alluvium associated with the wide floodplain of the River Foyle and narrow margins of alluvium associated with the Burn Dennet and a second east-west flowing tributary of the River Foyle, the Glenmornan River. There are extensive areas of glacio-fluvial sands and gravels which border the alluvium along the two tributaries and form a narrow margin between the alluvium and the north western foothills to the Sperrins. This extends south of Ballymagorry as far as the River Mourne in Strabane.
- 12.5.14 Located within the wide floodplain of the River Foyle, there are two areas of lowland raised peat bog west of Leckpatrick and Cloghcor. McKean's Moss is the largest of these. There are also islands of glacial till west of Ballymagorry which define localised gently elevated areas within the floodplain.

12.5.15 Where the Proposed Scheme passes to the west of Strabane, the floodplain and its associated alluvium is narrow along the banks of the Finn River and there is a band of hummocky glacial moraine which marks a transition from alluvium to glacial till.

Strabane to South of Omagh

12.5.16 Glacial tills constitute the principal deposits between Strabane and the northern margins of the Derg River. There are localised deposits of lake alluvium and raised peat bog. There are also hummocky glacial moraines along the Liscreevaghan Burn west of Victoria Bridge and on the northern margins of the Derg Valley.

12.5.17 As the route crosses the Derg Valley areas of glacio-fluvial sands and gravels frame a narrow margin of alluvium associated with the banks and channel of the river.

12.5.18 Beyond the Derg Valley, and as far as the contained Strule Valley as it emerges south of Bessy Bell, deposits of hummocky glacial moraine are virtually continuous. The moraines at Deer Park, west of Newtown Stewart, form part of the Foyle Valley Glacial Complexes. There are narrow bands of alluvium associated with the Coolaghy Burn and of glacial till associated with small watercourses descending the western slopes of Bessy Bell. These form brief breaks in the moraines.

12.5.19 Within the drumlin landscape between Bessy Bell and Omagh an initial expanse of glacial till gives way to a complex mosaic of deposits south of Mountjoy. These include:

- the designated Tully Bog ASSI and pockets of fen type peat in inter-drumlin areas;
- glacio-fluvial sands and gravels associated with the Fairy Water and the River Strule;
- glacial stony clay tills forming drumlin hills;
- areas of alluvium associated with the confluence of the River Strule and the Fairy Water at Poe Bridge; and
- lake alluvium to the south of Mountjoy.

12.5.20 There are also a number of areas of shallow cover where bedrock is close to the surface.

South of Omagh to Aughnacloy

12.5.21 As the Proposed Scheme corridor curves west and south of Omagh towards Doogary, the principal drift deposits comprise glacial till in the form of drumlins of stoney clay other than for an area where the rock is close to the surface to the south west of Omagh and alluvium defines the banks and channel of the Drumragh River.

12.5.22 Extensive areas of lowland raised peat bog in the vicinity of Doogary give way to a sequence of glacial till and areas where rock is close to the surface. This extends to Gortaclare / Moylagh, where the rock remains generally close to the surface as far as the crest of the Brougher (Slievemore) ridgeline. There are areas of alluvium associated with the Routing Burn and local watercourses and a locally large pocket of peat located south of Newtownsaville.

12.5.23 As the Proposed Scheme crosses the Brougher ridgeline, the Kilgreen deglacial sand and gravel complexes extend between Tullanafoile Hill and Birneys Hill / Tycanny Hill. Descending from the ridge and crossing the Clogher Valley there is a complex arrangement of glacial tills (which are typically formed into tightly packed oval shaped drumlins), alluvium associated with watercourses and areas where bedrock is close to the surface.

12.5.24 South of Ballygawley the Proposed Scheme corridor crosses a regularly changing sequence of glacial tills associated with drumlins and areas where rock is close to the surface. These are interspersed with deposits of alluvium and sands and gravels in the vicinity of the main watercourses (which include the River Blackwater and the Ballygawley Water) and alluvium deposits and peat accumulations in inter-drumlin areas.

Topsoils

12.5.25 The principal surface soils comprise:

- surface water gleys with some brown earths and peat podzols on gravel north of Strabane;
- brown earths and gleys in the immediate vicinity of Strabane;
- brown earth and gleys between Strabane and Omagh - gleys are more prevalent in the south;
- large areas of brown podzolics at Newtownstewart and in the upland areas north of Errigal;
- gleys south of Omagh; and
- peat in the Doogary area, south of Newtownsaville and more minor areas in inter drumlin areas, particularly to the south of Mountjoy.

Potentially contaminated / brownfield sites

12.5.26 Potentially contaminated sites which have been considered during the assessment are shown in Figures 12.1 to 12.6 and are scheduled in Table 12.1

Table 12.1 Potentially Contaminated Sites

Ref No.	Type	Location	Figure Reference
1	Petrol Filling Station	New Buildings	12.1
2	Corn Mills	Magheramason	12.1
3	Infilled Mill Pond	Grange Road	12.1
4	Backfilled Quarry	Sollus Hill	12.1
5	Disused Quarry	Sollus Hill	12.1
6	Infilled Brick Field	Route to Leckpatrick	12.2
7	Great Northern Railway Line, Including Mainline	New Buildings to South of Omagh	12.1

Ref No.	Type	Location	Figure Reference
8	Two Infilled Refuse Tips	North Strabane, east of Park Road	12.2
9	Infilled Canal and Tow Path	North Strabane	12.2
10	Disused Railway Station, Sidings and Engine House	North Strabane, south of Park Road	12.2
11	Area of Waste Deposition	Adjacent Urney Road	12.2
12	Flooded Limestone Quarry	East of Carricklee Hill	12.2
13	Petrol Station	Lifford Road	12.2
14	Backfilled Quarry	West of Sion Mills	12.3
15	Active Quarries	Urbalreagh	12.3
16	Active Quarries	Deer Park	12.3
17	Former Route of Great Northern Railway	South of Rash Road 1.5 km to Todds Road	12.4
18	Disused Nestle Factory	Poe Bridge	12.4
19	Back Filled Gravel Pit	Moylagh Road Junction	12.5
20	Back Filled Gravel Pit and Brick Kiln	Greenmount Road	12.5
21	Made Ground	South of Newtownsaville	12.5
22	Back Filled Quarries and Gravel Pits	Clogher Valley and Aughnacloy	12.6
23	Tullyvar Landfill	Clogher Valley and Aughnacloy	12.6
24	Reclaimed Landfill	Aughnacloy	12.6
25	Back Filled Quarries	West of Old Chapel Road	12.6
26	Clogher Valley Railway	Follows Clogher Valley through Aughnacloy	12.6

Human health risk

- 12.5.27 Samples from brownfield sites where they lie beneath the footprint of the Proposed Scheme were analysed in the ground investigation to determine chemical conditions. Very few concentrations of concern were identified. Occasional elevated chemical elements and compounds were found in these brownfield areas, with respect to long-term human health. Long term human health risks associated with pH (acidic), lead, carbazole and total petroleum hydrocarbons (C₁₂-C₁₆) were identified in locations positioned between New Buildings and Strabane. pH (acidic & alkaline) exceedances were respectively identified at two locations positioned between Strabane and Omagh. No exceedances with respect to long term human health were identified in locations positioned between Omagh and Aughnacloy.
- 12.5.28 Samples were analysed as part of the additional ground investigation works completed by the contractors between New Buildings and Strabane, and Omagh and Aughnacloy.

Long term risks associated with pH were identified at a number of locations, in addition to two exceedances of C₁₂-C₁₆. Asbestos was identified within two made ground samples at one location between Omagh and Aghnacloy. No additional sampling was undertaken between Strabane and Omagh.

- 12.5.29 Short term human health risks associated with pH (acidic), nickel, cadmium, copper, zinc and arsenic were identified in brownfield sites positioned between New Buildings and Strabane. A single pH (alkaline) exceedance was identified between Strabane and Omagh. A single sulphide exceedance was identified in one location between Omagh and Aghnacloy. All exceedances were identified in brownfield sites.
- 12.5.30 Samples were analysed as part of the additional ground investigation works completed by the contractors between New Buildings and Strabane and Omagh and Aghnacloy. Short term risks associated with nickel were identified in made ground and natural ground at several locations between New Building and Strabane and Omagh and Aghnacloy. In addition asbestos identified at one location between Omagh and Aghnacloy. No additional sampling was undertaken between Strabane and Omagh.
- 12.5.31 The background sampling of the greenfield sites established the unexpected presence of Polychlorinated biphenyls (PCBs) within natural ground at four locations, between New Buildings and Strabane. They occurred at depths of between 0.4 and 2.3mbgl indicating they cannot be attributed to aerial deposition. They are, however, at concentrations below the applied screening values and are not considered to be a risk to human health.
- 12.5.32 Occasional elevated concentrations of arsenic, nickel and boron in addition to pH with respect to short term human health risk, were identified in samples taken from greenfield sites during the site investigations undertaken along the entire route. There is no information available regarding expected background levels of these determinands in Northern Ireland. It has not been possible, therefore, to establish if the identified level is due to background conditions. However the Geological Society of Northern Ireland mapping indicates several mineral veins in the Sperrins Nappe strata and these are commonly associated with naturally enriched arsenic in soils.

Environmental Quality Standard – aquatic environment

- 12.5.33 A number of samples from brownfield areas distributed throughout the proposed route corridor also exceeded Environmental Quality Standard (EQS) screening values for risk to the aquatic environment. Elevated concentrations of chromium, copper, selenium, zinc, cadmium, nickel, naphthalene, ammonia as N and pH were identified at a number of locations between New Buildings and Strabane. Elevated concentrations of cadmium, copper, zinc, lead, mercury, selenium, ammonia as N, poly aromatic hydrocarbons and aliphatic hydrocarbons were identified in a number of locations between Strabane and Omagh. Elevated concentrations of copper, lead, zinc and selenium were identified at a number of locations between Omagh and Aghnacloy.
- 12.5.34 A number of samples from the greenfield areas along the entire proposed route corridor also exceeded EQS screening values for risk to the aquatic environment. Elevated concentrations of chromium, copper, selenium, zinc, cadmium, nickel and ammonia as N in addition to pH were identified at a number of locations positioned between New

Buildings and Strabane. Elevated concentrations of cadmium, copper, nickel, zinc, lead, mercury, selenium, ammonia as N in addition to pH, were identified in a number of locations positioned between Strabane and Omagh. Elevated concentrations of chromium, copper, lead, zinc mercury, selenium and phosphorus were identified at a number of locations positioned between Omagh and Aughnacloy.

- 12.5.35 A number of samples, analysed as part of the of the additional ground investigation works completed by the contractors between New Buildings and Strabane and Omagh and Aughnacloy, exceeded the EQS screening values for risk to the aquatic environment. Occasional elevated concentrations of cadmium, chromium, lead, copper, selenium, zinc, ammoniacal nitrogen, phenols, pyrene, nitrite and mercury were identified in made ground and natural ground at a number of locations. No additional sampling was undertaken between Strabane and Omagh.

Phytotoxicity

- 12.5.36 A number of samples from the brownfield areas exceeded the screening applied values for phytotoxicity. With the exception of pH (alkaline) identified at one location between Strabane and Omagh, all remaining exceedances, including arsenic, molybdenum, nickel, zinc, lead, copper cadmium and pH were identified between New Buildings and Strabane. No exceedances were identified between Omagh and Aughnacloy.
- 12.5.37 Samples of greenfield sites were also tested to determine the background chemical concentrations with regard to phytotoxicity. Occasional elevated concentrations of boron, nickel in addition to pH (acidic & alkali) were identified at a limited number of locations positioned between New Buildings and Strabane. Occasional elevated concentrations of arsenic, zinc and boron in addition to pH (acidic & alkali) were identified at a limited number of locations positioned between Strabane and Omagh. Occasional elevated concentrations of boron and nickel in addition to pH (acidic) were identified at a limited number of locations positioned between Omagh and Aughnacloy.
- 12.5.38 Samples were analysed as part of the of the additional ground investigation works completed by the contractors between New Buildings and Strabane and Omagh and Aughnacloy. Phytotoxic risk associated with pH (acidic) were identified at several locations between New Buildings and Strabane, in addition to a single copper exceedance. No exceedances were identified between Omagh and Aughnacloy. No additional sampling was undertaken between Strabane and Omagh.

Other testing

- 12.5.39 Samples primarily related to areas of overlying peat were found to be naturally highly acidic. Samples of peat taken between Strabane and Aughnacloy also contained phytotoxic concentrations of arsenic (two samples), boron and a number of acidic occurrences.
- 12.5.40 Levels of ammonia and ammonium within soils sampled throughout the Proposed Scheme corridor were found to be consistent with agriculture regimes with moderate to high fertilizer inputs.

12.6 Predicted impacts

Statutory and non-statutory designated sites

- 12.6.1 There would be no direct impact on McKean's Moss (1 & 2) ASSIs. The designated site is located 125m to the west of the Proposed Scheme, which would be aligned some 5m above the existing level of the moss. The road would be located on sands and gravels outside of the peat deposits or the river alluvium surrounding the moss such that there would be negligible risk of the construction of the road having an effect on the soils of, or the hydrological regime that currently supports the designated site.
- 12.6.2 There would be no direct impact on Tully Bog SAC/ASSI. The designated site is located a minimum of 110m to the west of the Proposed Scheme, which would be aligned a minimum of 4m above the existing level of the bog. The road would not cross any outliers of the peat associated with the bog. In this instance the bog is primarily supported by rainwater.
- 12.6.3 The Proposed Scheme is aligned across or on the fringe of the following areas of deglacial deposits included in the national schedule of ESCRS:
- the Foyle Valley Complex at Artigarven, near the Derg River, at Deer Park near Newtownstewart and in the Strule Valley south of Newtownstewart; and
 - the Clogher Valley Complex south of Newtownsaville.
- 12.6.4 Where this occurs, there would be a direct impact on the integrity of the geological formation, by virtue of the earthworks required to form the road. In all instances, the affected areas are small in the context of the defined area of interest. There may however be the opportunity for geological logging in these locations subject to the nature of the deposits and construction methodology.
- 12.6.5 Taking into account the extent of the impact, the effect on the integrity of the areas would be low.

Potentially contaminated sites

- 12.6.6 The assessment has demonstrated that construction of the Proposed Scheme is likely to involve the disturbance of some 26 potentially contaminated sites. Results to date suggest that elevated concentrations of contaminants are concentrated in the known brownfield areas around Strabane. Disturbance of these could potentially pose a risk to human health if the appropriate mitigation is not undertaken. Potential consequential impacts related to sensitive water related and nature conservation receptors are addressed in Chapter 11 (Ecology & Nature Conservation) and Chapter 16 (Road Drainage and the Water Environment). The contaminated land results are discussed in Appendix 12D.
- 12.6.7 Background testing in the greenfield areas has indicated there are occasional random naturally elevated concentrations of arsenic, nickel and boron in addition to pH which

could be a potential short term human health risk to construction staff. In addition asbestos was identified at one location between Omagh and Aughnacloy.

- 12.6.8 Where there are elevated levels of ammonia and ammonium, potential risks to nearby aquatic environments or sensitive terrestrial habitats are described in Chapter 11 and Chapter 16.
- 12.6.9 In relation to the potential for soils to support proposed planting, there would be a low risk to plant growth associated with areas of high acidity, elevated ammonium levels and/or phytotoxic determinands (copper, boron, nickel, zinc).

12.7 Proposed mitigation

- 12.7.1 In relation to the identified brownfield sites adjacent to and underlying the Proposed Scheme, more detailed investigations and sampling would be undertaken by the contractor in advance of construction commencing. This would enable the nature and extent of contaminants to be determined. A qualitative risk assessment would be undertaken to determine whether the associated risk is acceptable and no further remedial action is required. However, if treatment is necessary, then further testing and quantitative risk assessment would allow method statements to be prepared detailing handling, removal and disposal measures to ensure that site staff and the public are not exposed to risk. Where this involves removal of materials, the resultant material would be disposed of to a suitably licensed facility in accordance with the Duty of Care provisions under the Waste & Contaminated Land Order.
- 12.7.2 Where there are high levels of background acidity and phytotoxic determinands in the soils, adoption of seed mixes and species that have developed natural tolerance to these chemicals would ensure that adverse effects on planting are mitigated.

12.8 Conclusions and effects

- 12.8.1 The assessment has demonstrated that there would be no significant impacts on geology and soils. It has highlighted the presence of a small number of contaminated sites and land and identified an appropriate process for further investigation and the development of appropriate method statements to ensure the handling, removal and disposal of such material would not pose a risk to site staff or members of the public.

13 NOISE AND VIBRATION

13.1 Executive Summary

- 13.1.1 The assessment has considered the impacts of the Proposed Scheme on the noise and vibration level on nearby receptors. This has included impacts during the construction phase and during operation of the Proposed Scheme. The aim was to determine whether the Proposed Scheme would result in noise or vibration nuisance on sensitive receptors.
- 13.1.2 The assessment has demonstrated overall that there would be an adverse impact with more sensitive receptors experiencing an increase in road noise compared to those that would experience a reduction.
- 13.1.3 Construction noise would be temporary in nature. Specific contractor's method statements would be proposed prior to construction to ensure noise thresholds are not exceeded and any adverse impacts are minimised.
- 13.1.4 Road noise would be reduced by the introduction of noise barriers at targeted locations and the use of low noise surfacing.

13.2 Scope of Assessment

- 13.2.1 The assessments relating to noise and vibration have been focused on:
- construction-related noise associated with working areas and compounds;
 - traffic-related construction noise associated with delivery and removal of materials, and movement of machinery and plant to and from working areas and compounds;
 - construction-related vibration associated with working areas;
 - traffic-related noise associated with the Proposed Scheme and wider road network in the daytime during use;
 - traffic-related noise associated with the Proposed Scheme and wider road network in the night time during use;
 - noise nuisance associated with the Proposed Scheme and wider road network during use; and
 - traffic-related airborne vibration during use.

Construction-related noise associated with working areas and compounds

- 13.2.2 The assessment study area for construction-related noise comprises locations where construction activity would be likely to involve higher levels of construction-related noise (hot spots).
- 13.2.3 Hot spots considered have been proposed junctions, large earthworks, bridges and site compounds. Construction activities which have been considered relative to hot spots comprise; site clearance and earthworks, construction of road pavement, establishment of site compounds and bridge construction including piling.
- 13.2.4 The assessment timescale has been the anticipated 11 year phased construction period between 2017 and 2028.

Traffic-related construction noise

- 13.2.5 The assessment study area for construction-related traffic comprises sections of the existing road network which have been identified by the contractor advisors to the Department as routes which are likely to be used for the delivery and removal of materials and machinery and plant to and from working areas and compounds.
- 13.2.6 The assessment timescale has been the anticipated 11 year phased construction period between 2017 and 2028.

Construction-related vibration

- 13.2.7 The assessment study area for construction-related vibration comprises locations where piling, ground stabilisation, demolition, blasting or extended periods of breaking out of hard ground may be required.
- 13.2.8 The assessment timescale has been the anticipated 11 year phased construction period between 2017 and 2028.

Daytime traffic-related noise during use

- 13.2.9 The study area for daytime and night time assessments of traffic-related noise and nuisance during use comprises the Proposed Scheme and sections of the wider road network (affected routes) within the study area, adopted for the purposes of the traffic studies, where the traffic data indicates there is likely to be an increase or reduction in short-term or long-term traffic-related noise levels equal to or greater than 1 dB(A) and 3 dB(A) respectively. Affected routes have been identified by way of a review of the predicted Do-Minimum (DM) and Do-Something (DS) traffic forecasts for the Proposed Scheme for the short-term and long-term. An increase in flow of 25% or reduction of 20% in annual average weekly traffic (AAWT) 18-Hour (06:00 to 24:00 hours) is indicative of a 1 dB $L_{A10,18h}$ increase or reduction in levels in the short-term. An increase

of 100% or reduction of 50% is indicative of a 3 dB $L_{A10,18h}$ increase or reduction in levels in the long-term.

- 13.2.10 The assessment timescales adopted for the daytime assessment of traffic-related noise during use comprise one short-term and two long-term assessments for the fully completed scheme and two further assessments for the years it is anticipated phases 1 and 2 would be opened to use. The short-term assessment has involved comparison of predicted noise levels for the DM and DS scenarios in 2028, the year it is anticipated the fully completed scheme would be open to use. The long-term assessments have involved comparison of predicted noise levels for the DM scenario in 2028 and the DM scenario in 2041, the selected future assessment year, and for the DM scenario in 2028 and the DS scenario in 2041. The assessment years for the phase 1 and 2 assessments have been 2019 and 2023.

Night time traffic-related noise during use

- 13.2.11 The study area for the night time assessments of traffic-related noise has been the same as that adopted for the daytime assessment.
- 13.2.12 The assessment timescale for the night time assessment of traffic-related noise during use comprises that adopted for the long-term assessment for daytime, whereby comparison has been made between predicted noise levels for the DM scenarios in 2028 and 2041 and the DM scenario in 2028 and DS scenario in 2041.

Nuisance and traffic-related noise during use

- 13.2.13 The study area for the traffic-related noise nuisance assessment has been the same as that adopted for the daytime assessment.
- 13.2.14 The assessment timescales for the assessment of traffic-related noise nuisance have been those adopted for the two long-term assessments for daytime traffic-related noise, whereby comparison has been made between predicted noise levels for the DM scenarios in 2028 and 2041 and between the DM scenario in 2028 and the DS scenario in 2041.

Traffic-related vibration during use

- 13.2.15 The assessment study area for airborne traffic-related vibration during use comprises a 40m buffer either side of the Proposed Scheme in accordance with the guidance in HD 213/11.

Receptors

- 13.2.16 Receptors considered for the assessments comprise occupiers and users of residential dwellings, schools, churches, hospitals, children's nurseries and care homes.

Noise monitoring

- 13.2.17 Ambient noise monitoring has been undertaken in order to observe and gain an appreciation of the current local noise environment when assessing future operational noise levels due to the scheme as well as providing baseline information for the construction noise assessments. A glossary of acoustic terminology and description on of noise is provided in Appendix 13C.

Consultation

- 13.2.18 Officers of the Environmental Health Departments of Derry City Council, Strabane District Council, Omagh District Council and Dungannon and South Tyrone Borough Council have been consulted in relation to:
- protocols and methodologies pertinent to the assessments;
 - the identification of any reported instances of noise nuisance within the assessment study area; and
 - noise policies currently adopted by the authorities.

13.3 Methods of assessment

- 13.3.1 The methods of assessment have been informed by the guidance detailed in Volume 11, Section 3, Part 7 of the DMRB – Noise and Vibration (HD 213/11). Detailed explanation of the methods and their application is provided in Appendix 13A.
- 13.3.2 The location of residential and other sensitive receptors for the assessments has involved reference to OSNI Pointer data, selected site verification and using Geographical Information System (GIS) ESRI ArcGIS 9.3 software.

Construction-related noise associated with working areas and compounds

- 13.3.3 The assessment has involved:
- identification of construction hot spots;
 - liaison with the engineering design team and the contractor advisors to the Department to agree combinations of construction plant to represent principal noise generating activities at hot spots;
 - liaison with the engineering design team and the contractor advisors to the Department to agree the anticipated frequency and duration of the principal noise generating activities at hotspots;
 - calculation of predicted construction-related noise based on the agreed combinations of operating construction plant at hot spots;
 - evaluation of impacts relative to sensitive receptors; and

- identification of mitigation taking into account predicted noise levels, duration and frequency.

13.3.4 Calculations for predicted noise levels have been undertaken in accordance with the guidance detailed in BS 5228-1– Code of Practice for Noise and Vibration Control on Construction and Open Sites. The following assumptions have been made:

- all plant would be at the closest point within the working areas at the relevant hot spots to the nearest receptors. In reality, noise sources are likely to be spread more evenly across the construction sites such that the predicted noise levels would be lower;
- all plant and equipment would be running concurrently and 100% of the time for the purposes of calculating sound power levels for any one of the four activities. This represents a worst-case scenario; and
- there would be no overlap relative to each of the four main hot spot activities.

13.3.5 Method 1 – ABC Method has been adopted for the assessment of the Proposed Scheme. The ABC Method defines threshold levels as an indicator of potential significance for construction-related noise based on the ambient noise levels within the area which would be affected. The appropriate level, and that which has been adopted for the Proposed Scheme corridor based on the project specific monitoring data collected in 2014 is 65 dB(A)¹.

13.3.6 Where the calculations have indicated the threshold level would be exceeded, consideration has then been given to the number of receptors likely to be affected and the duration and nature of the impact to determine if there is likely to be a significant effect.

13.3.7 The identification of receptors likely to be affected by noise levels greater than the 65 dB(A) threshold has involved:

- calculation of the distance from the hot spots where it is predicted noise level would drop below the threshold for each of the four principal construction activities; and
- use of GIS to identify the number of sensitive receptors located within the areas defined by the distances specific to the four principal construction activities.

¹ Construction would occur during normal working hours of 07:00 to 19:00 Monday to Friday and 07:00 to 16:30 on Saturday with hours during the winter season reducing to 08:00 to 17:00 Monday to Friday. Although the example criteria described in BS 5228-1 define Saturday afternoons between 13.00 and 19.00 as weekends, and therefore subject to a lower noise limit than daytime periods; as the great majority of the work would take place only within daytime and due to the strategic nature of the development, it is considered reasonable in this instance to define the period 13.00 to 16.30 on Saturdays as daytime.

13.3.8 The following assumptions have been made as part of the calculation of the distance from hot spots:

- propagation occurs over mixed ground conditions;
- all construction equipment included in the calculation would operate concurrently; and
- there would be no intervening noise reducing barriers or terrain such as earth mounds or bunds.

Traffic-related construction noise

13.3.9 The assessment of the increase in local noise due to construction traffic (HGV) movements using site access roads has involved:

- identification of the routes it is anticipated would be used by the contractors for the delivery and removal of materials, machinery and plant to and from the working areas and compounds during construction;
- quantification of likely construction-related vehicle movements, and duration and frequency for each route;
- calculation of the likely construction traffic noise due to HGV movements using site access roads, using predicted HGV forecasts and the haul road method described in BS 5228-1;
- evaluation of the significance of the construction traffic noise levels; and
- identification of mitigation.

13.3.10 The identification of the anticipated routes and numbers and frequency of HGVs using them has been provided by the contractor advisors to the Department. Where both average and maximum daily two-way truck movements have been provided, the maximum movements have been used to calculate the worst case contribution from construction-related traffic.

13.3.11 Predicted noise levels have been calculated at 1m from the road edge. It has been assumed HGV's have a sound power level of 105.5dB, in accordance with maximum allowable noise levels as defined within European Directive 92/97/EC and that they would operate over a 10 hour working day. Where available, truck movements have been assigned the measured annual average daily speeds. Where the average daily speed is above the posted speed limit, it has been assumed that HGV construction traffic would travel at the speed limit. No screening, reflection, ground or distance corrections have been applied to the calculated noise levels which simply reflect source noise levels at the road location.

13.3.12 In common with the assessment for site based construction noise the evaluation of significance has involved the adoption of 65dB(A) as an indicator of potential

significance subject to consideration of the number of receptors likely to be affected and the duration and nature of the impact.

Construction-related vibration

13.3.13 The assessment has involved:

- identification of locations where there would be a risk of higher orders of ground borne vibration as a result of construction;
- identification of the nearest sensitive receptor(s) to the locations at risk; and
- identification of mitigation for the identified locations.

13.3.14 The identification of sensitive receptors has involved reference to OSNI Pointer data.

Daytime traffic-related noise during use

13.3.15 The assessment has involved:

- establishment of the assessment study area in accordance with the criteria described above;
- identification of sensitive receptors within the assessment study area;
- calculation of predicted traffic related noise levels for the sensitive receptors identified within the assessment study area;
- identification of locations where mitigation is to be provided and calculation of predicted traffic-related noise levels having taken mitigation into account;; and
- evaluation of the predicted changes in traffic related noise, allowing for mitigation, against magnitude of change criteria for short-term and long-term impacts.

Identification of sensitive receptors

13.3.16 The location and number of receptors within the assessment study area have been identified using NI Pointer data and Geographical Information System (GIS) ESRI ArcGIS 9.3 software.

Proposed residential development

13.3.17 A review of planning applications and consents for proposed potentially sensitive receptors was undertaken for submissions up to February 2014. At the time of the assessment 40 dwellings were identified as a possible future residential development with granted planning permissions and in close proximity to the Proposed Scheme. These future dwellings have been included within the noise model and the magnitude of impact at these receptors is included within the assessment tables.

Calculation of predicted traffic-related noise levels

- 13.3.18 The calculation of predicted traffic-related noise levels in the short and long term, has been undertaken in accordance with the procedures detailed within the Calculation of Road Traffic Noise (CRTN) - Department of Transport and Welsh Office, 1988; the procedures are nationally recognised and are adopted for major road projects throughout the UK.
- 13.3.19 Traffic related noise levels have been calculated using NoiseMap Server Edition, a 3-D computer modelling software package which accurately follows the methodology contained within the CRTN. Input data for the model has comprised:
- affected road links;
 - OSNI base mapping in DXF format;
 - OS Landform Profile contours in DWG format;
 - receptor locations in the form of Address Layer 2 Pointer data, giving building type information, in shape file format;
 - AAWT for affected roads, broken down into flows for the following categories: cars and LGVs, and HGVs with an unladen weight greater than 3.5 tonnes;
 - the annual average speed of vehicles using each link;
 - road type;
 - groundcover; and
 - the distance from relevant receptors to each section of road included in the study area.
- 13.3.20 In the case of the short-term assessment, which compares the DM and DS scenarios in the opening year for the fully completed scheme, traffic data for the the DM scenario has been based on data reflecting forecast growth between the traffic baseline survey years of 2013-2014 and 2028, without any allowance for the effect the phased opening of the Proposed Scheme, is likely to have on flows within the study area road network. The DS scenario has been based on predicted traffic flows within the study area road network once the fully completed scheme is open to use in 2028.
- 13.3.21 In the case of the long-term assessment, which compares the DM scenario in the opening year for the fully completed scheme and the DM scenario in the future assessment year, traffic data for the opening year, 2028, has been based on forecast growth between the traffic baseline survey years of 2013-2014 and 2028, without any allowance for the effect the phased opening of the Proposed Scheme, is likely to have on flows within the study area road network. Traffic data for the future assessment year has been based on forecast growth between the traffic baseline survey years of 2013-

2014 and 2041, without any allowance for the effect the phased opening of the Proposed Scheme, is likely to have on flows within the study area road network.

- 13.3.22 In the case of the long-term assessment, which compares the DM scenario in the year of opening for the fully completed scheme, 2028, and the DS scenario in the future assessment year, 2041, traffic data for the DM scenario has been based on forecast growth between the traffic baseline survey years of 2013-2014 and 2028 without any allowance for the effect the phased opening of the Proposed Scheme is likely to have on flows within the study area road network. Traffic data for the DS scenario has been based on predicted traffic flows in 2041 within the study area road network allowing for the inclusion of the fully completed scheme as part of the operating network.
- 13.3.23 In the case of the phase 1 assessment, which compares the DM and DS scenarios in 2019, traffic data for the DM scenario has been based on forecast growth between the traffic baseline survey years of 2013-2014 and 2019 within the study area road network excluding the presence of phase 1. Traffic data for the DS scenario has been based on predicted traffic flows in 2019 within the study area road network allowing for the inclusion of phase 1 as part of the operating network.
- 13.3.24 In the case of the phase 2 assessment, which compares the DM and DS scenarios in 2023, traffic data for the DM scenario has been based on forecast growth between the traffic baseline survey years of 2013-2014 and 2023 within the study area road network excluding the presence of phase 1 and phase 2. Traffic data for the DS scenario has been based on predicted traffic flows in 2023 within the study area road network allowing for the inclusion of phase 1 and phase 2 as part of the operating network.

Mitigation

- 13.3.25 The Proposed Scheme includes earth modelling and mounding in a number of locations. These have either been introduced to aid integration within the landscape or to screen sensitive receptors from views of the road and its traffic. They would also serve to reduce traffic-related noise in many locations. Where this is the case, the benefit afforded by such earthworks has been integral to the pre-mitigation assessment of noise levels.
- 13.3.26 Further measures specifically focused on mitigation of traffic noise have also been included in the proposals in the form of environmental barriers. The identification of the locations where barriers have been included has involved a review of the predicted traffic-related noise levels in the long-term to establish those receptors where it has been predicted there would be an increase of 10dB(A) or more in traffic noise levels and the predicted long-term traffic noise level would be 58dB $L_{A10,18h}$ or more at the most exposed façade.
- 13.3.27 Traffic noise levels of 58dB $L_{A10,18h}$ are approximately equivalent to the 55dB L_{Aeq} identified by the World Health Organisation in its Guidelines for Community Noise,

1999. The document states, 'To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB L_{Aeq} on balconies, terraces and outdoor living areas'.

- 13.3.28 An increase by 10dB(A) at the most exposed façade constitutes a major impact in the long-term as defined in HD 213/11.
- 13.3.29 Modelling has been undertaken to establish the effectiveness of barriers where receptors met the threshold and increase criteria. Locations where the modelling indicated barriers would provide a minimum reduction of 3dB(A) were further considered. Locations where the modelling indicated the minimum reduction would be unlikely to be achieved were excluded from further consideration on the basis that 3dB(A) is representative of a threshold for discerning change in traffic-related noise. Those that were further considered were then subject to evaluation in accordance with advice in HD 213/11 that 'where mitigation is to be considered, this should comply with acceptable standards in terms of traffic, safety, environmental and economic issues'.
- 13.3.30 It was recognised upon completion of the assessment that notwithstanding the reductions which earth modelling, mounding and environmental barriers would provide, traffic-related noise would have a significant effect on many receptors in the vicinity of the Proposed Scheme. It was concluded that low noise surfacing should be included as part of the scheme proposals for the dual carriageway and two sections of single carriageway at the northern and southern ends of the Proposed Scheme. This would have the effect of reducing levels for a substantial number of those receptors located along the Proposed Scheme corridor by between 2 and 3 dB(A).

Evaluation of the magnitude of change in traffic related noise

- 13.3.31 The evaluation of short-term and long-term magnitude of change in traffic related noise pre-mitigation and post-mitigation has involved application of the criteria detailed in Tables 3.1 and 3.2 in Chapter 3 of HD 213/11. The criteria are replicated below in Table 13.1.

Table 13.1: Short term and long term magnitudes of change

Short term change $L_{A10,18h}$	Long term change $L_{A10,18h}$	Magnitude of impact
0	0	No change
0.1 - 0.9	0.1 – 2.9	Negligible
1 – 2.9	3 – 4.9	Minor
3 – 4.9	5 – 9.9	Moderate
5+	10+	Major

Night time traffic-related noise during use

- 13.3.32 The assessment has involved prediction of changes in traffic-related noise as recommended in HD 213/11. The objective has accordingly been the identification of receptors which it is predicted would experience a change in night time traffic related noise levels greater than 3dB $L_{\text{night, outside}}$ and the $L_{\text{night, outside}}$ level is predicted to be above 55dB(A). $L_{\text{night, outside}}$ is defined as the equivalent continuous sound level $L_{\text{Aeq, 8hr}}$ for the period 2300 to 0700 hours assessed outside a dwelling and is free-field.

Nuisance and traffic-related noise during use

- 13.3.33 The assessment has involved an evaluation of changes in the percentage of the identified receptors within the study area for the daytime and night time traffic-related noise assessments which would be subject to nuisance as a result of changes in noise levels. It has involved reference to Figures A3.1 and A3.2 in Annex 3 of HD 213/11. Copies of the figures are provided in Appendix 13F.
- 13.3.34 Figure A3.1 is a graph representing the relationship between specific noise levels and the percentage of the population that would be bothered “very much” or “quite a lot” by virtue of the stated noise level. Figure A3.2 represents the relationship between the short-term noise level change and the change in the percentage of the population that would be bothered “very much” or “quite a lot” by virtue of that change at the opening of the Proposed Scheme.

Traffic-related vibration during use

- 13.3.35 DMRB notes a correlation between the percentage of people bothered by vibration nuisance and the $L_{\text{A10,18h}}$ statistical noise parameter experienced due to traffic noise. The correlation indicates that, for a given level of noise exposure, the percentage of people bothered “very much” or “quite a lot” by vibration is 10% lower than the corresponding figure for noise nuisance and that, where noise levels are below 58 dB $L_{\text{A10,18h}}$, it can be assumed the percentage of people bothered by vibration tends towards zero.
- 13.3.36 The assessment of the operational airborne vibration undertaken has been informed by the guidelines provided in the DMRB and is limited to a corridor 40m wide on either side of the carriageway boundary.

Noise monitoring

- 13.3.37 Noise monitoring surveys have been undertaken in accordance with the guidance provided in British Standard (BS) 7445:2003 ‘Description and Measurement of Environmental Noise’.
- 13.3.38 Environmental noise measurements have been taken at 54 locations during the daytime period in the vicinity of the Proposed Scheme. Of these 54 locations, night

time noise monitoring has also been carried out at 26 locations. Representative noise level measurements have been undertaken at each of the locations within the recommended hours of 1000 and 1700 during the day as defined in CRTN and between the hours of midnight and 0400 at night. Detailed information relating to monitoring locations, monitoring periods, equipment used and noise measurements is available in Appendices 13D and 13E.

13.4 Baseline environment

Consultations

- 13.4.1 During the consultations with the Environmental Health Departments of the Councils it was established there have been no reported instances of noise nuisance relating to road traffic noise within the relevant parts of their administrative areas. It was also established that none of the Councils have specific policies related to traffic and noise.

The study area and receptors

- 13.4.2 A total of 16,296 residential receptors and 332 other sensitive receptors have been identified within the study area for the traffic-related noise assessment during use.
- 13.4.3 Concentrations of receptors are located within the settlements of Derry/Londonderry, New Buildings, Magheramason, Bready, Ballymagorry, Strabane, Lifford, Sion Mills, Glebe, Victoria Bridge, Newtown Stewart, Mountjoy, Omagh, Garvaghy, Ballygawley and Aghnacloy. The existing A5 either passes through or close to most of these settlements such that noise associated with the strategic road is a discernible environmental influence. Outside of the main settlements receptors are distributed throughout the countryside in smaller settlements or as isolated properties. The area as a whole is one which does not currently support large-scale industrial development and where traffic noise is the dominant feature of the noise climate.

Baseline noise monitoring

- 13.4.4 Tables 13.2 and 13.3 detail the range of measured daytime and night time noise levels within the main settlements and the more sparsely populated rural areas associated with the Proposed Scheme corridor.

Table 13.2: Measured daytime and night time noise levels within the main settlements

Settlement	Range of daytime noise levels (L90dB(A))	Range of night time noise levels (L90dB(A))
Derry/Londonderry	51.2 – 58.2	-
New Buildings	52.4	42.1
Magheramason	39.3	35.8
Strabane	36.8-49.1	30.5-33.4

Settlement	Range of daytime noise levels (L90dB(A))	Range of night time noise levels (L90dB(A))
Sion Mills	36.7-41.6	29.0
Victoria Bridge	48.4	38.7
Mountjoy	41.7	29.0
Omagh	35.1-42.5	25.9-32.9
Gortaclare	43.3	30.5
Aughnacloy	44.4	-

Table 13.3: Measured daytime and night time noise levels in rural areas

Locality	Range of daytime noise levels (L90dB(A))	Range of night time noise levels (L90dB(A))
Magheramason	35.4	-
Bready	38.3-41.0	30.8
Burn Dennet (existing A5)	49.4	39.6
Ballymagorry	36.0-52.8	30.5-34.2
Strabane	39.8-41.8	28.6-30.8
Sion Mills (existing A5)	58.5	-
Ardstraw	44.1	30.9
Newstonstewart	38.3-50.4	27.0-36.7
Omagh	32.9-43.3	-
Doogary (existing A5)	48.5-51.9	32.5
Gortaclare	38.3-47.4	-
Garvaghy	39.6	29.0
Ballygawley	37.1-44.6	35.8
Aughnacloy	35.9-49.7	33.1-38.2

13.5 Predicted impacts and mitigation

Construction-related noise

- 13.5.1 Tables 13G.1 to 13G.4 in Appendix 13G detail the assumed plant type, quantity, L_{Aeq} at 10m and the total calculated sound power level for the four principal construction activities associated with the identified hot spots. Table 13.4 below provides a summary of the calculated sound power levels for the four principal construction activities.
- 13.5.2 Table 13.5 details the distance from each construction activity within which it is predicted noise levels associated with each of the four activities would be likely to

exceed 65dB(A). The table also details the distance at which levels of 70dB(A) and 75dB(A) would be exceeded.

Table 13.4: Construction activity sound power levels

Construction activity	Overall sound power level (dB)
Site Preparation and Earthworks	121
Construction of Road Pavement	115
Temporary Building Construction	116
Bridge Construction	125

Table 13.5: Distance to 65, 70 and 75 dB(A) for each construction activity

Construction Activity	65dB(A)	70dB(A)	75dB(A)
Site Preparation and Earthworks	180m	110m	65m
Construction of Road Pavement	110m	65m	40m
Temporary Building Construction	120m	75m	45m
Bridge Construction	280m	170m	105m

13.5.3 Tables 13B.5 to 13B.8 in Appendix 13B detail the identified hotspots which form the focus of the assessment and which of the four principal construction activities would occur at each. The tables also identify the receptors in the vicinity of the hot spots which would be subject to noise levels in excess of the 65dBA threshold adopted as an indicator of potential impact.

13.5.4 Table 13.6 quantifies the number of receptors likely to experience predicted noise levels above 65dB(A) for each noise hot spot, based on the distances in Table 13.5. It also provides the number of receptors which it is predicted would be potentially exposed to levels of 70 and 75dB(A). The table indicates that 89 receptors would be likely to experience noise levels above the 65dB(A) threshold, that 27 of the 89 would be likely to experience noise levels above 70dB(A) and that 4 of the 89 would be likely to experience noise levels above 75dB(A). The location of the affected receptors is shown in Figures 13.4 to 13.6.

Table 13.6: Numbers of receptors subject to construction noise levels above the BS5228 threshold

Hot Spot	Chainage	Construction activity	>65dB(A)	>70dB(A)	>75dB(A)
Junction 1	400	Site Prep & Earthworks	13	4	0

Hot Spot	Chainage	Construction activity	>65dB(A)	>70dB(A)	>75dB(A)
		Road Pavement	4	0	0
Main Compound	7700	Site Prep & Earthworks	1	1	0
		Road Pavement	1	0	0
		Temporary Building	1	0	0
Satellite Compound – Junction 3	14300	Site Prep & Earthworks	1	0	0
		Road Pavement	0	0	0
		Temporary Building	0	0	0
Flyover	10500	Site Prep & Earthworks	0	0	0
		Road Pavement	0	0	0
		Bridge Construction	1	0	0
Junction 4	17400	Site Prep & Earthworks	1	0	0
		Road Pavement	0	0	0
Junction 5	17800	Site Prep & Earthworks	5	1	1
		Road Pavement	1	1	0
Junction 7	19400	Site Prep & Earthworks	4	0	0
		Road Pavement	0	0	0
Bridge over Derg River	34374	Site Prep & Earthworks	0	0	0
		Road Pavement	0	0	0
		Bridge Construction	2	0	0
Junction 10	37200	Site Prep & Earthworks	1	1	0
		Road Pavement	1	0	0
Aggregate Processing	39500	Site Prep & Earthworks	1	0	0
		Road Pavement	0	0	0
		Temporary Building	0	0	0
Earthworks	43900	Site Prep & Earthworks	1	1	0

Hot Spot	Chainage	Construction activity	>65dB(A)	>70dB(A)	>75dB(A)
Main Compound	47000	Site Prep & Earthworks	4	3	1
		Road Pavement	3	1	0
		Temporary Building	4	2	0
Flyover	50100	Site Prep & Earthworks	1	0	0
		Road Pavement	0	0	0
		Bridge Construction	1	1	0
Earthworks	50700	Site Prep & Earthworks	2	1	0
Satellite Compound	53500	Site Prep & Earthworks	1	0	0
		Road Pavement	0	0	0
		Temporary Building	0	0	0
Bridge over River Drumragh	56693	Site Prep & Earthworks	1	0	0
		Road Pavement	0	0	0
		Bridge Construction	2	0	0
Satellite Compound	66500	Site Prep & Earthworks	3	2	2
		Road Pavement	2	2	0
		Temporary Building	3	2	0
Junction 14	68700	Site Prep & Earthworks	4	0	0
		Road Pavement	0	0	0
Earthworks	77300	Site Prep & Earthworks	1	0	0
Earthworks	79600	Site Prep & Earthworks	1	0	0
Junction 15	83400	Site Prep & Earthworks	1	0	0
		Road Pavement	0	0	0
Main Compound	83500	Site Prep & Earthworks	5	1	0
		Road Pavement	1	0	0

Hot Spot	Chainage	Construction activity	>65dB(A)	>70dB(A)	>75dB(A)
		Temporary Building	1	1	0
Flyover	83800	Site Prep & Earthworks	1	0	0
		Road Pavement	0	0	0
		Bridge Construction	3	1	0
Junction 16	88400	Site Prep & Earthworks	1	0	0
		Road Pavement	0	0	0
Satellite Compound	86700	Site Prep & Earthworks	1	1	0
		Road Pavement	1	0	0
		Temporary Building	1	0	0
Junction 17	92200	Site Prep & Earthworks	1	0	0
		Road Pavement	0	0	0
Totals			89	27	4

13.5.5 The results in table 13.6 indicate, that of the 46 hotspots identified in Figures 13.7 to 13.9, the predicted noise levels associated with 26 are such that they would have a potentially significant impact on nearby receptors.

Mitigation

13.5.6 The following mitigation measures have been identified and would form part of the CEMP for the construction contracts should the Proposed Scheme receive development consent and proceed to implementation:

- use of temporary acoustic barriers where appropriate;
- location of static noisy plant as far away from noise sensitive receptors as is feasible for the particular activity;
- ensuring that plant and equipment covers and hatches are properly secured and there are no loose fixings causing rattling;
- ensuring that equipment and plant is properly maintained;
- use of silenced equipment where possible; in particular silenced power generators if night time power generation is required for site security or lighting;
- ensuring that vehicles and mobile plant are well maintained such that loose body fittings or exhausts do not rattle or vibrate;

- ensuring that plant and machinery is turned off when not in use;
- closure of engine compartments for all equipment;
- use of suitable dampening materials to reduce the resonance of body panels and cover plates;
- siting and orientation of semi-static equipment as far as is reasonably practicable away from noise sensitive receptors;
- super-silencing and / or screening of generators and water pumps required for 24-hour operation;
- lubrication of crane spindles, pulley wheels, telescopic sections and moving parts of working platforms to prevent undue screeching and squealing; and
- use of mains electricity rather than generators where possible.

13.5.7 It would be a requirement of the contract(s) that the contractors' Environmental Site Manger would be responsible for ensuring that method statements for construction activities, including those associated with hot spots, incorporate the above measures and other appropriate noise mitigation measures relating to specific activities.

13.5.8 It would also be a requirement that contractors' CEMPs make provision for prior notification to potentially affected receptors in the vicinity of working areas where there would be a need for higher order noise generating activity. Information provided would include; the nature of the activity and associated noise, measures which would be adopted to reduce noise, duration and any working time limitations and channels of communication via the contractors' Site Liaison Manager for the registering and resolution of concerns or complaints.

Construction traffic noise

13.5.9 The findings of the assessment of construction traffic-related noise using identified roads within the existing road network to gain access to working areas, deliver materials and plant and remove excess materials and waste are detailed in Tables 13.B15 to 13.B18 in Appendix 13B. The assessment has indicated that 11 of the routes which it is anticipated would be used would be subject to levels in excess of 65dB(A), the threshold which has been adopted as an indicator of potentially significant impact.

13.5.10 The affected sections of road comprise:

- Areas along the existing A5 (specifically at CH 9100 and 11600);
- Junction 3 (existing A5);
- Junction 6 (existing A5);
- Strahans Road;

- Peacock Road;
- Seskinore Road;
- Moylagh Road;
- Augher Point Road;
- Springhill Road; and
- A4 Annaghilla Road.

Mitigation

13.5.11 The following mitigation measures have been identified and would form part of the CEMP for the construction contracts, should the Proposed Scheme receive development consent and proceed to implementation:

- introduction of vehicle speed limits for heavy goods vehicle traffic travelling on access roads close to receptors and ensuring that vehicles do not park or queue for long periods outside residential properties with engines running unnecessarily;
- ensuring, where practicable, that site access routes are in good condition with no pot-holes or other significant surface irregularities; and
- prior notification of intended use of the routes to households in the vicinity of the routes where they currently experience low levels of vehicular and HGV use.

Vibration due to construction

13.5.12 Construction activities which have been identified as being likely to generate the highest orders of vibration; are large-scale earthmoving, rock blasting, and pile driving. Table 13.7 details the locations where it is likely that vibration generating construction activity may pose a risk relative to concern or material damage to property. The table identifies the location, activity and distance to nearest receptor / property.

Table 13.7: Locations of higher risk vibration generating construction activity

Chainage	Activity	Approx. distance to nearest receptor
7700	Earthworks cut and embankment construction works	>180m
10500	Construction of Flyover	>180m
12700	Construction of Flyover	>180m
13500	Construction of Flyover	>180m
20400	Earthworks cut and embankment construction works	>180m
34374	Construction of bridge over River Derg	>180m
39500	Aggregate Processing	>120m

Chainage	Activity	Approx. distance to nearest receptor
43900	Earthworks cut and embankment construction works	>65m
55200	Earthworks cut and embankment construction works	>180m
56693	Construction of bridge over River Drumragh	>170m
62600	Earthworks cut and embankment construction works	>180m
64500	Earthworks cut and embankment construction works	>180m
71700	Construction of Flyover	>180m
77300	Earthworks cut and embankment construction works	>110m
79600	Earthworks cut and embankment construction works	>110m
83800	Construction of Flyover	>110m

13.5.13 In all but one of the locations the nearest property would be in excess of 100m from the relevant construction activity. The risk of significant adverse vibration effects would accordingly be low.

Mitigation

13.5.14 In common with site based construction noise, it would be a requirement that contractors' CEMPs make provision for prior notification to potentially affected receptors in the vicinity of working areas where there would be a risk that vibration may cause concern or superficial damage. Information provided would include: the nature of the activity and associated vibration, measures which would be adopted to reduce vibration, duration and any working time limitations and channels of communication via the contractors' Public Liaison Manager for the registering and resolution of concerns or complaints.

13.5.15 Works would also be programmed relative to piling, blasting, stabilisation & demolition such that the activities would not be concurrent in any one location.

Daytime traffic-related noise during use

13.5.16 The results of the noise modelling for the short-term and long-term assessments and the opening years for phases 1 and 2 are available in Appendix 13H. The appendix details the predicted noise levels and changes in noise levels in the short-term and long-term and in the opening year for phases 1 and 2 for residential and non-residential receptors included in the assessments. The appendix also details the predicted magnitude of impact for residential and non-residential receptors included in the assessments.

Short-term traffic-related noise impacts for the fully completed scheme

13.5.17 The numbers of residential and non-residential receptors it is predicted would experience a short-term increase or reduction in traffic-related noise, prior to consideration of proposed mitigation, once the fully completed scheme is open to use are scheduled in Tables 13.8 and 13.9.

Table 13.8: Short term traffic noise impacts DM 2028 / DS 2028 / residential receptors

Change in noise level L _{A10,18h} dB	Increase	Decrease
0 (No Change)	313	
0.1-0.9 (Negligible)	2358	3509
1-2.9 (Minor)	3360	1852
3-4.9 (Moderate)	1923	416
5+ (Major)	2252	313
Total	9893	6090

Table 13.9: Short term traffic noise impacts DM2028 / DS2028 / Non-residential receptors

Change in noise level L _{A10,18h} dB	Increase	Decrease
0 (No Change)	15	
0.1-0.9 (Negligible)	43	102
1-2.9 (Minor)	57	36
3-4.9 (Moderate)	34	11
5+ (Major)	28	6
Total	162	155

13.5.18 The figures indicate it is likely that 2252 and 1923 residential receptors would be subject to major and moderate increases in traffic-related noise and that 313 and 416 would be subject to major and moderate reductions. The equivalent figures for non-residential receptors are 28 and 34 would be subject to major and moderate increases and that 6 and 11 would be subject to major and moderate reductions. Locations where it is predicted there would be major adverse impact are: Strabane (554), Sion Mills (528), Omagh (515), Newtownstewart (121), Magheramason (60), Ballygawley (56), Bready (54), Seskinore (48), Victoria Bridge (47), Beragh (39), Dungannon (34), Ballymagorry (33), Aughnacloy (28), Glebe (27), Artigarvan (26), Mountjoy (23), Augher (17), Seskilgreen (13), Sixmilecross (11), Eskragh (11), Newtownsaville (4), Fintona (2) and New Buildings (1).

Long-term traffic-related noise impacts for the fully completed scheme

13.5.19 The numbers of residential and non-residential receptors it is predicted would experience a long-term increase or reduction in traffic-related noise, prior to consideration of proposed mitigation, once the fully completed scheme is open to use are scheduled in tables 13.10 and 13.11.

Table 13.10: Long-term traffic noise impacts without scheme DM 2028 / DM 2041 / residential receptors

Change in noise level L _{A10,18h} dB	Increase	Decrease
0 (No Change)	93	
0.1-2.9 (Negligible)	16072	105
3-4.9 (Minor)	26	0
5-9.9 (Moderate)	0	0
10+ (Major)	0	0
Total	16098	105

Table 13.11: Long-term traffic noise impacts without scheme DM2028 / DM2041 / Non-residential receptors

Change in Noise Level L _{A10,18h} dB	Increase	Decrease
0 (No Change)	0	
0.1-0.9 (Negligible)	327	1
1-2.9 (Minor)	4	0
3-4.9 (Moderate)	0	0
5+ (Major)	0	0
Total	331	1

13.5.20 The figures indicate that, should the Proposed Scheme not be implemented, it is likely that none of the residential or non-residential receptors identified would be subject to major or moderate increases in traffic-related noise in 2041 (the future assessment year).

13.5.21 The numbers of residential and non-residential receptors it is predicted would experience a long-term increase or reduction in traffic-related noise in 2041 (the future assessment year), should the Proposed Scheme be implemented, are scheduled in Tables 13.12 and 13.13.

Table 13.12: Long-term traffic noise impacts with scheme DM 2028 / DS 2041 / residential receptors

Change in noise level L _{A10,18h} dB	Increase	Decrease
0 (No Change)	492	
0.1-2.9 (Negligible)	6732	3497
3-4.9 (Minor)	2337	356
5-9.9 (Moderate)	1873	225
10+ (Major)	781	3
Total	11723	4081

Table 13.13: Long term traffic noise impacts with scheme DM2028 / DS2041 / Non-residential receptors

Change in noise level L _{A10,18h} dB	Increase	Decrease
0 (No Change)	9	
0.1-0.9 (Negligible)	153	78
1-2.9 (Minor)	44	10
3-4.9 (Moderate)	23	4
5+ (Major)	11	0
Total	231	92

13.5.22 The figures indicate it is likely that 781 and 1873 residential receptors would be subject to major and moderate increases in traffic-related noise respectively and that 3 and 225 would be subject to major and moderate reductions. The equivalent figures for non-residential receptors are that 11 and 23 receptors would be subject to major and moderate increases and that 0 and 4 would be subject to major and moderate reductions.

13.5.23 Comparison of the figures in Tables 13.10 and 13.12 indicates that should the Proposed Scheme be implemented there would be 2654 residential receptors subject to the two higher orders of adverse impact and 228 subject to higher orders of beneficial impact, whilst there would be none of either should the Proposed Scheme not be implemented.

13.5.24 Comparison of the figures in Tables 13.11 and 13.13 indicates that should the Proposed Scheme be implemented there would be 34 non-residential receptors subject to the two higher orders of adverse impact and 4 subject to higher orders of beneficial impact, whilst there would be none of either should the Proposed Scheme not be implemented.

13.5.25 Locations where it is predicted there would be concentrations of major adverse impact should the Proposed Scheme be implemented are Omagh (162 dwellings), Sion Mills (158 dwellings), Strabane (80 dwellings) and Newtownstewart (77 dwellings).

Mitigation

13.5.26 The numbers of residential receptors it is predicted would experience a long-term increase or reduction in traffic-related noise in 2041 (the future assessment year), taking account of the introduction of proposed environmental barriers (see Figures 6.18 - 6.45) are scheduled in Table 13.14. There where no non-residential receptors which met the criteria adopted for the introduction of barriers.

13.5.27 Comparison of the figures for impacts without mitigation in the long-term in Table 13.12 with those with the proposed barriers in place in Table 13.14 demonstrates there would be 16 fewer receptors subject major adverse impact and 38 fewer subject to moderate adverse impact with the proposed mitigation.

Table 13.14: Long term traffic noise impact with Scheme DM 2028 / DS 2041 / residential receptors with mitigation

Change in noise level L _{A10,18h} dB	Increase	Decrease
0 (No Change)	494	
0.1-2.9 (Negligible)	6764	3510
3-4.9 (Minor)	2341	358
5-9.9 (Moderate)	1835	226
10+ (Major)	765	3
Total	11705	4097

Impacts associated with phasing

13.5.28 Comparison of the predicted traffic-related noise levels for all receptors for 2028 (the opening year for the fully completed scheme) and the opening years for phases 1 and 2 has highlighted a number of locations where receptors would experience major temporary increases that they would not be subject to with the fully completed scheme.

- 13.5.29 Receptors which would be subject to temporary major impact upon the opening of phase 1 would be in Omagh (661), Strabane (637), Sion Mills (564), Newtownstewart (124), Victoria Bridge (57), Aughnacloy (51), Ballygawley (33), Glebe (27), Mountjoy (26), Artigarvan (23), Seskinore (5) and Ballymagorry (3).
- 13.5.30 Receptors which would be subject to temporary major impact upon the opening of phase 2 would be in Aughnacloy (30) and Ballygawley (27).

Night time noise

- 13.5.31 The results for the long-term assessment of predicted night time noise levels should the Proposed Scheme be implemented (with and without mitigation) and not implemented are available in Appendix 13I.
- 13.5.32 The numbers of receptors it is predicted would experience an $L_{\text{night, outside}}$ noise level greater than 55dB are scheduled in Table 13.16 below. The figures indicate there would be no receptors subject to major or moderate adverse increases should the Proposed Scheme not be implemented.
- 13.5.33 They indicate there would be 56 and 10 receptors subject to major and moderate increases should the Proposed Scheme be implemented. With the introduction of the proposed environmental barriers these numbers would reduce to 38 and 9.
- 13.5.34 Locations where it is predicted there would be a major increase are Glenfinn Park & Urney Road in Strabane (22), Primrose Park in Sion Mills (18) and Derry Road, north of Strabane (4). The remaining 12 are isolated dwellings and are dispersed along the Proposed Scheme corridor.

Table 13. 16 Night time noise impacts with and without implementation of mitigation measures

Change in noise level		Night time Dwellings 2028 DM vs 2041 DM	Night time Dwellings 2028 DM vs 2041 DS	Night time Dwellings 2028 DM vs 2041 DS with mitigation
Increase in noise level $L_{A10,18h}$ dB	0.1- 2.9 (Negligible)	2370	695	674
	3 – 4.9 (Minor)	7	40	40
	5 – 9.9 (Moderate)	0	10	9
	10+ (Major)	0	56	38
No Change	0	99	40	33

Decrease in noise level, LA10,18h dB	0.1- 2.9 (Negligible)	219	1155	1060
	3 – 4.9 (Minor)	0	258	254
	5 – 9.9 (Moderate)	0	357	349
	10+ (Major)	0	84	81

Traffic related noise nuisance during use

13.5.35 The numbers of receptors it is predicted would be subject to a change in nuisance level are scheduled in Table 13.17. The table shows firstly the Do-minimum scenario in the baseline year (2028) against the Do-minimum scenario in the future assessment year (2041) and in the second column the numbers show the Do-minimum scenario in the baseline year (2028) against the Do-something in the future assessment year (2041).

Table 13.17 Traffic-related noise nuisance impacts

Traffic Noise Nuisance Impacts		DM 2028 / DM 2041	DM 2028 / DS 2041
Change in nuisance level		Number of dwellings	Number of dwellings
Increase in nuisance level	<10%	15349	2014
	10 < 20%	0	1841
	20 < 30%	0	3595
	30 < 40%	0	2939
	>40%	0	1236
No Change		754	938
Decrease in nuisance level	<10%	193	3672
	10 < 20%	0	59
	20 < 30%	0	2
	30 < 40%	0	0
	>40%	0	0

13.5.36 As is shown in Table 13.17 above in the Do-minimum 2028 vs Do-minimum 2041 comparison, all increases in traffic noise nuisance are below 10%, whereas the increases in nuisance levels with the Proposed Scheme compared to the Do-minimum baseline are more widely distributed across the nuisance bands, with 1236 dwellings subjected to an increase in nuisance of over 40%. However 11625 properties experience an increase in traffic noise nuisance with the scheme, compared to 15349 without the scheme.

13.5.37 3733 properties are predicted to experience a noise nuisance reduction following the introduction of the scheme, compared with 193 dwellings without the scheme. This is due to traffic flows on the existing A5 which passes through densely populated residential areas route being diverted away to use the Proposed Scheme.

Traffic-related vibration nuisance during use

13.5.38 The assessment has identified 27 residential receptors which would be located within 40m of the Proposed Scheme and which could potentially be subject to traffic-related airborne vibration. The numbers of these which it is anticipated would be likely to be subject to a change in nuisance level due to the proximity of the Proposed Scheme are scheduled in Table 13.18.

13.5.39 The following table shows that there are more increases in airborne vibration when comparing the impacts of the proposed scheme in the design year with the Do-minimum in the baseline year, as opposed to the Do-minimum comparisons. In the long term it is predicted that 9 properties are subject to an increase in vibration nuisance of between 30% and 40%. Increases in vibration nuisance are due to the proximity of the proposed carriageway to these properties. No properties are subject to a decrease in vibration nuisance.

Table 13.18: Traffic Related vibration nuisance impacts

Traffic vibration nuisance impacts		Do-minimum	Do-something
Change in nuisance level		Number of dwellings	Number of dwellings
Increase in nuisance level	<10%	4	2
	10 < 20%	0	10
	20 < 30%	0	5
	30 < 40%	0	9
	>40%	0	0

Traffic vibration nuisance impacts		Do-minimum	Do-something
Change in nuisance level		Number of dwellings	Number of dwellings
No Change	0%	23	1
Decrease in nuisance level	<10%	0	0
	10 < 20%	0	0
	20 < 30%	0	0
	30 < 40%	0	0
	>40%	0	0

13.6 Conclusions and effects

Construction-related noise

- 13.6.1 The assessment has identified 26 construction hot spots where noise generating construction activity would be likely to result in levels in excess of 65dB(A), the level established as an indicator of potentially significant impact in accordance with BS 5221. As recommended in the BS, consideration has been given to the numbers of receptors affected and the duration and nature of the impacts.
- 13.6.2 The numbers of receptors potentially affected at each hot spot are small, the highest being 8 in the vicinity of junction 1. Construction at the other 25 locations would affect between 1 and 5 receptors whilst the duration of the activities which would be likely to involve levels in excess of the threshold would be limited to periods of relatively short duration within each anticipated three-year construction phase. It has accordingly been concluded there would be no significant environmental effects associated with construction-related noise.

Construction traffic noise

- 13.6.3 The assessment has demonstrated there would be 11 access routes where noise levels associated with their use by construction traffic would be likely to exceed the threshold level of 65dB(A) identified in accordance with BS 5221. These comprise sections of the existing A5, Strahans Road, Peacock Road, Seskinore Road, Moylagh Road, Augher Point Road, Springhill Road and A4 Annaghilla Road.

- 13.6.4 The effect would be temporary and occur for periods of relatively short duration over approximately 3 years.

Construction vibration

- 13.6.5 The assessment has demonstrated that risk related to vibration during construction would be low prior to mitigation. Taking mitigation into account it has been concluded there would be no significant effects associated with construction-related vibration.

Traffic-related noise during use

- 13.6.6 The assessment has demonstrated that, taking mitigation into account, there would be 765 and 1835 receptors subject to major and moderate long-term increases in traffic-related noise respectively.
- 13.6.7 It has been concluded that, in light of the number and order of predicted increases and the distribution of major and moderate increases throughout a substantial proportion of the Proposed Scheme corridor as a whole, impacts associated with traffic-related noise during use would constitute a significant environmental effect.

Traffic-related Vibration during use

- 13.6.8 An evaluation of the number of residential receptors within 40m of the Proposed Scheme and with predicted noise levels of greater than 58 dB $L_{A10,18h}$ shows that there are 27 residential receptors which could potentially be subject to significant levels of airborne vibration associated with vehicles using the route.

14 EFFECTS ON ALL TRAVELLERS

14.1 Executive summary

- 14.1.1 The aim of the assessment was to determine the potential impacts of the Proposed Scheme on the users of long distance routes and local roads. There has also been an evaluation of driver stress relative to the existing A5.
- 14.1.2 The Ulster Way long distance footpath would be traversed at two locations and at one of these locations severed. The Ulster way is not promoted for use where it is severed and is a location where public transport is encouraged. Provision would be made for local roads which form a part of long distance cycle routes to cross either beneath or above the new carriageway. Crossing would be provided beneath or above the new carriageway at three locations where it crosses the South Sperrin Scenic Route.
- 14.1.3 Access onto the existing local road network would be maintained either by bridging or, where road closures are required, by a short diversion to link with an alternative road.
- 14.1.4 The Proposed Scheme would improve safety and reduce journey times and driver stress for users of the existing A5.

14.2 Scope of the assessments

- 14.2.1 The assessments have been focused on:
- impacts on journeys undertaken by pedestrians, cyclists and equestrians (collectively referred to as Non-Motorised Users – NMUs) and users of local roads either for recreation or to access facilities used by communities; and
 - evaluation of driver stress relative to the existing A5 and the Proposed Scheme

Impacts on NMUs and users of local roads

- 14.2.2 The assessments related to NMUs and users of local roads have involved:
- consideration of routes which are solely available to NMUs and of local roads used by NMUs and motorists which would be crossed by the alignment of the Proposed Scheme such that access along and/or enjoyment of the routes is likely to be affected as a result of new severance and impacts on amenity; and
 - consideration of the extent to which the existing A5 acts as a barrier to movement of NMUs who are required to cross the existing road to gain access to community facilities and the displacement of traffic onto the Proposed Scheme is likely to relieve such severance.

- 14.2.3 The study area for the assessment of new severance and impacts on amenity comprises long distance footpaths, public footpaths, cycle routes, scenic routes and local roads which would be crossed by the alignment of the Proposed Scheme.
- 14.2.4 The study area for the relief of existing severance comprises the existing A5 between New Buildings and the border with the Republic of Ireland (ROI).
- 14.2.5 Both assessments have been focused on changes in severance based on comparison of the Do-Minimum (DM) and Do-Something (DS) scenarios for 2028, the anticipated opening year for the fully completed scheme.
- 14.2.6 Community focused facilities which have been considered include education, health, religious buildings, libraries, leisure and recreational facilities, local shops and village halls.

Driver stress

- 14.2.7 The assessment has involved comparison of predicted levels of driver stress for users of the existing A5 and users of the Proposed Scheme. Comparison has been made between predicted levels of driver stress for the DM and DS scenarios for 2041, the longest term future assessment year for which project specific traffic forecasts are available.

14.3 Statutory and planning context

- 14.3.1 Statutory provisions relating to public rights of way and access areas are detailed in The Access to the Countryside (Northern Ireland) Order 1983. The Order details obligations, powers and rights required of, and available to, local authorities and landowners in relation to the establishment, maintenance and extinguishment of public rights of way, long distance routes and countryside access areas.

14.4 Methods of assessment

Impacts on NMUs and users of local roads

- 14.4.1 The method of assessment related to new severance and relief of severance for NMUs and users of local roads has been based on the guidance provided in the DMRB, Volume 11, Section 3, Part 8 (Pedestrians, Cyclists, Equestrians and Community Effects).

New severance

14.4.2 The assessment has involved:

- identification of long distance footpaths, public footpaths, cycle routes, scenic routes and local roads which would be crossed by the alignment of the Proposed Scheme;
- identification of the location of the principal communal facilities in the vicinity of the existing A5 corridor and the Proposed Scheme;
- identification and description of changes in journeys along the routes used by NMUs and motorists, including impacts on amenity; and
- categorisation of severance specific to each location where existing routes and the Proposed Scheme cross, taking into account combinations of criteria related to vehicle flows on new sections of road, the form of crossing provided and increases in journey length, as detailed in Chapter 6, Section 3, Part 8, Volume 11 of the DMRB and replicated in Table 14.1.

Table 14.1: New severance

Severance	Criteria
Slight	<ul style="list-style-type: none"> • Pedestrian at-grade crossing of a new road carrying below 8,000 vehicles per day (AADT); or • A new bridge would need to be climbed or a subway traversed; or • Journeys would be increased by up to 250m.
Moderate	<ul style="list-style-type: none"> • Two or more of the hindrances set out under 'slight' applying to single trips; or • Pedestrian at-grade crossing of a new road carrying 8,000-16,000 vehicles per day (AADT) in the opening year; or • Journeys would be increased by 250m-500m.
Severe	<ul style="list-style-type: none"> • Pedestrian at-grade crossing of a new road carrying over 16,000 vehicles per day (AADT) in the opening year; or • An increase in length of journeys of over 500m; or • Three or more of the hindrances set out under 'slight' or two or more set out under 'moderate'.

14.4.3 The identification of community facilities and routes used by NMUs and motorists using local roads has involved reference to Ordnance Survey of Northern Ireland (OSNI) mapping, consultation with Derry City Council, Strabane District Council, Omagh District Council, Dungannon and South Tyrone Borough Council and site verification. A review has also been undertaken of side road assessments completed as part of the development of the transportation model for the Proposed Scheme.

Relief of severance

14.4.4 The assessment has involved categorisation of the predicted relief of severance for sections of the existing A5 between New Buildings and the border with the ROI based on the guidelines provided in Chapter 7, Section 3, Part 8, Volume 11 of the DMRB and replicated in Table 14.2 below. In accordance with the guidance, three levels of relief have been adopted; slight, moderate and substantial, according to the urban or rural location of the existing section of road and the percentage reduction in predicted traffic flows along the sections.

Table 14.2 Relief from existing severance

	Level of relief from severance % Reduction in existing traffic levels		
	Slight	Moderate	Substantial
Built-up area	c. 30%	30-60%	60%+
Rural area	60-75%	75-90%	90%+

Driver stress

14.4.5 The method of assessment for driver stress has been based on the guidance provided in the DMRB, Volume 11, Section 3, Part 9 (Vehicle Travellers). It has involved consideration of the following factors:

- traffic flows;
- journey speed;
- frustration - the inability to drive at a speed consistent with the driver's wishes in relation to the general standard of the road;
- fear - the potential for accidents due to the presence of other vehicles, poor road standards and the possibility of pedestrians stepping into the road; and
- uncertainty - primarily due to signing that is inadequate for the driver's purpose.

14.4.6 In relation to traffic flows and journey speed, the DMRB provides guidance relating levels of driver stress relative to average hourly flow per lane, average journey speed, the urban or rural location of the road and the type of road (e.g. motorway, dual carriageway or single carriageway). The existing A5 road is a single carriageway. The Proposed Scheme is a dual carriageway other than for two short sections at its northern and southern ends. Table 14.3 details the DMRB stress ratings for a single carriageway. Table 14.4 details the DMRB stress ratings for a dual carriageway.

Table 14.3 : Stress ratings for single carriageway roads

Average hourly flow per lane Flow units/1 Hour	Average journey speed – km/hr		
	Under 50	50 – 70	Over 70
Under 600	High*	Moderate	Low
600-800	High	Moderate	Moderate
Over 800	High	High	High

* Moderate in urban areas

Table 14.4 Stress ratings for dual carriageway roads

Average hourly flow per lane Flow units/1 Hour	Average journey speed – km/hr		
	Under 60	60 – 80	Over 80
Under 1200	High*	Moderate	Low
1200-1600	High	Moderate	Moderate
Over 1600	High	High	High

* Moderate in urban areas

- 14.4.7 Preliminary ratings for sections of the existing A5 and Proposed Scheme have been derived from the application of the criteria in tables 14.3 and 14.4. These have then been subject to review taking into account frustration, fear and uncertainty and the preliminary ratings have either been confirmed or modified.

14.5 Baseline environment

NMUs

- 14.5.1 The location of long distance routes, public footpaths, cycle routes and scenic routes considered during the assessments are indicated in Figure 14.1.

The Ulster Way

- 14.5.2 The Ulster Way is a 675-mile long distance circular route promoted by WalkNI. The route offers walkers access to many of the most scenically impressive parts of Northern Ireland. It comprises a combination of ‘quality sections’ and ‘link sections’. Quality sections are those which are promoted for their scenic quality and walking experience. Link sections are parts of the circuit where the use of public transport is actively promoted as the route is mostly on public roads, which can be very busy. Quality sections are waymarked, whereas link sections are not.

- 14.5.3 There are two sections of the Ulster Way which would be affected by the Proposed Scheme. The first is the Lough Bradan to Gortin (quality section), where it descends from the crest of Bessy Bell and crosses the Strule Valley south of Newtownstewart before continuing east to the Sperrin Hills and Gortin Glen Forest Park. The footpath users are currently required to cross the existing A5 at grade where conflict can occur with vehicular traffic. The second comprises the Scarva to Aughnacloy link section as it approaches Aughnacloy from the east, initially along a farm track and then via a number of local roads in the Blackwater Valley.

Long distance cycle routes

- 14.5.4 Some 1000 miles of National Cycle Route (NCR) make up the current National Cycle Network in Northern Ireland. Developed by Sustrans and promoted by CycleNI, these routes comprise combinations of on-road and traffic-free sections which provide for recreational cyclists of all ages and aptitudes seeking access to the countryside. Parts of three designated routes would be affected by the Proposed Scheme; NCR 92, 93 and 95.
- 14.5.5 NCR 92 extends from Londonderry to Enniskillen. There are two locations where the NCR would be affected by the Proposed Scheme. The first is where the NCR is routed along the A38 as it crosses the River Foyle between Lifford and Strabane (Figure 14.1, Inset 1) and continues through Strabane town centre before running south along the lower eastern valley slopes of the Mourne River and River Strule as far as Newtownstewart. The second is south of Omagh where it follows a well-defined arc south and west of the town, crossing the existing A5 and Proposed Scheme at Doogary, before continuing in a south-westerly direction towards Fintona (Figure 14.1, Inset 5). The section of the NCR between Strabane and Enniskillen also forms part of the North West Trail, a 326km circular cycle route through the counties of Donegal, Tyrone, Fermanagh, Leitrim and Sligo.
- 14.5.6 National Cycle Route 93 runs from Larne, generally along the coast as far as Castlerock, and then inland via Claudy and Limavady to Londonderry. The part of the NCR which would be affected by the Proposed Scheme is located where it approaches New Buildings from the north along the traffic-free margin of the River Foyle, and crosses the existing A5 to pass through the settlement before progressing south along the B48.
- 14.5.7 National Cycle Route 95 runs north from Tynan towards Lough Neagh before returning east via Cookstown, Gortin and Newtownstewart to Pettigoe. In the vicinity of the Proposed Scheme it runs from Gortin, west along the southern valley slopes of the Owenkillew Valley, and across the River Strule at Moyle Bridge to Newtownstewart. West of Newtownstewart the NCR is routed through Deer Park, passing south of Harry Avery's Castle along Oldcastle Road and through Baronscourt Forest.

14.5.8 Sperrins Cycle Route 6: The Derg Valley (SCR6), promoted by CycleNI, offers the cyclist a 30-mile round trip from Newtownstewart (Figure 14.1). It follows the lower eastern slopes of the Strule Valley as far as Sion Mills, before climbing the western slopes of the valley to the south-west of the town along Garden Road and Peacock Road. It descends into Castlederg and then returns along the southern slopes of the Derg River valley, where it joins NCR 95 at Castlebane Road, and follows the national route through the Barronscourt Estate before descending into Newtownstewart. There are two locations where SCR6 and the Proposed Scheme cross. The first is where SCR6 is routed along Bells Park Road as it climbs out of Sion Mills and onto the western slopes of the Mourne River valley. The second is coincident with NCR 95 as it descends towards Newtownstewart and passes Harry Avery's Castle along Oldcastle Road.

Motorised users

Scenic Driving Routes (SDR)

14.5.9 Two scenic driving routes (SDRs) promoted by Discover Northern Ireland would be affected by the Proposed Scheme; the Central Sperrins Scenic Driving Route and the South Sperrins Scenic Driving Route.

14.5.10 The Central Sperrins SDR comprises a 90-mile circuit through the central Sperrin Hills taking in Strabane, Sion Mills, Newtownstewart, Gortin, Carrickmore, Creggan, the Glenelly Valley and Donemana. The western sections of the SDR utilise the existing A5 from its junction with the B49 north of Strabane, through Strabane and the valleys of the Mourne River and River Strule as far as Newtownstewart

14.5.11 The South Sperrins SDR comprises a 64-mile drive. The route takes in Omagh, Gortin Glen Forest, the Owenkillew Valley and the Strule Valley south of Newtownstewart, Bessy Bell, the Barronscourt Estate, the Derg Valley, Castlederg, Drumquin and Pigeon Top. There are four locations where the SDR and Proposed Scheme would cross:

- on Castletown Road south of Newtownstewart (Figure 14.6);
- on McCormacks Road as it descends from Castletown Road to the A5 Beltany Road - this location is coincident with the Ulster Way referred to in 14.5.3 above (Figure 14.6);
- on Dunteige Road / Cashty Road west of Mountjoy (Figure 14.7); and
- on the A32 as it approaches Omagh from the south-west (Figure 14.8).

Public Rights of Way (PRoW)

- 14.5.12 There is one section of footpath between the crest of Bessy Bell and the River Strule at Beltany, which coincides with the route of the Ulster Way and which is scheduled as a PRoW by Omagh District Council.
- 14.5.13 Strabane District Council has also purchased and is promoting the development of a 3-mile section of the disused Strabane Canal, with a view to developing it as a publicly available walk (Figures 14.3-14.4). There are no current plans, however, to designate this route as a PRoW under the Access to the Countryside (Northern Ireland) Order 1983. To encourage the use of the footpath facility, Strabane District Council has provided a number of parking lay-bys along Park Road.
- 14.5.14 The Council has also indicated there are two undesignated walks which the public currently use to access the eastern margins of the Rivers Foyle and Finn. The first comprises a circular riverside walk with access off Lifford Road to existing jetties on the eastern bank of the River Foyle (Figure 14.4). The second comprises a walk from the junction of Urney Road and Finn View in Strabane, along Finn View and the crest of the flood defences following the eastern and southern banks of the River Finn and Mourne River. It returns along the west side of the existing A5 before crossing to Bradley Way at the roundabout between the existing A5 and Bradley Way.

Local roads

- 14.5.15 The local road network provides for access within the larger towns and villages and between the dispersed rural populations within the countryside surrounding the larger settlements and essential commercial, retail and communal facilities generally located within the larger settlements.
- 14.5.16 The principal commercial and retail centres relied on by local communities are in Londonderry, Strabane, Lifford, Omagh and Aughnacloy. There are also established commercial and retail facilities at many other settlements along the route.
- 14.5.17 The extent of the local road network and location of the principal settlements and facilities used by local communities relative to the Proposed Scheme is shown in Figures 14.2 – 14.14.
- 14.5.18 Hospitals, GP surgeries, dental practices, pharmacies and opticians are located in the following settlements with access for residents living outside of the settlements being either by car, local bus services or taxi:
- New Buildings
 - Strabane
 - Sion Mills
 - Newtown Stewart
 - Omagh
 - Ballygawley

- Aughnacloy

14.5.19 Colleges, high schools, primary schools and libraries are located within the following settlements:

- | | |
|-------------------|---------------|
| • New Buildings | • Gillygooley |
| • Bready | • Omagh |
| • Strabane | • Seskinore |
| • Lifford | • Gortaclare |
| • Cloghor | • Eskragh |
| • Artigarvan | • Garvaghy |
| • Glebe | • Roscavey |
| • Sion Mills | • Seskilgreen |
| • Victoria Bridge | • Ballygawley |
| • Ardstraw | • Aughnacloy. |
| • Newtownstewart | |

14.5.20 The catchments for the colleges and high schools include the settlements within which they are located, and the many smaller settlements and dispersed communities in the rural areas surrounding them. The catchments related to the primary schools outside of the larger towns and villages, are generally more local to the small settlements within which they are located.

14.5.21 Roads within the local network which form part of established school bus routes include: Cloghboy Road, Peacock Road, Donaghedy Road, Orchard Road, Drumlegagh Road North, Drumlegagh Road South, Drumconnelly Road, Moylagh Road, Greenmount Road, Springhill Road, Rockmore Road and Tullyrush Road.

14.5.22 There are also a number of public bus services providing for journeys between the settlements.

14.5.23 There are cycle ways located at New Buildings, Strabane through-pass and along the existing A5 at Drumconnelly Road. Sections of the affected roads with pedestrian footpaths are located on parts of the existing A5, Cloghboy Road, Woodend Road and Melmount Road.

14.5.24 There are a number of sports and leisure facilities, which are predominantly associated with settlements as indicated below:

- New Buildings (golf course);
- Burdennett (cricket club);
- Ballymagorry (cricket club);

- Strabane (cricket club, golf course, sports pitches, sports club);
- Sion Mills (golf course, bowling, cricket ground, playing fields);
- Newtownstewart (sports pitches, playing fields);
- Mountjoy (playing fields);
- Omagh (golf courses, sports pitches, sports clubs);
- Garvaghy (Gaelic Athletics Association facilities);
- Ballygawley (sports pitches); and
- Auchnacloy (golf course, sports pitches).

14.5.25 CanoeNI promotes a 53km River Foyle canoe trail extending from Lifford to the mouth of the river. River access points and parking are provided along the trail (Figure 14.2 – 14.14).

Driver stress

14.5.26 Current users of the existing A5 are subject to levels of driver stress ranging from moderate within the inter-settlement sections to high where the road passes through the larger settlements. Outside of the settlements, frequent side roads and private accesses onto the road and limited overtaking opportunities, lead to frustration and fear. Within settlements, where side roads and private accesses increase in frequency and there are larger numbers of vulnerable and unpredictable pedestrians, frustration and fear increases.

14.6 Predicted impacts and mitigation

NMUs

The Ulster Way

14.6.1 The Proposed Scheme would cross the existing alignment of the Ulster Way at two locations; at Beltany in the Strule Valley and south east of Auchnacloy.

14.6.2 Provision has been made for continuation of the quality section of the long distance route at Beltany by way of a proposed realignment of McCormacks Road to the north of its existing alignment, The realignment, which is illustrated in Figure 14.1(Inset 4) would pass beneath the Proposed Scheme via a new underpass. There would be a nominal increase in the length of the section, an improvement in visibility along the short section of the route affected and localised impact on the amenity value for users of the route by virtue of the presence of the road and its traffic. Taking into account the small-scale impact on the national route, its objectives relative to users and the current impact on amenity by virtue of the proximity of the affected part of the quality section to the existing A5 and its traffic, these localised impacts are ones which would not be significant relative to accessibility, amenity value or purpose of the Ulster Way. There

would be the potential for temporary disruption to users of the route during construction. There would, however, be a requirement for the contractors to provide for safe access across the construction corridor, pending completion of the works in this location.

- 14.6.3 There are no proposals to cater for a crossing beneath or over the Proposed Scheme where it crosses the linking section of the Ulster Way south-east of Aughnacloy. Users of this section of the national route are required to travel along Rehagh Road to the north or the A28 to the south to re-join the Ulster Way on Glencrew Road. In the context of the purpose of the route and the status of this part of the national route as a linking section, which involves the use of significant sections of local road and along which the use of public transport is positively promoted by WalkNI, the impact on users would be slight adverse.

Long distance cycle routes

- 14.6.4 The Proposed Scheme would have an impact at five locations along established National Cycle Routes. These comprise:
- NCR 93 at the northern limit of New Buildings where it crosses the existing A5 and the northern terminal roundabout for the Proposed Scheme would be located;
 - NCR 92 where it is routed along the A38 between Lifford and Strabane where the proposed grade-separated junction north of the River Mourne is located;
 - between Glebe and Sion Mills where the Proposed Scheme would cross Sperrins Cycle Route 6 as it is routed along Bells Park Road;
 - NCR 95 to the west of Newtownstewart; and
 - NCR 92 immediately west of where it crosses the existing A5 at Doogary.
- 14.6.5 In all instances, provision has been made for the roads which form part of the cycle routes at these locations to cross beneath or over the Proposed Scheme. There would be the potential for temporary disruption to users of the routes during construction, though there would be a requirement for the contractors to provide for safe access across the construction corridor, pending completion of construction. Once these are open to use, there would be no discernible impact related to accessibility along the routes.
- 14.6.6 The introduction of a dual carriageway with its associated traffic at the five locations would not constitute a significant impact on the amenity value of the routes as a recreational resource. These are long-distance routes where the influence of traffic on the dual carriageway would be brief in the context of the cyclist's journey.

Public Rights of Way

- 14.6.7 Other than for the PRow between Beltany and the crest of Bessy Bell, which coincides with, and has been described in the context of the Ulster Way, the Proposed Scheme would not cross or sever any PRow asserted in accordance with the provisions of The Access to the Countryside (Northern Ireland) Order 1983.
- 14.6.8 The Proposed Scheme would not prevent access to the Strabane Canal as a footpath available to the public or prevent the use of the car parking lay-by along Park Road. Access to Park Road would be catered for via a bridge on the existing alignment and via Junction 3 & 4. Continued access to the Strabane Canal along Greenlaw Road would be available via an underpass on Park Road and NMUs would be able to use a footpath linking Park Road to Greenlaw Road. Access via Spruce Road would be stopped up and access provided for vehicle users via Junction 3 across the A5.
- 14.6.9 There would be no severance of access to the River Foyle canoe trail and its associated facilities.

Motorised users

Scenic Driving Routes (SDR)

- 14.6.10 Where the Proposed Scheme crosses the South Sperrins SDR, provision has been made for the roads which form part of the routes at these four locations to cross beneath or over the Proposed Scheme. There would be the potential for temporary disruption to users of the routes during construction, though there would be a requirement for the contractors to provide for safe access across the construction corridor pending completion. Once these are open to use, there would be no discernible impact related to accessibility along the routes.
- 14.6.11 The introduction of a dual carriageway with its associated traffic at the four locations would not constitute a significant impact on the amenity value of the routes as a recreational resource. These are long-distance routes where the influence of traffic on the dual carriageway would be brief in the context of the motorist's journey.

Local roads

- 14.6.12 The Proposed Scheme would cross roads within the local road network in approximately 100 locations. In most instances continued access is provided for by the introduction of a bridge beneath or over the Proposed Scheme or by localised realignment of the local road to a bridge over or beneath the Proposed Scheme. In 17 instances the local road would be stopped up without provision for realignment or introduction of new linking roads. Details of the measures proposed at each location are provided in Appendix 14A. In most cases there would be a negligible increase in journey length, and hence journey time, such that there would be no material impact as

a result of severance for users of these routes. In 13 instances it has been concluded the impact would be slight adverse and in 9 instances moderate adverse. These nine locations are at Spruce Road, Park Road, Peacock Road, Milltown Road, Drumlegagh Road, Drumlegagh Road South, Todds Road, Seskinore and Cormore Road.

- 14.6.13 The distance for users of Spruce Road seeking access to Woodend Road would increase by some 500m, Drivers would also be required to negotiate 3 new roundabouts through junction 3.
- 14.6.14 Drivers seeking access between Park Road and the existing A5 would be required to negotiate 3 new roundabouts.
- 14.6.15 The distance for drivers seeking access between Peacock Road and the existing A5 Melmount Road would increase by some 570m.
- 14.6.16 The distance for drivers seeking access east to west and west to east along Milltown Road would increase by some 2100m. Drivers would also be required to negotiate 2 roundabouts through Junction 11.
- 14.6.17 The distance for drivers seeking access along Drumlegagh Road would increase by some 200m. Drivers would also be required to negotiate 2 new roundabouts through Junction 10.
- 14.6.18 The distance for drivers seeking access between Drumlegagh Road South and the existing A5 would increase by some 500m. Drivers would also be required to negotiate 2 new roundabouts through Junction 11.
- 14.6.19 The distance for drivers seeking access between Todds Road and the existing A5 would increase by some 650m. Drivers would also be required to negotiate 2 new roundabouts through Junction 11.
- 14.6.20 The distance for drivers seeking access between Seskinore Road and the existing A5 would increase by 40m. Drivers would also be required to negotiate 3 new roundabouts through Junction 13.
- 14.6.21 The distance for drivers seeking access between Cormore Road and Tullanfoille Road would increase by some 1300m.
- 14.6.22 Displacement of a large part of the traffic from the existing A5 to the Proposed Scheme would have the effect of reducing severance within existing communities and along rural sections of the existing road which link communities. Table 14.5 schedules the predicted relief from severance along the specified sections of the existing A5 based on changes in traffic flows in 2028, the anticipated year for the fully completed scheme would be open to use.

Table 14.5 : Relief from severance on the existing A5

Location	Built up / Rural	AADT 2028 (DM)	AADT 2028 (DS)	% Reduction in traffic	Impact rating
New Buildings	Built Up	16908	9904	41%	Moderate
New Buildings to Ballymagorry	Rural	15509	2498	84%	Moderate
Ballymagorry to Strabane	Rural	16418	6345	61%	Slight
Strabane	Built Up	20746	10756	48%	Moderate
Strabane to Sion Mills	Built Up	18835	7615	60%	Substantial
Sion Mills to Victoria Bridge	Built Up	12244	2655	78%	Substantial
Victoria Bridge to Newtown Stewart	Rural	12246	2880	76%	Moderate
Newtown Stewart to Omagh	Rural	13839	5494	60%	Slight
North Omagh	Built Up	24365	18495	24%	Slight
South Omagh	Built Up	26883	19568	27%	Slight
Omagh to Junction of the B46	Rural	16877	8144	52%	Slight
A5/B46 Junction to A5/A4 Junction	Rural	14464	5463	62%	Slight
A5/A4 Junction to Lissenderry	Rural	24916	11121	55%	Slight
Lissenderry to Aughnacloy	Built Up	9243	6255	32%	Moderate

Driver stress

- 14.6.23 The findings of the assessment of driver stress are presented in Tables 14.6. The table provides a comparison between the predicted stress levels for users of the existing A5 should the Proposed Scheme not be implemented and users of the Proposed Scheme assuming it is implemented. The findings indicate levels of driver stress would remain

moderate to high for most sections of the existing A5, whereas levels for the Proposed Scheme would be low other than at New Buildings where the level would be moderate.

Table 14.6 Driver Stress

Road Section	Location	Driver Stress Do-Minimum 2041 (Existing A5)			Driver Stress Do Something 2030 (Proposed Scheme)		
		Average Peak Hourly flow units*	Speed km/hr	Stress level	Average Peak Hourly flow units*	Speed km/hr	Stress level
J1 - J2	New Buildings	757	45	High	797	66	Moderate
J2 - J3	New Buildings to Ballymagorry	679	72	Moderate	762	102	Low
J3 - J4	Ballymagorry to Strabane	674	54	Moderate	677	102	Low
J4 - J8	Strabane/Sion Mills	845	57	High	966	98	Low
J8 - J9	Sion Mills to Victoria Bridge	589	65	Moderate	973	102	Low
J9 - J10	Victoria Bridge to Newtownstewart	578	80	Low	812	103	Low
J10 - J11	Newtownstewart to Omagh	634	81	Moderate	752	103	Low
J11 - J12	North Omagh	1023	56	High	622	103	Low
J12 - J13	South Omagh	1117	48	High	681	103	Low
J13 - J14	Omagh to Junction of the B46	693	80	Moderate	843	103	Low
J14 - J15	A5/B46 Junction to A5/A4	712	79	Moderate	775	103	Low

Road Section	Location	Driver Stress Do-Minimum 2041 (Existing A5)			Driver Stress Do Something 2030 (Proposed Scheme)		
		Average Peak Hourly flow units*	Speed km/hr	Stress level	Average Peak Hourly flow units*	Speed km/hr	Stress level
	Junction						
J15 - J16	A5/A4 Junction to Lissenderry	427	80	Low	292	100	Low
J16 - J17	Lissenderry to Aughnacloy	381	53	Moderate	209	100	Low

* one way flow units and speeds are similar in both directions and therefore average flows and speeds for both directions have been used to categorise predicted driver stress levels.

14.6.24 In light of the findings of the assessments it has been concluded there is no need for mitigation relative to new severance or driver stress other than during construction when the contractor(s) would be required to provide continued access or localised temporary diversions along all local roads pending completion of the works.

14.7 Conclusions and effects

14.7.1 The assessments related to all travellers have demonstrated:

- new severance resulting from the implementation of the Proposed Scheme would not be significant relative to the EIA Directive and Regulations;
- relief of severance resulting from the implementation of the Proposed Scheme would not be significant relative to the EIA Directive and Regulations; and
- changes in levels of driver stress resulting from the implementation of the Proposed Scheme would not be significant relative to the EIA Directive and Regulations.

15 COMMUNITY AND PRIVATE ASSETS

15.1 Executive summary

- 15.1.1 The assessment has focussed on the impacts on private property, land used by the community, development land, on individual farms and agricultural land as a regional and national resource.
- 15.1.2 Approximately 1150 hectares of land would be required for the construction of the Proposed Scheme. The demolition of 8 properties would be required. The Proposed Scheme would also have a direct impact on 7 commercial properties and 3 community assets including a recycling centre, rugby club and nature reserve. An additional 41 residential properties would be affected with the impacts relating to loss of garden, although the dwellings themselves would not be directly affected.
- 15.1.3 The Proposed Scheme route runs primarily through agricultural land. In total, approximately 698ha of higher grade land would be required to construct the Proposed Scheme. The loss of higher grade agricultural land would result in a slight adverse impact at a Northern Ireland and County Derry level given that a small fraction of this resource being affected. Impacts in County Tyrone would be moderately adverse given the proposed loss and scarcity of this resource in the county as a whole. A slight adverse impact would be experienced by 185 farms, 70 farms would experience a moderately adverse impact and 59 farms would experience a high adverse impact as a result of the Proposed Scheme.

15.2 Scope of the assessments

- 15.2.1 The assessments have been focussed on:
- effects associated with private land take and demolition of private property;
 - effects on agricultural land quality;
 - effects on individual farms;
 - effects on land used by the community; and
 - effects on development land.

Demolition of non-agricultural property and land take of non-agricultural land

- 15.2.2 The assessments have investigated impacts and their consequent effects on residential, commercial and industrial land uses which would be affected by the loss of property or land as a result of the inclusion within the Vesting Order for the Proposed Scheme. The study area for the assessments comprises land which has been included within the Vesting Order and would be taken to facilitate implementation of the

Proposed Scheme and land adjoining the land take boundary which constitutes part of a land use within the boundary.

Agricultural land quality

- 15.2.3 The assessment has investigated the extent to which the land take for the Proposed Scheme would involve the loss of agricultural land, classified according to its agricultural capability by the Department of Agriculture and Rural Development (DARD) and Agri-Food & Biosciences Institute (AFBI).

Farms

- 15.2.4 The assessment has investigated the extent to which impacts associated with land take and severance would be likely to affect the future operational efficiency of farms located along the alignment of the Proposed Scheme and of farms located remotely from the alignment but with land use interests within farms on the alignment, established by way of land taken in conacre.

Land used by the community

- 15.2.5 The assessments have investigated impacts and their consequent effects on sites and / or areas which are focused on providing facilities for communal use and which would be affected by the loss of property or land as a result of the inclusion of either or both within the proposed Vesting Order. The study area for the assessments comprises land which would be taken to facilitate implementation of the Proposed Scheme and land adjoining the land take boundary which constitutes part of a land use within the boundary.

Development land

- 15.2.6 Development land has been defined, for the purposes of the assessment, as areas of land for which planning applications have been approved but where construction is in its early stages or has not yet commenced. Areas of land which have been identified for potential future development in saved local development plan documentation, and which may be impacted by the Proposed Scheme, have also been identified.

15.3 Methods of assessment

- 15.3.1 The methods of assessment have been informed by the guidance detailed in the DMRB Volume 11, Section 3, Part 6 Land Use (Incorporating Amendment No.1 dated August 2001).

Private land take and demolition of private property

- 15.3.2 The assessment has involved:

- identification of residential, commercial and industrial property and land which would be temporarily or permanently taken to facilitate implementation of the Proposed Scheme;
- quantification of land take relative to the identified uses and description of the function of the land which would be taken in the context of the current use, taking into account amenity value where appropriate; and
- evaluation of the order of impact based on the ratings described in Table 15.1.

15.3.3 The assessment has included consideration of land which is known to have turbary rights for peat extraction. Information obtained from Land Registry records from Land and Property Services and landowner meetings demonstrated that no such land would be taken to enable the Proposed Scheme to be implemented.

Table 15.1 Impact ratings – private assets and property

Impact Rating	Criteria
Negligible	<ul style="list-style-type: none"> • a barely discernable impact on use or amenity value.
Slight adverse	<ul style="list-style-type: none"> • land take peripheral to existing or intended use; • activity that temporarily compromises or precludes use; and • loss of amenity that does not compromise use.
Moderate adverse	<ul style="list-style-type: none"> • land take that compromises but does not preclude existing or intended use; • activity that compromises or precludes use for a protracted period; and • loss of amenity that compromises but does not preclude use.
Substantial adverse	<ul style="list-style-type: none"> • land take that precludes existing or intended use; • activity that permanently compromises or precludes use; and • loss of amenity that precludes use.

Agricultural land quality

15.3.4 The assessment has involved:

- identification of the agricultural land capability of the agricultural areas through which the Proposed Scheme is aligned for the six grades (1, 2, 3a, 3b, 4a, 4b and 5) adopted by DARD under the agricultural land classification for Northern Ireland; and
- quantification of the total land take for each of the seven agricultural land classification grades.

15.3.5 Evaluation of the significance of the loss of agricultural land as an important resource has involved comparison of the combined total of grades 1, 2 and 3a land that would be taken for the implementation of the Proposed Scheme with the combined totals for

the three grades within Counties Derry / Londonderry and Tyrone and within Northern Ireland as a whole.

Farms

15.3.6 The assessment has involved:

- identification of farms (and land taken/let in conacre) which would be affected by the loss of land and / or severance by virtue of the implementation of the Proposed Scheme;
- collection of data relevant to the status of the identified farms with reference to the total area of land farmed, types of husbandry adopted, and current management regimes;
- quantification and description of the likely impacts focused on land take and severance;
- identification of proposed mitigation measures in light of the impacts; and
- evaluation of the predicted impacts taking mitigation into account.

Identification of farms

15.3.7 The identification of farms has involved:

- reference to information relating to affected farms provided in the A5WTC ES 2010;
- verification and updating of information relating to farms and ownership by way of correspondence with previously identified owners, further landowner meetings and reference to the land registry; and
- identification of land relating to farms which would be affected which is subject to conacre and of the location of the farms beyond the road corridor with an interest in the conacre land.

Collection of data relevant to the status of the identified farms

15.3.8 The collection of data has involved initial correspondence in August 2013 with owners of farms identified and assessed in the A5WTC ES 2010, the objective being to identify if the data which was originally obtained remained valid or if it should be updated. Correspondence was sent to 208 owners. Responses were received from 57.

15.3.9 Owners who did not respond to the initial correspondence were written to again in November 2013. Owners were informed it was being assumed the data collected in 2008 and 2009 and issued with the correspondence in August 2013 did not need to be amended, but if that was not the case, further relevant information would be welcomed to enable the baseline data for their farm to be updated. Correspondence was sent to

140 owners who had not responded to the August letter. Responses were received from 2.

15.3.10 A further request for information relating to farms was undertaken as part of an overarching request for meetings with all landowners with land located within the proposed Vesting Order. Meetings were held between May and July 2014. A total of 198 owners of farms agreed to a meeting.

15.3.11 Once the landowners had been given opportunities to provide feedback, a screening exercise was undertaken to determine which landowners should be revisited to allow for further discussions about their farm. The screening criteria for revisiting landowners was:

- where the scheme design had changed since the 2010 ES in a manner which would affect large areas of additional land or change severance;
- where feedback from correspondence identified a change in information;
- where conacre interest of affected land was identified; and
- where the landowner specifically requested a re-assessment.

15.3.12 No revisit was deemed necessary where the scheme only affected a small area of land and did not result in severance.

15.3.13 A total of 138 farms were identified during the screening. The relevant farm owners were either contacted by phone or letter with a view to arranging a meeting. Meetings were held with 104 landowners, 11 landowners could not be contacted and 23 landowners declined the offer of a revisit.

15.3.14 In instances where information has not been made available by owners during the preparation of the A5WTC ES 2010 or in response to the correspondence in 2013 and / or meetings in 2014 the information has been limited to a desk-based assessment of land take and severance on the land parcel only.

15.3.15 Where correspondence has been exchanged and / or meetings have been held, the data collected has included the:

- total area of the farm;
- types of husbandry practiced;
- numbers of livestock supported;
- position of farmyard relative to farm layout, access to lands and frequency of movements and infrastructure relating to water, power supply and drainage;
- arrangements relating to the day-to-day management of the farm, including any conacre taken; and

- information relating to Single Farm Payments, the Less Favoured Area Compensatory Allowance Scheme and the Nitrates Directive.

Quantification and description of the likely impacts

15.3.16 The identification of impacts has involved:

- quantification of the total land take relative to the area farmed with a breakdown relating to differing husbandry types and management arrangements including conacre;
- quantification of impacts on access arrangements in terms of increased distance, time and likely frequency of movements where existing arrangements would be severed by the Proposed Scheme; and
- description and quantification relating to the extent and timescales, where relevant, of disruption to infrastructure in the form of water and power supply and drainage.

15.3.17 Impact ratings for the farms included in the assessment have been based on the criteria described in Table 15-2.

Table 15.2: Impact ratings

Rating	Description
Minor adverse	<ul style="list-style-type: none"> • An inconsequential land take or minimal loss of agricultural production, relative to overall scale of the farm. • Insignificant disruption to the present farm management routine. • Insignificant impact on present farm output. • Little or no impact, since the land is not currently used for agricultural production purposes. • Little or no impact on overall farm viability.
Moderate Adverse	<ul style="list-style-type: none"> • Small to moderate land take relative to overall scale of the farm. • Small to moderate severance or disruption to the present farm management routine. • Small to moderate impact on present farm output, arising from additional inputs associated with farming retained lands. • Moderate impact on farm viability.
Substantial Adverse	<ul style="list-style-type: none"> • A substantial area of the land constituting the farm would be taken by the Proposed Scheme. • Substantial disruption of the present day to day management routine. • Significant impact on overall farm viability. • Significant impact on farm output, arising from additional inputs associated with farming retained lands.

Community land

15.3.18 The assessment has involved:

- identification of land currently used by the community which would be required for the construction of the Proposed Scheme;
- analysis of the extent to which the Proposed Scheme would sever or fragment areas of land used by the community, or where the proximity of the Proposed Scheme would have a potential impact on its current and continued use;
- description of impacts related to the proximity of the Proposed Scheme to an existing community land use where the amenity value of the environmental context is integral to the use;
- evaluation of the Proposed Scheme to establish the potential impact on land used by the community and identify appropriate design and mitigation measures; and
- assessment of the significance of the identified impacts taking mitigation into account.

15.3.19 Land used by the community has been identified from a review of relevant policy documents and the Northern Ireland Neighbourhood Information Service (NINIS).

15.3.20 Impacts have been described, taking into account the evaluation outlined above, and impact ratings have been attributed to each area of community land that would be affected based on the criteria presented in Table 15.1.

Development land

15.3.21 The assessment of the effects on development land has involved:

- a review of development plan documentation and local planning registers to identify and quantify development land and its intended future use within the Proposed Scheme footprint;
- a preliminary screening exercise to screen out planning applications that would not be directly affected by the Proposed Scheme;
- an analysis of the extent to which the Proposed Scheme would sever or fragment areas of development land; and
- identification of the potential impacts on development land.

15.3.22 The identification of development land has involved a review of relevant local policy, the planning registers and consultation with the Northern Ireland Planning Portal. Reference has been made to the Derry Area Plan 2011, Dungannon and South Tyrone Area Plan 2010, Omagh Area Plan 1987-2002 and Strabane Area Plan 1986-2001.

15.3.23 The evaluation of the significance of impacts on development land has been informed by an analysis of the proportion of land that would be taken in the context of the overall extent of each area. Consideration has also been given to the type of land use

proposed, the effect of the Proposed Scheme on access arrangements and potential compatibility or conflict with the presence of the Proposed Scheme.

15.3.24 An initial screening assessment was carried out on all of the approved planning applications within the fence line of the Proposed Scheme. All applications approved in the last five years were considered. Planning applications that met the following criteria were screened out of the assessment:

- applications to make minor alterations to an existing structure including loft conversions, small extensions or a change in signage;
- applications for developments to replace existing structures on a like-for-like basis; and
- applications for developments that would not be affected by the Proposed Scheme due to the type of development including overhead power lines and utilities (refer to Chapter 6 for further information).

15.3.25 Impact ratings have been attributed to each area of development land that would be affected based on the criteria described in Table 15.1.

15.4 Baseline environment

Private land and property

15.4.1 Figures 15.1 – 15.3 in Volume 2 show land use within the Proposed Corridor.

Residential development.

15.4.2 Concentrated areas of residential development associated with the assessment study area comprise:

- New Buildings where the proposed northern terminal roundabout would be located on the line of the existing A5;
- Strabane, where the route would run along the western margins of the rivers Foyle and Finn; and
- Glebe and Sion Mills where the Proposed Scheme would be aligned between these two closely located settlements.

15.4.3 Groups of houses within smaller villages and townland settlements are located at Magheramason, Bready, Moylagh and Newtonsaville. Outside of the towns, villages and townland settlements, individual houses and farmsteads are dispersed across the countryside through which the Proposed Scheme would be aligned.

Commercial and industrial development

15.4.4 There are seven commercial and industrial developments located along the Proposed Scheme. These are outlined in Table 15.3 below.

Table 15.3: Commercial and industrial facilities

Building Type	Facility Reference on Figures	Approximate Chainage	Land Parcel Reference	Description
Commercial builders store	CP 1	16400	59105	Used to store materials for a small building company
Commercial property (garage & car breakdown business)	CP 2	17000	58065	Forms part of a garage and car breakdown service centred around the garage.
Concrete works	CP 3	20800	66015	Concrete works. The facility is made up of facilities for the manufacture of concrete products and storage yard and a permitted development for an extension to the storage area (J/2009/0354/F).
Training centre	CP 4	21100	71020	The site is used as a training centre for plant and machinery operators.
Storage yard	CP 5	70600	246045	An area used as a store area for machinery and trailers.
Mineral extraction	CP 6	33600	100015, 100085	Sand and gravel quarry. Some areas of extraction are due to revert to agricultural land once mineral extraction has been completed and areas which are currently agricultural land would be used for quarrying.
Mineral extraction	CP 7	33500	100070	Sand and gravel quarry. Some areas of extraction are due to revert to agricultural land once mineral extraction has been completed and areas which are currently agricultural land would be used for quarrying.

Agricultural land quality

15.4.5 The extent and distribution of each of the grades of agricultural land capability within the study area is shown in Figures 15.21 – 15.26.

- 15.4.6 There are no areas of Grade 1 or 5 land. Some 13% (143ha) of the study area comprises Grade 2 land, 50% (555ha) Grade 3A land, 23% (266ha) Grade 3B land 1% (7ha) Grade 4A land and 13 % (148ha) Grade 4B land.
- 15.4.7 Land allocated to each grade is scattered along the scheme length as illustrated in Figures 15.21 to 15.26. The different land quality forms contrasting mosaics along the route with high grade and low grade in close proximity. Though found in areas along the entire route, low grade land is often associated with the urban fringe of settlements and large areas to the west of Ballymagorry, north-west of Omagh and east of Aughnacloy. Higher grade land is found along the length of the scheme with larger areas located south of Omagh, south-west of Strabane and north of Strabane to New Buildings.

Farms

- 15.4.8 The majority of farms which would be affected by the Proposed Scheme are used for livestock, particularly beef and dairy. Other livestock businesses within the study area include poultry, pigs, sheep and horses. Almost all of the farms have a mix of livestock plus areas allocated for silage or other crops to be used on the farm. Only a very small number of the farms are arable.
- 15.4.9 The size of farms range from approximately 800ha to 2ha, the average being approximately 60ha.
- 15.4.10 Information specific to the current status of each farm is provided in the data sheets presented in Appendix 15A. Appendix 15B supports this document to provide definitions of the agricultural terminology.

Community land

- 15.4.11 There are three areas of land within the land take for the Proposed Scheme that are currently in community use. These are listed in Table 15.4.

Table 15.4 Affected Community Land

Site	Facility reference	Approximate chainage	Type and amount of use	Land parcel reference
Public Amenity Woodland	CF 1	17500	Strabane Nature Reserve with public access.	58070
Recycling Centre	CF 2	20600	Waste transfer centre.	66085
Rugby club	CF 3	50100	Land owned by a local rugby club. Land take (0.12ha) is a wooded area outside the sports facilities.	157030

Development Land

- 15.4.12 There are 63 approved planning applications (up to September 2014) currently valid within the study area and are predominantly for the development of new housing. In addition to approved applications for housing, other approved planning applications in the study area include farm buildings and commercial units. The locations of all the approved planning applications within the study area are presented in Figures 15.25 – 15.27.
- 15.4.13 The Proposed Scheme would not affect any development land allocated in current local planning policies for Derry City Council, Strabane District Council or Dungannon & South Tyrone Borough Council.
- 15.4.14 Within the Omagh Area Plan 1987-2002 there are two areas affected by the Proposed Scheme. The first is an area of existing Recreation & Open Space (Policy 15.0) (Ch.50100), see CF 9. The second area (Facility reference on figures CF 10) (Ch.50900 - 51200) along Gillygooley Road is identified for recreational development purposes (Policy 34.1). An area of 12.8 hectares would be lost to the Proposed Scheme.

15.5 Predicted impacts and mitigation

Private land and property

- 15.5.1 The impacts on private land and property as a result of implementation of the Proposed Scheme are outlined in Table 15.5 below.

Table 15.5 Impacts on Private Land and Property

Building Type	Approximate Chainage	Land Reference	Parcel	Impact
Farmhouse dwelling	3300	15025		Dwelling demolished. Substantial adverse
Dwelling	11600	43115		Dwelling demolished. Substantial adverse
2 Dwellings & double garage	11600	4005		Dwellings demolished. Substantial adverse
Halting Site	17500	58145, 58170	58150,	Site within land take. Substantial adverse
Castletown House (flats)	19000	62075		Dwelling demolished. Substantial adverse
Dwelling	37300	112040		Dwelling demolished. Substantial adverse
Dwelling	37400	112015		Dwelling demolished. Substantial adverse

Building Type	Approximate Chainage	Land Parcel Reference	Impact
Dwelling	80000	305025	Dwelling demolished. Substantial adverse

- 15.5.2 Implementation of the Proposed Scheme would involve the demolition of 8 dwellings, loss of one halting site and impacts on 6 commercial buildings or associated infrastructure as listed in Table 15.5.
- 15.5.3 In addition, the construction of the Proposed Scheme would require land take from several residential land parcels, without the requirement to demolish the residential building. These include areas currently used for gardens and driveways. In total the Proposed Scheme would take land from 41 residential properties. In each of these cases the impact would range from slight to moderate. Please refer to Appendix 15E.
- 15.5.4 The halting site is an area designated in the Strabane Local Plan as a short term halting site for use by the travelling community and would be completely included in the Proposed Scheme land take. Strabane District Council is exploring potential replacement sites, however, no site has been identified or agreed to date. In the absence of an identified replacement site it has been concluded the impact would be substantial adverse.
- 15.5.5 Where the Proposed Scheme would involve land take on the boundary of private properties, boundaries would be reinstated as part of the accommodation works for the Proposed Scheme. Where existing access to properties or land would be severed, the proposals allow for new access.

Commercial and industrial development

- 15.5.6 Areas to the east of the Proposed Scheme are currently used for the processing of concrete (Table 15.4). Land take from the concrete works at Ch. 20800 would be approximately 0.45ha of a total area of 1.8ha (25%). The facility manufactures concrete products and the land affected by the vesting land take is used for the storage of the concrete products that are produced on the site. There would be a slight adverse impact on this facility from this land take as the area for storage would be reduced.
- 15.5.7 Extraction at the sand and gravel quarry at Ch. 33600 forms part of a larger sand and gravel extraction operation covering several land parcels. Operations across three parcels would be directly affected by the Proposed Scheme, 100010, 100015 and 110085. Approximately 12.5ha of land in the vicinity of the Proposed Scheme has been identified for mineral extraction, based on information from the NI planning portal. Impacts are considered to be moderate adverse due to 2ha of land, where extraction is being undertaken or planned, being required for the Proposed Scheme. This is approximately 16% of the land identified for gravel and sand extraction. The Proposed

Scheme would result in severance across Parcel 100015 and 100010 which would isolate 1.7ha to the west of the Proposed Scheme. Access would be allowed for across the realigned Derg Road. A moderate adverse impact would be experienced.

- 15.5.8 The quarrying operation in the adjacent Parcel 100070 is operated by a separate company and would result in the loss of approximately 1.2ha of the 11.8ha (10%) of land identified for mineral extraction. The scheme would not result in any severance to the parcel. A moderate adverse impact would be experienced.
- 15.5.9 The commercial building store at CH. 16400 would be demolished as a result of the Proposed Scheme. The commercial facilities cover an area of 0.32ha within a 6.5ha parcel. The existing facilities would be demolished, though the land owner would retain 3.56ha of land within the parcel. A substantial adverse impact is anticipated given the loss of facilities.
- 15.5.10 The commercial garage at Ch. 17000 would be demolished as a result of the Proposed Scheme. All the associated land around the facility would also be vested. A substantial adverse impact is anticipated.
- 15.5.11 The training centre at Ch. 21100 is used for the training of plant and machinery operators. The facility covers a 5ha area, 1.3ha of which would be vested (26%). The loss of land would likely require some modification of the facility layout as a result of the Proposed Scheme but would not preclude the use of the land as a training centre, therefore, a moderate adverse impact is anticipated.
- 15.5.12 The storage yard at Ch. 70600 is used to store machinery and equipment by the landowner. A total of 0.05ha would be vested out of 0.4ha (12%) of the storage yard. The land vested would be along the periphery of the yard and the main areas for storage would remain unaffected. The impact on the land use would be slight adverse.

Agricultural land capability

- 15.5.13 The total area of agricultural land required for the construction of the Proposed Scheme would be approximately 1,100ha. This is broken down according to the grades used in the Northern Ireland classification in Table 15.6. Some 698ha of the total would be either grade 2 or 3A, representing higher quality land (Figures 15.21-15.26).

Table 15.6 Agricultural land capability within the land take for the Proposed Scheme

Agricultural Land classification	Northern Ireland hectares	County Londonderry	County Tyrone
2	143 (0.14%)	5.6 (0.03%)	137.4 (0.59%)
3A	555 (0.16%)	2.5 (0.03%)	552.4 (0.75%)
3B	266 (0.07%)	13 (0.003%)	253 (0.31%)
4A	7 (0.00006%)	0	7 (0.04%)

Agricultural Land classification	Northern Ireland hectares	County Londonderry	County Tyrone
4B	148 (0.05%)	0	148 (0.14%)

- 15.5.14 Consultation was undertaken with DARD regarding the agricultural land classification resources in relation to the Proposed Scheme land take. The areas of higher grade (2, 3A) land that would be required for the Proposed Scheme within Northern Ireland and County Londonderry is a small percentage of the overall resource available in these regions. It has been concluded that there would be a slight adverse impact.
- 15.5.15 Higher grade agricultural land is a particularly scarce resource throughout County Tyrone. Higher grade agricultural land is in high demand in the region, particularly over winter for use as winter fodder when lower grade land becomes unsuitable. It has been concluded that a moderate adverse impact would result at a County Tyrone level.

Farms

- 15.5.16 The Proposed Scheme would affect 314 farms. The data sheets provided in Appendix 15A detail the findings specific to each farm. A summary of all impacts on the farms which have been subject to assessment is provided in Appendix 15C. It has been concluded 185 farms would be subject to slight adverse impact, 70 to moderate adverse impact and 59 to substantial adverse impact. Of those which would be subject to substantial adverse impact, it has been concluded four would be at risk of no longer being viable.
- 15.5.17 Accommodation works would be provided to maintain access (where economically viable), services and a secure boundary. These works would be agreed with the individual landowners prior to the construction phase. Similarly, access to severed land would be maintained during the construction phase.

Community land

- 15.5.18 The proposed alignment would affect three areas of land currently in community use as listed in Table 15.6 (Figures 15.1-15.3).
- 15.5.19 An area of 0.6ha of Strabane nature reserve at Ch. 17500 would be within the land take required for the construction of the Proposed Scheme. This equates to approximately 30% of the site. Access to the remaining area of the site would be maintained. The land take would compromise the site but not preclude its use. It has been concluded there would be a moderate adverse impact on this site.
- 15.5.20 The recycling facility at Ch.20600 (parcel 66085) would experience loss of an area of land along the periphery, however the operation of the facilities would not be affected.

The impacts on the local community is therefore considered slight adverse as waste management facilities would continue to be available to the local community.

- 15.5.21 The area of existing recreation & open space (Ch.50100) identified in the Omagh 1987-2002 local plan is land owned by a local rugby club. The land parcel area is 9.23ha in total of which approximately 6ha is used for sport facilities and pitches. The Proposed Scheme would affect 0.12ha, all of which is wooded and the sports facilities would not be affected. The impact is considered negligible.

Development land

- 15.5.22 The Proposed Scheme would require land take from 63 plots with approved planning applications. The impact of the Proposed Scheme on each of these consents has been assessed based on the type of development approved and the proportion of the land taken. Appendix 15D lists the planning applications, the development type and the impact rating and Figures 15.27 - 15.29.
- 15.5.23 With the Proposed Scheme in place, it would not be possible for development to proceed in line with the approved planning applications in 15 cases due to the land take requirements. In all cases the impact is considered to be substantial adverse. Development should still be able to proceed for a further 11 cases although the planned use is likely be compromised to some degree. In each of these cases the impact is considered to be moderate adverse. Slight adverse impacts are anticipated in 20 cases in which some amendments may be required to the planned development but they would not be substantially compromised by the Proposed Scheme. This is summarised in Table 15.7 below.

Table 15.7 Number of affected planning applications

Impact	Number of approved planning applications
Negligible impact	17
Slight adverse impact	20
Moderate adverse impact	11
Substantial adverse impact	15

- 15.5.24 All 15 planning applications that would experience a substantial adverse impact are applications for the erection or modifications to existing residential dwellings.
- 15.5.25 The land proposed for recreational development purposes in the Omagh Area Plan 1987-2002 (Ch. 50900 – 51200) would involve the loss of 12.8ha of a total area of 24.7ha. Future development of the remaining land would be possible but restricted to the eastern half of the policy area. A moderate adverse impact is anticipated as a result of the Proposed Scheme.

15.6 Conclusions and effects

Private land and property

- 15.6.1 The Proposed Scheme would result in the demolition of 8 dwellings and the loss of a halting site used by the travelling community. The loss of these dwellings would constitute a significant environmental effect.

Commercial and industrial development

- 15.6.2 The Proposed Scheme would affect 7 commercial and industrial facilities with impacts ranging from slight to moderate adverse. The impact on these facilities would not constitute a significant environmental effect.

Agricultural land

- 15.6.3 698ha of higher grade agricultural land would be required for construction of the Proposed Scheme. This includes 143 Grade 2 & 555ha of Grade 3A land under the agricultural land classifications. The loss of this land would not constitute a significant environmental effect.

Farms

- 15.6.4 The assessments have demonstrated that the Proposed Scheme would have a substantial impact on 59 farm holdings, a moderate impact on 69 and a slight impact on the remaining 186. This is considered to be a significant environmental effect.

Loss of land used by the community

- 15.6.5 The Proposed Scheme would impact upon the Strabane nature reserve, a local rugby club and a waste management facility. The impacts on these facilities would not constitute a significant environmental effect.

Development land

- 15.6.6 The assessment has identified that there would be 15 residential development sites subject to substantial adverse impacts where previously approved development would no longer be able to proceed. This would not constitute a significant environmental effect.

16 ROAD DRAINAGE AND THE WATER ENVIRONMENT

16.1 Executive summary

- 16.1.1 The assessment has applied a catchment-based approach, taking account of locations adjacent to and downstream of the scheme which could be impacted by the Proposed Scheme. The assessment has focused on the impacts of the construction and operation of the Proposed Scheme on surface water, groundwater and flood risk.
- 16.1.2 Implementation of mitigation measures during planning, design and construction would ensure that the Proposed Scheme has no more than a slight adverse impact on surface water and groundwater resources at the Water Framework Directive catchment and groundwater body level.
- 16.1.3 There would be some loss of storage capacity where the Proposed Scheme crosses the various floodplains. Areas of lost storage capacity have been identified and an appropriate level of mitigation against potential effects of increased flood risk associated with construction in the flood plain is being proposed. The proposed dual carriageway is at a sufficiently high level so as not to be at risk from flooding.
- 16.1.4 The overall assessment concludes that the significance of Proposed Scheme impacts on surface water and flooding would be no greater than a slight adverse effect. The overall Proposed Scheme is therefore evaluated as not significant.

16.2 Scope of the assessments

- 16.2.1 The assessments relating to road drainage and the water environment have been focused on surface waters, flood risk and groundwater. The information derived from the assessments has also been used to inform assessments undertaken in relation to ecological and nature conservation resources as reported in Chapter 11.

Surface waters

- 16.2.2 The assessments have been focused on:
- potential pollution of watercourses as a result of construction activities, such as earthworks or spillage and leakage associated with construction plant and site storage areas;
 - potential pollution where the drainage proposals for the Proposed Scheme discharge routine runoff to watercourses;
 - potential pollution of watercourses as a result of accidental spillage once the road is open to use;

- impacts associated with changes in surface water flow characteristics and fluvial geomorphology associated with the introduction of road surface drainage, location of proposed bridges, culverts, watercourse diversions and drainage outfalls; and
- alterations to availability of surface water abstractions.

16.2.3 Consequential impacts on sites designated for their nature conservation value, aquatic and marginal habitats and associated fauna are discussed in Chapter 11.

Construction related pollution

16.2.4 The assessment of impacts resulting from the release of sediments or construction related pollutants into watercourses or water bodies has involved the identification of locations where construction would be required in close proximity to watercourses and water bodies and of appropriate mitigation measures targeted at avoiding or minimising the risk of pollution. This included identification of surface water abstraction locations which could potentially be effected.

16.2.5 The assessment has generally focused on working areas required for the construction of the Proposed Scheme, including anticipated compound and storage areas, which would be located within 50m of existing watercourses or water bodies. Mitigation measures have been identified which address these risk areas and which would also be adopted to safeguard watercourses and water bodies beyond such locations, as per the obligations placed on member states of the EU by the Water Framework Directive (WFD).

Pollution associated with routine runoff

16.2.6 The assessments of impacts associated with the collection and discharge of road related run-off to watercourses once the Proposed Scheme is opened to use, has focused on acute pollution impacts associated with soluble pollutants, chronic pollution impacts associated with sediment bound pollutants and long-term chronic impacts associated with soluble pollutants on water quality and aquatic ecology where the Proposed Scheme provides for discharge to watercourses.

In-stream sedimentation

16.2.7 The assessments have involved evaluation of sediment levels downstream of each proposed drainage outfall using a combination of water quality monitoring data, outfall discharge theoretical sediment levels and annual average flow values for both receiving watercourse and respective outfalls. The objective has been to ensure that the total suspended solids value downstream of the proposed outfalls would not be likely to exceed 25mg/l, a value which is identified in the WFD as being a guideline value for salmonid watercourses and which Loughs Agency has stipulated should be achieved for all outfalls for the Proposed Scheme.

Accidental spillage during use

16.2.8 The assessments have involved analysis of the risk that there would be a spillage of pollutant and that the pollutant would reach and have an impact on a watercourse or

water body to such an extent that it constitutes a serious pollution incident. This risk is expressed as the annual probability that a serious pollution incident could occur.

Impacts associated with changes in surface water flow characteristics

16.2.9 The assessments associated with changes in surface water flow characteristics have investigated the extent to which proposed bridges, culverts, watercourse diversions and drainage outfalls would be likely to affect surface flows. The objective has been to determine:

- scale of any changes in watercourse volumes and flow rates;
- alterations to fluvial geomorphology of watercourse channels; and
- changes in water quality as a result of increased erosion and sedimentation.

Impacts associated with alterations to availability of surface water abstractions

16.2.10 The assessments associated with changes in surface water quality and flow characteristics have investigated the extent to which surface water abstractions would be affected by the Proposed Scheme. The objective has been to determine changes upon availability of supply where there are surface water abstractions on relevant sections of watercourse.

Flood risk

16.2.11 DMRB HD45/09 states that when an infrastructure is located within a floodplain, a detailed assessment of flood risk is required.

16.2.12 The Flood Risk Assessment (FRA) has focused on the review of floodplain elevations and extents where the Proposed Scheme would potentially interact with existing floodplains. The FRA considered both river and coastal flooding risk and the following has been assessed:

- potential increase in upstream water level caused by any restriction in flow (afflux);
- potential loss of floodplain storage due to obstruction caused by road infrastructure in the floodplain locations with potential increased flood risk; and
- potential impediment of water flow caused by road infrastructure crossing existing drainage channels, causing potential blockage and altering local catchment area boundaries.

16.2.13 To complete this assessment it was necessary to understand the extents of the floodplain/floodwater levels, the impact arising from the proposed road and the development of appropriate mitigation measures.

16.2.14 Hydraulic models were utilised for the assessment, comparing the existing floodplain extents and elevations to the Proposed Scheme to ascertain the impacts; these are reported within the FRA.

Groundwater

- 16.2.15 The assessments have focused on:
- potential pollution of groundwater and local aquifers as a result of construction activities, such as earthworks or spillage and leakage associated with construction plant and site storage areas;
 - potential pollution of groundwater due to infiltration of soluble contaminants within routine runoff and accidental spillage once the road is open to use;
 - changes in groundwater level and flow characteristics, during construction and once the road is open to use; and
 - changes to availability of supply, during construction and once the road is open to use where there are local groundwater abstractions.
- 16.2.16 Consequential impacts on sites designated for their nature conservation value, aquatic and marginal habitats and associated fauna are discussed in Chapter 11.

Construction related pollution

- 16.2.17 The assessment of impacts resulting from the release of soluble pollutants into groundwater bodies and local aquifers has involved the identification of locations where construction would involve excavations and potentially operating below the water table, thereby increasing the opportunity for pollutants to reach groundwater. Local groundwater abstraction locations were identified for assessment of the effect of the Proposed Scheme.
- 16.2.18 Appropriate mitigation measures have been identified and targeted at avoiding or minimising the risk of groundwater pollution, which would also be adopted to safeguard groundwater bodies as per the obligations placed on member states of the EU by the Water Framework Directive (WFD).

Pollution associated with routine runoff and accidental spillage

- 16.2.19 The assessments of impacts associated with the pollution of groundwater, once the Proposed Scheme is opened to use, considers the risk of soluble contaminants from road runoff surface drainage networks (as discussed in 16.2.6) contaminating local groundwater via infiltration.
- 16.2.20 Accidental spillage incidents, when the road is open to use, also have the potential to cause pollution to groundwater.

Impact on groundwater levels and flows

- 16.2.21 The assessments associated with changes in groundwater level and flow characteristics have considered groundwater conditions and investigated the extent to which proposed road cuttings would be likely to affect sub-surface water flows and availability of this resource. The objective has been to determine:
- assessment of cutting locations to identify likely scale of any local changes in groundwater levels and flows; and

- identification of local groundwater dependent receptors.

Impact on availability of groundwater abstractions

- 16.2.22 The assessments associated with changes in groundwater level and flow characteristics can have specific impacts upon local groundwater abstractions. The objective has been to determine changes to availability of supply where there are groundwater abstractions close to the Proposed Scheme.

16.3 Statutory and planning context

- 16.3.1 Reference has been made to the following statutes, strategies and regulations. A detailed explanation of each and their specific relevance to the assessments is provided in Appendix 16A.

The Water Framework Directive (2000/60/EC)

- 16.3.2 Directive 2000/60/EC establishes a framework for community action in the field of water policy. The Water Framework Directive (WFD), implemented in Northern Ireland by The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003, seeks to enhance the status of aquatic ecosystems, promotes sustainable water use and contributes to mitigating the effects of flood and drought. It is a requirement of the Directive that member states classify major rivers and their tributaries in terms of their ecological status with reference to biological, chemical and hydromorphological quality indicators. In January 2014 the Freshwater Fish Directive (2006/44/EC) was revoked and was subsumed under the WFD.

Planning Policy Statement (PPS) 15: Planning and Flood Risk

- 16.3.3 Revised Planning Policy Statement (PPS) 15 (Sept 2014) supercedes the previous PPS 15 published in June 2006. PPS 15 aims to minimise and manage flood risk to people, property and the environment. It adopts a precautionary approach to sustainable development, accounting for emerging information in relation to flood risk through the implementation of the Floods Directive (2007/60/EC) in Northern Ireland.

The Groundwater Directive (80/68/EEC as amended by 91/692/EEC)

- 16.3.4 Council Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (as amended - the Ground Water Directive dangerous substances (consolidated)) places an obligation on member states to prevent pollution of groundwater by substances including hydrocarbons and control the introduction of named metals, including copper.

The Groundwater Daughter Directive (2006/118/EC)

- 16.3.5 Directive 2006/118/EC the "Daughter Directive" to the Water Framework Directive establishes specific measures as provided for in the Water Framework Directive to prevent and control groundwater pollution. It defines criteria for the assessment of good groundwater chemical status.

The Groundwater Regulations (Northern Ireland) 2009 and Groundwater (Amendment) Regulations (Northern Ireland) 2014

- 16.3.6 The Groundwater Regulations (Northern Ireland) 2009, and Groundwater (Amendment) Regulations (Northern Ireland) 2014 transpose the Groundwater Daughter Directive (2006/118/EC).

16.4 Methods of assessment

- 16.4.1 The assessments have been informed by the guidelines and methods described in Volume 11, Section 3, Part 10 (HD 45/09 - Road Drainage and the Water Environment) of the DMRB. A detailed explanation of the methods and their application is provided in Appendix 16B.
- 16.4.2 The approach has been focused upon characteristics and subsequent Proposed Scheme impacts upon surface water hydrological catchments and underlying groundwater bodies, using water body boundaries mapped for the Water Framework Directive by NIEA. This hydrological catchment-based approach enables due consideration to be given to both individual locations and the wider cumulative impacts within larger surface water and groundwater body areas.

Surface waters

- 16.4.3 The identification of surface watercourses and waterbodies has involved reference to Ordnance Survey of Northern Ireland (OSNI) mapping, consultation with the Rivers Agency and Northern Ireland Environment Agency (NIEA) Water Management Unit. NIEA River Basin Management Plan online mapping and associated Water Framework Directive datasheets. Information on water supplies has been provided by NIEA and a project-specific water supply survey questionnaire issued to potentially affected landowners in 2010.
- 16.4.4 Data relating to the current physical status of watercourses has been obtained from site observations and NIEA status reports. The current chemical status of watercourses has been obtained from a 2014 review of NIEA records and project surface water quality monitoring data.
- 16.4.5 A number of technical appendices have been prepared to provide further data. A Water Framework Directive Assessment of Proposed Scheme effects is presented as Appendix 16D. Fluvial geomorphology has been evaluated for watercourse interactions and is provided as Appendix 16F. A project-specific programme of water quality sampling was undertaken between November 2009 - May 2010 and presented in Appendix G.

Construction related pollution

- 16.4.6 A review of the Proposed Scheme in relation to surface water bodies has been undertaken, with particular attention to locations where construction activity is required within 50m of an existing watercourse and those Proposed Scheme components with direct interactions with the water environment; bridges, culverts, watercourse diversions and discharge outfalls.

16.4.7 The assessment has involved:

- a review of the Proposed Scheme alignment and land included in the vesting proposals to establish locations where watercourses would be crossed and where construction activity would occur within 50m of watercourses;
- liaison with the contractor advisors to the Department to identify the nature of the construction activities anticipated at the locations identified above;
- identification of the risks relating to sedimentation and spillage of construction related pollutants taking into account location and the nature of the activities identified;
- identification of surface water abstraction locations within the vesting area and downstream of the Proposed Scheme corridor, based on information received from NIEA in 2014 and from a project-specific questionnaire survey issued to 785 landowners in 2010 (to which 40% of landowners responded);
- identification of generic mitigation measures which would be adopted for all at risk locations and specific measures which would be applied to high risk locations; and
- evaluation of the predicted effects in accordance with the guidance provided in Annex IV of HD 45/09 as detailed in Appendix 16B and outlined in the Evaluation Criteria and Prediction of Effects section below.

Pollution of surface waters associated with routine runoff

16.4.8 The assessment of impacts associated with the collection and discharge of road related run-off to watercourses once the Proposed Scheme is opened to use has involved use of the Highways Agency Water Risk Assessment Tool (HAWRAT) in accordance with the 'Assessment of Pollution Impacts from Routine Runoff to Surface Waters' and covering both Method A (Simple Assessment) and Method B (Detailed Assessment) as described in HD 45/09. Detailed explanation of these methods and application is provided in Appendix 16B.

16.4.9 The HAWRAT is a Microsoft Excel application which has been developed to assess acute pollution impacts associated with soluble pollutants and chronic pollution impacts associated with sediment-bound pollutants on aquatic ecology where new drainage outfalls are proposed for major road projects. Information derived from the application of the HAWRAT also enables long-term chronic impacts associated with soluble pollutants to be investigated by comparing in-river annual average concentrations for soluble pollutants, including the contribution from road runoff, with published Environmental Quality Standards (EQSs) to assess whether there is likely to be a long-term impact on ecology.

16.4.10 The principal tasks involved have been:

- identification of proposed road drainage outfalls and receiving watercourses (including transitional waters of the River Foyle and Finn River);
- establishment of current flow regimes and ecological status in relation to the Water Framework Directive for the receiving watercourses and water bodies;

- evaluation of each proposed drainage outfall to receiving watercourses using the HAWRAT; and
- identification of appropriate mitigation measures where the HAWRAT or downstream sediment calculation has indicated that an outfall would not meet the acceptance criteria.

- 16.4.11 Principal user entry parameters for undertaking HAWRAT assessment are traffic flows, climatic data, impermeable surface area, watercourse flow values, watercourse dimensions, hydrological linkage with designated sites and water hardness. Treatment mitigation efficiencies were applied based on current Highways Agency treatment efficiency guidance.
- 16.4.12 Watercourse dimensions have been gained by project-specific watercourse surveys. Large watercourses are more likely to have river gauging stations, therefore theoretical flow values have been derived for the smaller watercourses more commonly interacted with by the Proposed Scheme. Flow values have been estimated using the LowFlows2 software package. This theoretical data was found to be comparable with equivalent locations, with available gauging station data, giving confidence in the correlation of results. Q95 is defined as the flow exceeded 95% of the time and is a measure of annual low flows. The river's Q95 flows in the vicinity of the route can indicate the dilution potential available in the rivers for point source drainage outfall discharges. If there is insufficient flow within a watercourse during low flow conditions, this may result in pollution.
- 16.4.13 Evaluation of the predicted effects has been undertaken in accordance with the guidance provided in Annex IV of HD 45/09 as detailed in Appendix 16B and outlined in the Evaluation Criteria and Prediction of Effects section below.

In-stream sedimentation

- 16.4.14 The evaluation of sediment levels downstream of each drainage outfall has involved the use of a combination of water quality monitoring data, outfall discharge theoretical sediment levels and annual average flow values for receiving watercourses and associated outfalls. This assessment was undertaken in parallel with the HAWRAT evaluation.
- 16.4.15 Evaluation of the predicted effects has been undertaken in accordance with the guidance provided in Annex IV of HD 45/09 as detailed in Appendix 16B and outlined in the Evaluation Criteria and Prediction of Effects section below.

Accidental spillage during use

- 16.4.16 The assessments have involved the application of Method D – 'Assessment of Pollution Impacts from Spillages' described in HD 45/09. Detailed explanation of the method and its application is provided in Appendix 16B.
- 16.4.17 The method takes the form of a risk assessment, whereby the risk is defined as the probability that there would be a spillage of pollutant and that the pollutant would reach and impact a water body to such an extent that it constitutes a serious pollution

incident. The risk is expressed as the annual probability that a serious pollution incident could occur.

- 16.4.18 Typically, an annual probability of 1% (a 1 in 100 chance of a serious pollution incident occurring in any one year) is considered an acceptable risk, although in exceptional circumstances, where a discharge is located within 1km of a water dependent designated site, a higher level of protection is recommended; such that the return period should be no less than 0.5% (1 in 200 chance in any one year).
- 16.4.19 Evaluation of the predicted effects has been undertaken in accordance with the guidance provided in Annex IV of HD 45/09 as detailed in Appendix 16B and outlined in the Evaluation Criteria and Prediction of Effects section below.

Impacts associated with changes in surface water flow characteristics

- 16.4.20 The assessments have involved investigation of the fluvial geomorphology of sections of existing watercourses on which bridges, culverts, watercourse diversions and drainage outfalls would be located. The investigation has been used to determine if potential changes in channel form and gradients would be likely to result in changes to established erosion and deposition characteristics and the availability of existing volumes of water upstream or downstream of the design components.
- 16.4.21 The investigation has involved a combination of desk-based appraisal and site surveys. Aerial and ground-based photographs and maps were initially screened to identify sections of watercourse where the design components are located. This resulted in the identification of 27 watercourses with associated bridge, culvert and watercourse diversions locations, which were investigated in detail on site. The higher risk watercourses were walked upstream and downstream from the potential point of impact, the distance varying between 100m and 500m depending on the size of the watercourse, its geomorphological sensitivity and the nature of the potential impact. A record was made of channel morphology, bed and bank material, vegetation, sinuosity, braiding, evidence of erosion and deposition, and land use. Any evidence of historic channel change was also recorded, including palaeochannels, terraces and raised bars. Detailed explanation of the investigation undertaken is provided in Appendix 16F – Fluvial Geomorphology.
- 16.4.22 Where the assessments have identified risks relative to erosion, sedimentation and loss or deterioration in resource availability for abstractions, mitigation measures have been identified and incorporated as part of the Proposed Scheme.
- 16.4.23 Evaluation of the predicted effects has been undertaken in accordance with the guidance provided in Annex IV of HD 45/09 as detailed in Appendix 16B and outlined in the Evaluation Criteria and Prediction of Effects section below.

Alteration to availability of surface water abstractions

- 16.4.24 Public and private surface water abstraction information was gained in 2014 from NIEA and from landowner surveys and consultations plus monitoring data gathered in 2011 and 2012.

- 16.4.25 The review of the information gathered identified the surface water abstractions downstream and hence hydrologically connected to the Proposed Scheme. Private water supplies can be used for a variety of purposes and these were identified from the NIEA records.
- 16.4.26 Where downstream connectivity has been established, mitigation measures have been identified as part of the Proposed Scheme.
- 16.4.27 Evaluation of the predicted effects has been undertaken in accordance with the guidance provided in Annex IV of HD 45/09 as detailed in Appendix 16B and outlined in the Evaluation Criteria and Prediction of Effects section below.

Flood risk

- 16.4.28 The assessment of flood risk was completed in accordance with DMRB Method E – Hydrological Assessment of Design Floods and Method F – Hydraulic Assessment, as detailed in HD 45/09. Detailed information relating to flood risk is provided in Appendix 16B and Flood Risk Assessment Reports 1, 2 and 3.
- 16.4.29 To assess the extents, mitigation, impacts and flood risk, DMRB HD45/09, Annex 1, Method F recommends that a hydraulic assessment should be undertaken. This was completed using 25 models along the route of the Proposed Scheme. The preliminary assessments to identify these floodplains can be seen in Appendix 16C. Rivers Agency was consulted throughout the assessments.
- 16.4.30 The flood risk assessment has utilised a number of data sources, including Rivers Agency Flood Maps, alluvium mapping, historical mapping and topographical surveys.
- 16.4.31 To build the models, site inspections of all the proposed modelling locations were undertaken to confirm the location and nature of the various watercourses, gain an appreciation of catchment characteristics (steepness, land use, etc), confirm model extents and determine the appropriate channel and floodplain roughness (Manning's n) coefficients to be applied to the hydraulic model. The model cross sections and any hydraulic control structures (bridges, culverts, etc) were then surveyed.
- 16.4.32 DMRB HD45/09, Annex 1, Method E – Hydrological Assessment of Design Floods recommends the Flood Estimation Handbook (FEH) for assessing hydrology. Two approaches have been utilised for the Proposed Scheme; the statistical analysis of peak flows and the rainfall-runoff method.
- 16.4.33 These site-specific parameters were input into either 1D or 2D hydraulic modelling software packages as appropriate, depending on the characteristics of the watercourse/existing floodplain.
- 16.4.34 Water levels along the watercourses were calculated for a range of return periods up to and including the 100 year + climate change event for the existing scenario.
- 16.4.35 Model calibration/sensitivity testing is necessary for the validation of the results and thus the inferred mitigation strategies. The models were calibrated by obtaining water levels for a recorded flood event of known peak flow, and adjusting the model coefficients until a results' match was obtained. This calibration method was used where peak flow recorded information existed for a particular model. However, in some

cases the model could not be calibrated as there was no existing peak flow data. In these instances, the model was subjected to sensitivity testing. Once the calibration of each of the models was completed, a series of sensitivity tests were undertaken in order to determine the models' sensitivity to the coefficients and parameters used.

- 16.4.36 The hydraulic models were then utilised to inform the route development and to assist in the avoidance and/or reduction of impacts arising from the Proposed Scheme as far as reasonably practicable. The models facilitated the testing of various crossing structure sizes and floodplain impacts. Generally, flood impacts would be mitigated using measures which include some, or all, of the following:
- avoidance of floodplains as far as reasonably practicable whilst incorporating multi-discipline engineering and non-engineering factors;
 - minimisation of road footprint as far as reasonably practicable whilst incorporating multi-discipline engineering and non-engineering factors;
 - appropriately sized culverts;
 - large span structures where feasible;
 - provision of floodplain connectivity structures to maintain floodplain conveyance where floodplains are bisected by the road alignment; and
 - provision of compensatory storage where feasible and material volumetric floodplain encroachment remains.
- 16.4.37 Various iterations with regards to the mitigation measures have been undertaken to find the optimum mitigation solution, within practical / feasible bounds. These iterations have run alongside the multidisciplinary evolution of the scheme and have been discussed with Rivers Agency throughout.
- 16.4.38 For flood risk identification within the FRA, the limits of floodplains assessed are:
- rivers – the extent of a flood risk event with a 1% (1 in 100) Annual Exceedance Probability (AEP) of exceeding the peak floodwater level; and
 - coastal – the extent of a flood risk event with a 0.5% AEP (1 in 200) of exceeding the peak floodwater level.
- 16.4.39 Flood risk has been assessed using the specified 'design' flood event. To assist in the determination of residual, post scheme flood risk associated with the Proposed Scheme, assessment methodologies identified within appendices of the DMRB were used; whereby the importance of the floodplain, the magnitude of the impact and the significance of the potential effects have been defined as per the guidance tables A4.3 HD 45/09, A4.4 HD 45/09 and A4.5 HD 45/09. Finally, the qualifying conditions for the overall assessment score for residual, post mitigation flood risk from Table A4.6 HD 45/09 have been applied.
- 16.4.40 Evaluation of the predicted effects is outlined in the Evaluation Criteria and Prediction of Effects section below.

Groundwater

- 16.4.41 The identification of groundwater bodies has involved reference to NIEA River Basin Management Plan online mapping and associated Water Framework Directive datasheets. Information on groundwater supplies has been provided by NIEA records and a project-specific water supply survey questionnaire issued to potentially affected landowners in 2010.
- 16.4.42 Data relating to the chemical status of groundwater has been obtained from long-term NIEA groundwater monitoring records and a project-specific programme of groundwater well inspections and monitoring undertaken during 2011 - 2012.

Construction related pollution

- 16.4.43 Evaluation of the potential for pollution of groundwater has involved a review of locations where the road alignment encounters shallow groundwater locations and with particular attention to where road cuttings are required to achieve vertical alignment requirements. Such cuttings may involve excavation in permeable soils or drift deposits close to or potentially penetrating the water table.
- 16.4.44 The assessment has involved:
- a review of the Proposed Scheme alignment and land included in the vesting proposals to establish which groundwater bodies would be crossed by the Proposed Scheme;
 - identifying the locations where cuttings are required for the vertical alignment of the Proposed Scheme;
 - liaison with the contractor advisors to the Department to identify the nature of the construction activities involving topsoil stripping and at cutting locations;
 - identification of the risks relating to spillage of construction related pollutants and temporary dewatering, taking into account location and the nature of the activities identified;
 - identification of groundwater abstraction locations within the vesting area which would require decommissioning;
 - identification of generic mitigation measures which would be adopted for all at risk locations and specific measures which would be applied to higher risk locations; and
 - evaluation of the predicted effects in accordance with the guidance provided in Annex IV of HD 45/09 as detailed in Appendix 16B and outlined in the Evaluation Criteria and Prediction of Effects section below.

Pollution associated with routine runoff and accidental spillage

- 16.4.45 This assessment has involved the application of Method C – ‘Assessment of Pollution Impacts from Routine Runoff of Groundwaters’ as detailed in HD 45/09 and in Appendix 16B.

- 16.4.46 Accidental spillage contamination of groundwater is closely aligned to surface water accidental spillage risk. The outcomes of the surface water assessment (Method D) for each drainage network have been reviewed in order to establish the likelihood of incident and potential for any incident that would consequently contaminate groundwater, taking account of surface water drainage design and pollution control mitigation measures once the road is in use.

Impacts on groundwater levels and flows

- 16.4.47 The assessment has involved establishing the reduction in permeable surface due to the creation of the proposed road surface across the various groundwater bodies. This impermeable surface would act as a barrier to ground infiltration of rainfall and could lead to lower groundwater recharge, if so this would lower groundwater level or reduce groundwater flows.
- 16.4.48 NIEA data and mapping for each of the groundwater bodies crossed by the Proposed Scheme has been appraised, in tandem with calculating the additional impermeable area within the extent of each groundwater body.
- 16.4.49 The likely impact of road cuttings on groundwater receptors has been assessed for each cutting using available data on water table depth, depth of proposed cutting and the likely permeability of the local superficial geology and bedrock. Distances of influence have been estimated for each cutting in relation to sensitive receptors such as habitats or surface waters supported by groundwater conditions.
- 16.4.50 Evaluation of the predicted effects has been undertaken in accordance with the guidance provided in Annex IV of HD 45/09 as detailed in Appendix 16B and outlined in the Evaluation Criteria and Prediction of Effects section below.

Impacts on groundwater abstractions

- 16.4.51 The assessment identified groundwater abstractions for residential, agricultural or industrial use close to the land take boundaries of the Proposed Scheme. Baseline data for wells and springs was collected during monitoring undertaken in 2012. The survey covered wells and springs to be decommissioned, replaced or within a 150m buffer zone of the vesting area.
- 16.4.52 The outcomes of the potential impacts upon groundwater levels and flows were then considered with regard to local groundwater abstraction locations to assess likely effects of the Proposed Scheme.
- 16.4.53 Evaluation of the predicted effects has been undertaken in accordance with the guidance provided in Annex IV of HD 45/09 as detailed in Appendix 16B and outlined in the Evaluation Criteria and Prediction of Effects section below.

Evaluation criteria and prediction of effects

- 16.4.54 The prediction of effects for all of the assessments has involved adoption of the guidance provided in Annex IV of HD 45/09. The guidance, which is replicated in Appendix 16B, is based on an evaluation of the importance of affected surface waters,

groundwater and floodplains and the magnitude of impact to arrive at a predicted effect.

- 16.4.55 Determination of the value of the assessed water resources has involved reference to Table A4.3 in Annex IV of HD 45/09. The table provides examples of water resources which are considered to be of very high, high, medium or low importance based on their quality, rarity, scale and sustainability. The table is replicated as Table 16B.11 in Appendix 16B.
- 16.4.56 Determination of the magnitude of impact has involved reference to Table A4.4 in Annex IV of HD 45/09. The table provides examples whereby the magnitude of impact can be considered to be major, moderate minor or negligible and adverse. The table is replicated as Table 16B.12 in Appendix 16B.
- 16.4.57 Evaluation of the predicted effect has involved reference to Table A4.5 in Annex IV of HD 45/09. The table, which is replicated in Table 16.2 (and duplicated as Table 16B.13 in Appendix B), indicates appropriate orders of effect comprising very large, large, moderate, slight and adverse and neutral based on combinations of importance and magnitude of impact. Where the table indicates alternative ratings, the assessment team has determined the outcome based on the specific context for the relevant outfalls and the receiving watercourses.

Table 16.2 Impact Criteria and Significance Ratings

Importance of Attribute	Magnitude of Impact			
	Major	Moderate	Minor	Negligible
Very High	Very Large	Large / Very Large	Moderate / Large	Neutral
High	Large / Very Large	Moderate / Large	Slight / Moderate	Neutral
Medium	Large	Moderate	Slight	Neutral
Low	Slight / Moderate	Slight	Neutral	Neutral

16.5 Baseline environment

Designated sites

- 16.5.1 There are six sites associated with the study area which are designated under national and/or European legislation for their nature conservation value and which are dependent on the quality of the water environment.

River Foyle & Tributaries Special Area of Conservation (SAC)

- 16.5.2 The SAC is designated for its habitats of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation and the largest population of Atlantic salmon in Northern Ireland. The river is notable for the physical diversity and

naturalness of the banks and channels, especially in the upper reaches, and the richness and naturalness of its plant and animal communities.

River Finn Special Area of Conservation (SAC)

- 16.5.3 The River Finn SAC is designated by the Republic of Ireland along the Finn watercourse and continues downstream beyond the Finn's confluence with the Mourne to form the River Foyle. On the River Foyle this designated area is immediately adjacent to the River Foyle & Tributaries SAC on the Republic of Ireland side of the border.
- 16.5.4 The SAC is designated for its habitats of Oligotrophic Waters, Wet heath, Blanket Bogs, Transition Mires, as well as its Atlantic Salmon and Otter species. The northern section of this site also comprises the River Foyle, Mongavlin to Carrigans Proposed Natural Heritage Area (pNHA).

McKean's Moss Area of Special Scientific Interest (ASSI)

- 16.5.5 The intact bog surface exhibits a well-defined dome with characteristic vegetation and structural features, including hummock and lawn complexes and small shallow pools. Sphagnum species are well represented. The periphery of the bog has been extensively cut for turf in the past. The cutover area is dominated by mature woodland and scrub.

Strabane Glen ASSI

- 16.5.6 Strabane Glen is a narrow valley supporting calcareous wet woodland which is atypical of the region and the presence of which is related to the underlying geology.

Tully Bog SAC & ASSI

- 16.5.7 Tully Bog is an isolated lowland raised bog lying in a shallow hollow within the former floodplain of the Fairy Water. The central intact dome supports a small pool system with a good hummock and hollow development on the bog plain. Surface water flowpaths radiate out from Tully Bog, such as via the Tully Drain channel and other minor watercourses that form tributaries to the Fairy Water.

Grange Wood ASSI

- 16.5.8 Grange Wood is a calcareous wet woodland located on the lower north-eastern slopes of Bessy Bell. It comprises a low, multi-stooped hazel canopy with occasional ash standards over a diverse base-rich ground flora. Frequent exposed rocky outcrops and boulders are covered by a luxuriant growth of mosses, particularly on the upper slopes. The lower slopes are waterlogged with extensive flushing. In these areas, willow and alder predominate.

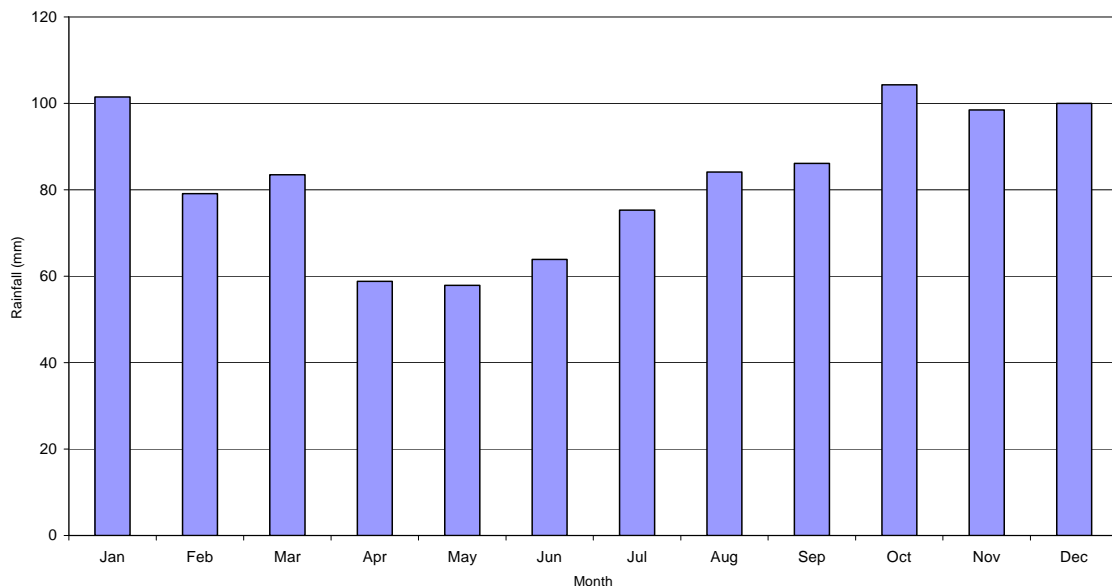
Rainfall

- 16.5.9 Northern Ireland has a temperate climate characterised by cool summers and mild, wet winters. The wettest areas are upland areas such as the Sperrin Hills where there are annual rainfall averages of 1600mm. The driest areas are on the east coast where

annual rainfall averages are 800mm. Rainfall in the western counties of Londonderry, Tyrone and Fermanagh is influenced by the rain-bearing winds off the Atlantic and is relatively high. Standard Annual Average Rainfall (SAAR) in the vicinity of the Proposed Scheme corridor ranges from 1035mm to 1491mm.

- 16.5.10 Seasonal variations in the western parts of Northern Ireland are relatively large, monthly rainfall totals vary from less than 80mm in the late spring to greater than 130mm in the winter months. Monthly rainfall data for Carmoney, the nearest available monitoring station, located 7km north-east of Londonderry, is representative of the area. The data is shown graphically on Diagram 16.1.

Diagram 16.1 Average Monthly Rainfall (1971-2000) at Carmoney



Surface waters

Catchment Descriptions

- 16.5.11 The Proposed Scheme would be located within the catchments and associated sub-catchments of the River Foyle and River Blackwater. The River Foyle catchment comprises several major tributaries including the Burn Dennet, Glenmornan, Finn, Mourne, Strule, Owenkillew, Derg, Fairy Water, Camowen and Drumragh rivers.
- 16.5.12 The extent and relationship of the catchments, sub-catchments and major watercourses to the Proposed Scheme is shown on Figure 16.1. Smaller watercourses are shown on Figures 16.2-16.18 (as a series of detailed sheets).
- 16.5.13 Further catchment details are provided in Appendix 16C Baseline Data.

Lower Foyle catchment

- 16.5.14 The River Foyle constitutes the focus of the Lower Foyle Catchment as it flows from the confluence of the rivers Mourne and Finn through Londonderry to Lough Foyle. The river, which reaches a width of approximately 750m, is tidally influenced beyond

Strabane and has a tidal range of approximately 3m. The Proposed Scheme would run between New Buildings and Strabane along the eastern margins of the river, primarily through agricultural land. This is identified by NIEA as a heavily modified watercourse, with flood defences at various locations.

Burn Dennet catchment

- 16.5.15 The Burn Dennet has a catchment of approximately 150km². It rises in the Sperrin Hills and flows 35km west to the River Foyle. The catchment is predominantly agricultural, although there are notable sand and gravel quarries close to its lower reaches. The Proposed Scheme would cross the river in the vicinity of Burn Dennet Bridge. At the crossing, the watercourse is approximately 15m wide and typically transitional in character, the valley being relatively unconfined with a wide floodplain and a channel which is relatively shallow in gradient and meandering in form with riffle/pool sequences.

Glenmornan catchment

- 16.5.16 The Glenmornan River (also known as the Ballymagorry Burn) has a catchment of approximately 35km². It rises in the foothills of the Sperrin Hills and flows 16km west to the River Foyle passing through the villages of Artigarvan and Ballymagorry. The upper catchment comprises peat covered hills. The landscape of the mid and lower reaches is predominantly agricultural. There are some sand and gravel workings adjacent to the middle reaches of the watercourse. Where the Proposed Scheme would cross the river, north-west of Ballymagorry, the river channel is between 4m and 20m wide and typically transitional in character.

Finn catchment

- 16.5.17 The Finn River rises in Lough Finn, County Donegal, and flows east for 60km to Strabane, where it joins with the Mourne River. The upper reaches of the river's 495km² catchment generally flow through upland terrain. The lower reaches, a section of which marks the western edge of the Proposed Scheme corridor, are typical of a mature, deep and slow flowing lowland river with a wide unconfined valley and floodplain. The Finn's lower reaches are subject to tidal influence upstream to Flushtown Bridge, with anecdotal evidence suggesting this influence can range further upstream, depending on river flow and tidal conditions.

Mourne catchment

- 16.5.18 The Mourne River constitutes the middle section of the main spine of the Foyle catchment, with a catchment area of 1860km². The river extends from its origin where the River Strule and Derg River meet, near Ardstraw, to its confluence with the Finn River and the formation of the River Foyle at Strabane. The Mourne has numerous riffle and pool sequences, which flow in a relatively unconfined valley within a large floodplain. The river channel is, on average, 60m wide. It has been heavily modified at Sion Mills, where there is a large weir. As the river passes through Strabane, its channel has been modified by various flood defences. The Proposed Scheme would cross the river at Strabane and follow the lower western slopes of the river valley south of the town as far as the Derg Valley.

Derg catchment

- 16.5.19 The Derg River rises in the Killeter Uplands and flows east for 53km to its confluence with the Strule River near Ardstraw. It has a total catchment of 440km². The upper reaches of the catchment are characterised by peatlands, while the lower reaches flow through farmland within a well-developed valley. The Proposed Scheme would cross the river channel between Ardstraw and the confluence with the Strule River in a location where there is a variable substrate within the channel and there are riffle and pool sequences.

Strule catchment

- 16.5.20 The Strule River is the focus of a catchment which extends for 1,340km² and which constitutes the upper main spine of the Foyle Catchment. Originating at the confluence of the Camowen and Drumragh rivers in the centre of Omagh, the river flows north for approximately 21km to its confluence with the Derg River. It is fed by two major tributaries, the Owenkillew River which is located east of Newtown Stewart and the Fairy Water north-west of Omagh. There are numerous minor tributary streams which descend the slopes of Bessy Bell and the Sperrin foothills. The Strule has variable bed materials, riffle and pool sequences and an unconfined valley and floodplain. Agriculture is the dominant land use. There are areas of peat bog associated with the upper reaches of the large tributaries and sand and gravel quarrying in the Strule valley, particularly north of Newtown Stewart. The Proposed Scheme would occupy a corridor along the steep western valley slopes of the Strule Valley and the undulating drumlin landscape west of Mountjoy.

Fairy Water catchment

- 16.5.21 The Fairy Water rises on the slopes of Bolaght Mountain in West Tyrone and flows east for 30km to its confluence with the River Strule. It has a total catchment of 180km². It is an area of agricultural grassland with significant areas of peat, particularly in the valley floor. The lower reaches of the river, associated with the Proposed Scheme corridor, are transitional in character as they meander across the wide valley floor. The route crosses the watercourse immediately west of the confluence with the Strule River at a point where the river is approximately 16m wide and there are well defined riffle and pool sequences.

Drumragh catchment

- 16.5.22 The Drumragh River is formed where the Ballynahatty Water and Quiggery Water meet to the south of Omagh. It flows generally north through the centre of Omagh before merging with the Camowen River to become the Strule River. There is an intricate pattern of tributaries of distinctive dendritic (many-branched) form that feed into the main watercourse and its two principal tributaries between the drumlins that shape the landscape of the area. The Proposed Scheme is located towards the eastern margin of the upper Drumragh catchment, crossing a number of small streams / large field drains within the Routing Burn and Eskragh Water sub-catchments. Other than the Routing Burn, many of the streams have been straightened or otherwise modified.
- 16.5.23 The Proposed Scheme would cross the Drumragh River approximately 2.5km downstream of the confluence of the Ballynahatty Water and Quiggery Water. At this

point the river is approximately 10-15m wide and has typical transitional characteristics with variable bed material, riffle and pool sequences and an unconfined valley and floodplain.

Camowen catchment

- 16.5.24 The Camowen River rises in the hills to the west of Pomeroy and flows west to Omagh, where it joins with the Drumragh to form the Strule River. The Proposed Scheme would be located on the westernmost fringe of the catchment where it crosses the headwaters of the Ranelly Drain, a minor tributary to the Camowen. These headwaters, which rise in the low lying peatlands between the drumlins that characterise the area, range from small semi-natural streams a few metres wide, and with good flow, to very narrow ditches with limited flow.

Blackwater catchment

- 16.5.25 The River Blackwater rises to the west of Fivemiletown and flows east to Aughnacloy, then north-east to Lough Neagh. The Proposed Scheme would cross the eastern part of the Upper Blackwater catchment, passing through the major tributary sub-catchments of the Roughan Burn and Ballygawley River, before terminating on the northern bank of the River Blackwater immediately south of Aughnacloy.
- 16.5.26 The Roughan Burn rises on the southern slopes of Slievemore and flows south through Ballymackilroy before joining the River Blackwater downstream of Augher. Where the route would cross the Roughan Burn it is a small, shallow stream with a gravel and cobble bed. Although this reach is generally unmodified the lower reaches have been extensively straightened.
- 16.5.27 The Ballygawley Water rises on the slopes of Eshmore Hill approximately 12.5km north-east of Ballygawley. The river flows through the town before joining the River Blackwater at Lismore Bridge, approximately 6km downstream. The Proposed Scheme would cross the Ballygawley Water approximately 2km downstream of the town. At this point the river is approximately 10m wide with a shallow cobble and gravel bed.
- 16.5.28 The remainder of the Proposed Scheme would cross a number of smaller tributaries of the River Blackwater in and around Aughnacloy; the Tullyvar, Ravella and Lisadavil. The Tullyvar and Ravella are narrow, shallow, fast-flowing, cobble and gravel-bedded streams, while the Lisadavil is a narrow, deep, heavily vegetated, sluggish channel that has been heavily modified.

Standing water

- 16.5.29 There are few standing waterbodies associated with the Proposed Scheme corridor, with these typically being small ponds and a smaller number of artificial waterbodies (flooded quarry and redundant reservoir). Details of these features are listed in Appendix 16C and shown on Figures 16.1 and 16.2-16.18.

Surface water quality

- 16.5.30 The overall status of watercourses which have been classified in accordance with the requirements of the Water Framework Directive (WFD) is scheduled in Table 16.3. Where data is not available for smaller watercourses it has been assumed for the

purposes of the assessment that such headwater streams and tributaries have the same classification status as the classified downstream watercourse. The River Foyle, Mourne River and River Strule are classified as heavily modified by the NIEA due to existing flow control and flood defence installations, with the Camowen River classified due to drinking water storage features. Further WFD status information for surface water bodies is provided in Appendix 16D and shown on Figure 16.19.

- 16.5.31 Data relating to chemical characteristics of the watercourses monitored by NIEA is available in Appendix 16C, with Appendix 16G providing additional information derived from the project-specific surface water monitoring programme undertaken during 2009 - 2010 for watercourses with Proposed Scheme interactions.
- 16.5.32 The data in Table 16.3 demonstrates that the majority of the watercourses do not currently meet the required standards of the Water Framework Directive, which has set a target status of 'Good' (or 'Good Ecological Potential').

Surface water abstractions

- 16.5.33 There are no surface water supply abstraction locations within the land being vested for the Proposed Scheme.
- 16.5.34 There are three public surface water abstraction locations, operated by Northern Irish Water, in the WFD surface water bodies crossed by the Proposed Scheme. These are located on the Mourne River, Derg River and Camowen River. The abstractions on the Mourne River and Camowen River are both located downstream of the Proposed Scheme corridor and therefore hydrologically connected.
- 16.5.35 There are 58 private surface abstractions in the River Foyle and River Blackwater catchment areas, of which 8 abstraction locations are downstream of the Proposed Scheme corridor and therefore hydrologically connected. These are located on the River Foyle, Mourne River, River Strule and Eskragh Water. These private abstractions are utilised by a range of processes, including fish farms, power stations, gold extraction, concrete production and quarries.
- 16.5.36 Further surface water abstraction details are provided in Appendix 16C and locations are shown on Figures 16.2-16.18 and 16.19.

Table 16.3 WFD classification of surface water

Local Management Area	WFD Surface Water Body WFD ID	Type	WFD Overall Status, 2013
Burn Dennet and Foyle	Foyle and Faughan Estuaries UKGBNI5NW250010	Transitional Water Heavily Modified Water Body	Moderate Ecological Potential
	Burn Dennet UKGBNI1NW010101070	Freshwater	Moderate
	Glenmornan River UKGBNI1NW010101075	Freshwater	Good
Derg and Mourne	Finn River UKGBNI1NW010103063	Freshwater	Poor
	Mourne River UKGBNI1NW010102074	Freshwater Heavily Modified Water Body	Moderate Ecological Potential
	Derg River 1 (Lower) UKGBNI1NW010102095	Freshwater	Moderate
	River Derg Tributary (Coolaghy Burn) UKGBNI1NW010102005	Freshwater	Good
Strule	River Strule UKGBNI1NW010102020	Freshwater	Moderate
	River Strule UKGBNI1NW010102093	Freshwater Heavily Modified Water Body	Moderate Ecological Potential
	Fairy Water UKGBNI1NW010102041	Freshwater	Moderate
	Drumragh River UKGBNI1NW010102006	Freshwater	Moderate

Local Management Area	WFD Surface Water Body WFD ID	Type	WFD Overall Status, 2013
Strule	Camowen River UKGBNI1NW010102033	Freshwater Heavily Modified Water Body	Moderate Ecological Potential
	Routing Burn UKGBNI1NW010102090	Freshwater	Moderate
	Eskragh Water UKGBNI1NW010102008	Freshwater	Moderate
	Eskragh Water UKGBNI1NW010102089	Freshwater	Poor
Blackwater	Blackwater Tributary (Roughan Burn) UKGBNI1NB030307180	Freshwater	Poor
	Ballygawley River UKGBNI1NB030307175	Freshwater	Poor
	River Blackwater (5) UKGBNI1NB030308201	Freshwater	Moderate
	Blackwater Aughnacloy UKGBNI1NB030307041	Freshwater	Poor

Discharges

- 16.5.37 A total of 25 consented discharges to watercourses have been identified by reference to NIEA and Northern Ireland Water (NIW) records within 1km of the Proposed Scheme corridor. A list of the discharges is provided in Appendix 16C. These discharges are from industrial premises, public wastewater treatment works, combined sewer overflows and septic tanks owned and operated by NIW. These works are generally associated with the larger towns and villages in the area and treated sewage effluent is discharged directly into the larger rivers. The septic tanks typically serve small clusters of properties and the partially treated effluent is generally discharged to groundwater via soakaways.
- 16.5.38 In rural areas, where connection to the public sewerage system is not possible, individual properties are serviced by private septic tanks for which there is no formal

register. The number within the vicinity of the proposed route is, therefore, uncertain. However, it is assumed that the majority of properties outside of defined settlements are served by individual private septic tanks.

Surface water flow patterns

- 16.5.39 Surface water drainage patterns in the Proposed Scheme corridor include large numbers of small artificial drainage channels and minor natural watercourses which drain to larger watercourses including major tributaries and the main channels of the River Foyle and River Blackwater.
- 16.5.40 Watercourse flow values vary depending on the size of watercourse catchment, seasonality and due to characteristics within each catchment, such as rainfall and underlying soils and geology. Small catchments are likely to be more responsive to recent rainfall events or display very low flow conditions during dry spells. Flow rate baseline results are provided in Appendix 16C.
- 16.5.41 Where the data demonstrates that the low flow (Q95) value represents a relatively high percentage of the mean flow (Qmean) for a watercourse, it is likely there may be substantial groundwater-fed base flows such that water levels are maintained during periods of prolonged dry weather. This is the case with the Burn Dennet (20%), Glenmornan River (17%) and Routing Burn (15%). In the case of the Burn Dennet and Glenmornan River, base flow is likely to be supported by groundwater within the underlying superficial sand and gravel deposits. In the case of the Routing Burn, it is likely that groundwater is available due to the more permeable sandstone and limestone that underlies the watercourse and is close to the surface.
- 16.5.42 Where watercourses are underlain by relatively impermeable rock and soils (such as clay and peat), groundwater contribution to base flow is not similarly available. Flows during prolonged dry spells are accordingly low. Smaller watercourses constituting the upper parts of the catchments for these watercourses also tend to be 'flashy', demonstrating rapid response in flow conditions during and following heavy rainfall events. This is particularly the case with the Fairy Water (8%) and Drumragh River (8%).

Flood risk

- 16.5.43 Many of the watercourse catchments crossed by the Proposed Scheme have existing flood risk concerns, including the Mourne River, River Strule, Derg River, Camowen River, Eskragh Water, Routing Burn and River Blackwater systems. However, the most extensive of the existing floodplains are those associated with sections of the River Foyle, Fairy Water and Ballygawley Water.
- 16.5.44 A full list of the flood models associated with the scheme is provided in Appendix 16C and within the Flood Risk Assessment Reports 1, 2 and 3. The predicted existing floodplain extents for the 'design' events (1% annual exceedance probability (AEP) for river floodplains and 0.5% AEP for tidal floodplains) associated with the flood models referenced in Table 16C.9 can be seen on Figure 16.1 and in more detail on Figures 16.2-16.18.

Groundwater

16.5.45 There are six WFD groundwater bodies located beneath the Proposed Scheme corridor, these typically are larger in extent than the WFD surface water bodies, often with a number of surface water bodies associated with each underlying groundwater body. Those crossed by the Proposed Scheme are as follows (sequentially north to south):

- Claudy WFD Groundwater Body (Chainage 0-17700m);
- Balleybofey WFD Groundwater Body (Chainage 17700-21600m);
- Gortin WFD Groundwater Body (Chainage 21600-33080m);
- Castlederg WFD Groundwater Body (Chainage 33080-38900m);
- Omagh WFD Groundwater Body (Chainage 38900-77080m); and
- Aghnacloy WFD Groundwater Body (Chainage 77080-93150m).

16.5.46 The extent of each groundwater body relative to the Proposed Scheme corridor is shown in Figure 16.20. A detailed description of each and their characteristics is available in Appendix 16C.

16.5.47 Aquifers are the locations where useful quantities of groundwater are contained due to local geological characteristics. These are the locations where extraction of groundwater supplies are more feasible and a number of aquifers will be present in each groundwater body.

Groundwater quality

16.5.48 The groundwater bodies throughout the study area have been assessed by NIEA under the WFD as 'Good', as shown on Table 16.4, which also identifies related surface waterbodies. Groundwater bodies as defined by NIEA are shown on Figure 16.20.

16.5.49 The NIEA has provided water quality data from groundwater monitoring wells which are located in close proximity of the Proposed Scheme, shown on Figure 16.20. Screening of the groundwater quality data against drinking water standards was undertaken and shows only a small number or localised exceedances, mainly related to iron, manganese, nitrate or bacteria levels.

16.5.50 Local aquifers have specific characteristics, related to topography, soil type, geological conditions and land use, thus groundwater quality can vary within the large WFD groundwater body areas.

16.5.51 The 2012 project-specific monitoring programme of groundwater abstractions provided evidence that supplies generally are of good water quality. However, some contamination was noted at a number of the monitoring locations considered, potentially related to farming activities. Approximately 25% of the tested wells or springs had bacteria counts exceeding the drinking water standards and ammonium and nitrate concentrations were of concern, with levels recorded above drinking water standard at a small number of locations.

16.5.52 Further details on groundwater quality are provided in Appendix 16C.

Groundwater vulnerability

- 16.5.53 Groundwater vulnerability is classified from very high to low, but is generally high in this area of Northern Ireland. Some lower vulnerability areas have been identified in the southern section of the Proposed Scheme, interspersed with higher vulnerability where the route crosses thin soils or river alluvium which enable increased infiltration to underlying groundwater bodies.
- 16.5.54 Groundwater vulnerability is summarised in Table 16.4, with further details provided in Appendix 16C.

Groundwater yield and productivity

- 16.5.55 Groundwater productivity, related to the local aquifers, associated with the Precambrian metamorphic sandstones and mudstones that underlie the route between New Buildings and Omagh is generally limited, with groundwater flow dependent on the presence of fractures and water supply yields are generally low.
- 16.5.56 Productivity related to the aquifers associated with the Devonian and Carboniferous sandstone, limestone and conglomerate formations south of Omagh is generally moderate. However, there are potentially localised high to moderate yields in places, mainly through fracture and fissure flow but also occurring as porous flow.
- 16.5.57 There are localised areas of good groundwater flow associated with granular drift deposits comprising glacial sands and gravels and coarse grained alluviums. Areas of note include the Strule valley between Victoria Bridge and Newtown Stewart, where there is highly productive local aquifer, and the Burn Dennet and Glenmornan River valleys, which, though less productive, are locally important.
- 16.5.58 Within the River Foyle floodplain there is substantial variability in local aquifer yield and productivity, due to the highly variable mix of coarse and fine-grained alluviums.
- 16.5.59 Groundwater also provides base flow to surface water features such as wetlands and watercourses, local geological conditions determine the relative proportion of base flow in surface water catchments, as discussed in the surface waters baseline section. In dry periods, such base flow input may help maintain surface water flows, retain wetland characteristics and/or maintain good quality ecological conditions.

Groundwater abstractions

- 16.5.60 Information received from NIEA indicates there are no public groundwater abstractions within 1.2km of the Proposed Scheme.
- 16.5.61 The location of private wells and springs derived from the desk-based studies, landowner questionnaires and site inspections and monitoring are shown on Figure 16.2-16.18. The investigations have confirmed 24 actively used wells or springs located within the vested area, with a further 79 actively used wells located nearby.
- 16.5.62 Most of the confirmed abstractions are used for farm supply, potable supply for the farm household, livestock watering or irrigation. A small number of supplies are used for industrial purposes or non-farm household supply.

Table 16.4 WFD Groundwater Classification and Vulnerability

WFD Groundwater Body WFD ID	Related WFD Surface Waterbodies	General Groundwater Vulnerability	WFD Overall Status
Claudy UKGBNI4NW003	River Foyle Burn Dennet	High	Good
Ballybofey UKGBNI4NW048	Finn River	High	Good
Gortin UKGBNI4NW004	Mourne River	High	Good
Castledearg UKGBNI4NW005	Derg River	High	Good
Omagh UKGBNI4NW006	River Strule Camowen River Fairy Water Drumragh River	Low High at locations with shallow soil coverage and river alluvium	Good
Aughnacloy UKGBNI4NB007	River Blackwater	Low High at locations with shallow soil coverage and river alluvium	Good

Peatlands

- 16.5.63 Peat bog areas are distributed throughout the study area and are dependent on the water regimes that support them for their survival. The status, condition and extent of many of the areas associated with the Proposed Scheme corridor are such that they are generally of low value in terms of their nature conservation value. Four are, however, of medium to very high importance.
- 16.5.64 The location and extent of all areas of peat located within the potential influence of the Proposed Scheme is identified in Appendix 16C. At the medium and high importance locations, the Proposed Scheme crosses pockets of deep peat in intra-drumlin areas, these are not designated areas.

- 16.5.65 The two areas considered of very high importance are Tully Bog SAC & ASSI and McKean's Moss ASSI, shown on Figure 16.1 and Figure 16.10-16.11 (Tully Bog) and Figure 16.4 (McKean's Moss).
- 16.5.66 Tully Bog is located 60m west of the Proposed Scheme (relative to a proposed upgrading of an existing road) to the north-west of Omagh, within the Fairy Water surface catchment and underlain by the Omagh groundwater body.
- 16.5.67 McKean's Moss is located 80m west of the Proposed Scheme between Ballymagorry and Strabane, within the Glenmornan River surface catchment and underlain by the Claudy groundwater body.
- 16.5.68 Both Tully Bog and McKean's Moss sites are designated as raised bogs, which have generally been considered rainwater-fed raised domes and effectively isolated from local surface water and groundwater influence. However, in late 2014 NIEA indicated that ongoing (as yet unpublished) research had demonstrated that raised bogs in Northern Ireland can be hydrologically linked to the groundwater regime in the surrounding area. The specific locations of these raised bogs in relation to the local landforms suggest groundwater hydrological linkages would be limited and are not likely to be the primary influence on the water conditions present.

16.6 Predicted impacts and mitigation

Surface waters

- 16.6.1 The Proposed Scheme requires substantial earthwork activities to achieve the designed vertical alignment and the installation of a large number of components which would interact with surface waters; 150 watercourse crossings (13 bridges and 137 culverts for smaller watercourses), 104 watercourse diversions and 91 mainline drainage outfalls. There are an additional 2 bridging structures which cross floodplain rather than watercourses. These component locations are shown on Figures 16.2-16.18 and each component, relative to WFD surface hydrological catchment, is identified in Table 16.5.

Table 16.5 Bridges, culverts, watercourse diversions and drainage outfalls in each hydrological catchment

Local Management Area	WFD Surface Waterbody Name WFD ID	Surface Water Interactions
Burn Dennet and Foyle	Foyle and Faughan Estuaries UKGBNI5NW250010	3 Bridges 8 Watercourse Diversions 21 Culverts 19 Mainline Outfalls
	Burn Dennet UKGBNI1NW010101070	1 Bridge 3 Mainline Outfalls
	Glenmornan River UKGBNI1NW010101075	1 Bridge 1 Watercourse Diversion 3 Culverts 3 Mainline Outfalls
Derg and Mourne	Finn River UKGBNI1NW010103063	1 Watercourse Diversion 3 Culverts 6 Mainline Outfalls
	Mourne River UKGBNI1NW010102074	1 Bridge 7 Watercourse Diversions 15 Culverts 7 Mainline Outfalls
	Derg River 1 (Lower) UKGBNI1NW010102095	1 Bridge 2 Mainline Outfalls
	River Derg Tributary (Coolaghy Burn) UKGBNI1NW010102005	1 Bridge 1 Mainline Outfall
Strule	River Strule UKGBNI1NW010102020	18 Watercourse Diversions 19 Culverts 10 Mainline Outfalls
	River Strule UKGBNI1NW010102093	5 Watercourse Diversions 6 Culverts 2 Mainline Outfalls
	Fairy Water UKGBNI1NW010102041	1 Bridge 1 Watercourse Diversion 1 Culvert 4 Mainline Outfalls
	Drumragh River UKGBNI1NW010102006	1 Bridge 5 Watercourse Diversions 6 Culverts 5 Mainline Outfalls

Local Management Area	WFD Surface Waterbody Name WFD ID	Surface Water Interactions
Strule	Camowen River UKGBNI1NW010102033	14 Watercourse Diversions 11 Culverts 5 Mainline Outfalls
	Routing Burn UKGBNI1NW010102090	1 Bridge 7 Watercourse Diversions 6 Culverts 4 Mainline Outfalls
	Eskragh Water UKGBNI1NW010102008	5 Watercourse Diversions 6 Culverts 1 Mainline Outfall
	Eskragh Water UKGBNI1NW010102089	3 Watercourse Diversions 6 Culverts 3 Mainline Outfalls
Blackwater	Blackwater Tributary (Roughan Burn) UKGBNI1NB030307180	9 Watercourse Diversions 12 Culverts 3 Mainline Outfalls
	Ballygawley Water UKGBNI1NB030307175	2 Bridges 7 Watercourse Diversions 7 Culverts 6 Mainline Outfalls
	River Blackwater (5) UKGBNI1NB030308201	5 Watercourse Diversions 7 Culverts 2 Mainline Outfalls
	Blackwater Aughnacloy UKGBNI1NB030307041	8 Watercourse Diversions 8 Culverts 5 Mainline Outfalls

Construction related pollution

16.6.2 Potential impacts during construction relate to:

- release of sediment into watercourses as a result of activities such as topsoil stripping, earthworks and installation of highway structures; and
- spillage of fuels, lubricants, hydraulic fluids and cement.

16.6.3 The highest risk of sedimentation or spillage affecting watercourses would be at locations where construction would be required alongside and within 50m of a watercourse, where watercourse diversions are proposed, where bridges and culverts provide for the crossing of watercourses and at drainage discharge outfalls. There will

also be a requirement for accommodation and temporary structures, these would be carefully located and designed to minimise impact upon surface waters, following the same good practice principles employed for permanent mainline structures.

16.6.4 There are a number of Pollution Prevention Guidelines (PPGs) good practice guidance documents available from the Department of the Environment and Heritage website and by organisations such as CIRIA for site environmental management:

- PPG1: General guide to the prevention of pollution;
- PPG2: Above ground oil storage tanks;
- PPG3: The use and design of oil separators in surface water drainage systems;
- PPG4: Disposal of sewage where no mains drainage is available;
- PPG5: Works in, near or liable to affect watercourses;
- PPG6: Working at construction and demolition sites;
- PPG7: Construction and operation of fuelling stations;
- PPG8: Safe storage and disposal of used oils;
- PPG10: Highway depots;
- PPG18: Managing fire water and major spillages;
- PPG21: Pollution incident response planning;
- PPG22: Dealing with spillages on highways;
- PPG23: Maintenance of structures over water;
- PPG 26: Safe storage drums and intermediate bulk containers;
- CIRIA Report C532: Control of water pollution from construction sites. Guidance for consultants and contractors;
- CIRIA Report C648: Control of Water Pollution from Linear Construction Projects – Technical Guidance; and
- CIRIA: Control of Water Pollution from Linear Construction Projects, Site Guide.

16.6.5 From such documents there are a number of mitigation measures which would be applied in all cases and some which are specific to particular design features and locations. Those which would generally apply comprise:

- preparation of method statements to be agreed prior to commencement of works with NIEA and Loughs Agency / DCAL for all locations where working is required within 50m of existing watercourses, in accordance with Pollution Prevention Guideline (PPG) 5 – Works and Maintenance in or Near Water;
- environmental incident response plans will be prepared and submitted for approval prior to construction works commencing;
- identification of defined working zones and areas which are to be excluded from access for construction purposes within method statements;

- 50m minimum exclusion zone for the site compounds and any stockpiling of soils, rock and granular materials in relation to environmentally sensitive watercourses or abstraction locations, minimum of 10m from all watercourses;
- secure storage of fuels and potentially hazardous construction materials in bunded storage areas with external cut off drainage. Fuel would be stored in double skinned tanks with 110% capacity. Storage locations shall be at least 10m from any watercourse and 50m from sensitive watercourses or abstraction locations;
- refuelling and lubrication of construction vehicles and plant at dedicated hard standing areas, located at least 50m from watercourses with spill kits and appropriate cut-off drainage. Appropriately trained personnel shall be responsible for refuelling activities;
- safe refuelling methodologies developed for large plant, where relocation to refuelling areas is not reasonably practicable;
- regular monitoring of construction plant to check for oil or fuel leaks and specific checks prior to commencement and throughout extended periods of construction activity near to watercourses;
- collection of wash down from aggregate stockpiles via cut off drains, using settlement to remove solids, monitoring suspended solids and pH levels prior to discharge to the receiving watercourse;
- collection and treatment of wash down water from delivery wagons and concrete lorries, monitoring suspended solids and pH levels prior to discharge to the receiving watercourse;
- collection of waste fuels and other fluid contaminants in leak-proof containers, prior to removal to an approved recycling facility;
- the installation of construction-phase drainage as a priority before substantial earthworks commence, surface runoff shall be intercepted before entering construction site and separately transferred to local surface waters to avoid site contamination;
- retention of strips of existing vegetation, wherever possible, along the immediate margins of existing watercourses, vegetation only to be stripped immediately before required, rather than long periods in advance of engineering requirement;
- rapid re-vegetation of profiled and soiled areas to minimise the area of potential soil loss, resulting in sediment-bearing run-off;
- treatment of sediment-laden runoff prior to discharge, typical measures, subject to location and volumes, may include use of silt fences, silt traps, filter bunds, settlement ponds and/or proprietary silt treatment units;
- use of coffer dams or temporary water diversions where in-channel works are required to provide for dry working conditions. The method of isolation used would be dependent on the scale and timing of the works and the size and sensitivity of the watercourse;

- pumping of water from contained in-stream working areas onto a land site with peripheral cut off drainage to settle out solids or the use of 'silt buster' type equipment to settle out suspended solids, prior to discharge of the water to an existing watercourse;
- Watercourse monitoring at locations where construction activity has reasonable potential to effect water quality, to monitor NIEA discharge limit standard of 50mg/l sediment. Including upstream and downstream monitoring to evaluate Proposed Scheme influence against baseline value;
- where possible, culverts and diversions to be constructed offline and diversion to the new channel would be timed to allow for the establishment of vegetation within the channel. Construction would proceed from the low end of the newly constructed watercourse channels, to minimise sedimentation, with 'breakthrough' of upper end of the channel and release of flow only when new channel is suitably prepared; and
- use of pre-cast concrete structural materials, where feasible, to minimise placing of wet concrete during near-channel or in-channels works.

Construction alongside watercourses

- 16.6.6 There is one high risk location where the Proposed Scheme would follow an alignment which runs alongside and encroaches to within 50m of an existing watercourse. This comprises the section of the proposed dual carriageway between Ch. 18750 - 19500, where it runs along the eastern margin of the Finn River on the western fringe of Strabane. The Finn River at this location is designated as the Foyle and Tributaries SAC / River Finn SAC. At this particularly sensitive location additional mitigation to the measures and protocols described in section 16.6.5 would take the form of a lined barrier to prevent the migration of soil/sediment into the river and control pollution associated with accidental spillages during construction.
- 16.6.7 The Proposed Scheme is also within 50m of the Foyle and Tributaries SAC / River Finn SAC boundary between Ch. 3100 - 3300, however this occurs where the SAC boundary extends inland from the bank of the River Foyle, with the Proposed Scheme approximately 100m from the river bank.
- 16.6.8 Construction also occurs alongside the River Foyle, downstream of the SAC boundary and hence without hydrological linkage upstream to the SAC, within 50m of the river bank, at a number of other locations; Ch. 0, Ch. 170, between Ch. 300 - 350, Ch. 600 - 1100, Ch. 1850 - 2600 and close to Ch. 2750. At the southern end of the scheme, construction activity is within 50m of the River Blackwater between Ch. 92950 - 93100.
- 16.6.9 Additionally, there are also a large number of locations where the approach to watercourse crossings necessitates construction activity within 50m of non-designated watercourses.
- 16.6.10 With the proposed mitigation in place, the magnitude of impact would be negligible such that the impact on the very important surface water quality attribute (SAC) would be neutral. The magnitude of impact on the other surface water quality attributes,

ranging from low to high, would not exceed minor adverse or slight adverse significance.

Bridges

- 16.6.11 The proposals provide for 10 bridges to carry the Proposed Scheme over existing watercourses; Burn Dennet, Glenmornan River, Mourne River, Derg River, Coolaghy Burn (also known as channel UD_20), Fairy Water, Drumragh River, Routing Burn and Ballygawley Water (2 crossings). All are WFD classified. The sections of the Mourne River and the Derg River at the proposed bridging locations are included in the River Foyle and Tributaries SAC / River Finn SAC, with both attributes of very high importance. The remaining surface water quality attributes range from high to low importance.
- 16.6.12 All of the proposed bridges over watercourses are open clear span structures and would not require in-stream working. Construction would, however, involve the use of heavy plant equipment and earthwork activities close to the banks. Additional mitigation to that described in 16.6.5 would involve the use of coffer dams along the margins of the watercourses to enable construction to proceed and control potential release of sediment into the watercourses. With the proposed mitigation in place, the magnitude of impact would be negligible such that the impact on attributes of all levels of importance would be neutral.

Culverts, watercourse diversions and drainage outfalls

- 16.6.13 There are 137 culverts proposed to accommodate the passage of watercourses beneath the Proposed Scheme. Many are artificially modified channels or field drains. Provision has also been made for 104 watercourse diversions in order to minimise the number of culverts and these are typically orientated perpendicular to reduce the length of culvert. The proposals also provide for 91 drainage outfalls all of which would discharge to existing watercourses.
- 16.6.14 With the adoption of the mitigation measures described in 16.6.5 which would restrict activities undertaken within the watercourse channel, establish protocols on working distances, provide for temporary barriers to reduce sediment transport and include soil stabilisation measures to limit sediment transport, impacts on surface water quality associated with the installation of these design components would be short-term, localised and reversible. The magnitude of impact would be minor or negligible and the effect on these attributes of importance ranging from high to low would be slight or neutral.
- 16.6.15 Four outfalls would be installed at the low water mark in the transitional (estuary) waters of the River Foyle (S1-OF-1.1, S1-OF-2.1A S1-OF-2.1B, S1-OF-25) between New Buildings and Bready. These outfalls involve construction within the inter-tidal zone and the introduction of temporary works and coffer dams. There would be a localised disturbance to river-bed sediments which would constitute a negligible magnitude of impact in the context of the scale of the river and tidal influences. In the context of attributes which are very high, a negligible magnitude impact would result in a neutral effect.

Pollution of surface waters associated with routine runoff

- 16.6.16 Potential impacts during routine operation relate to discharges from carriageway drainage outfalls such as:
- release of sediment into watercourses which can lead to sedimentation of watercourses, deterioration in water quality and subsequent damage to habitat and sensitive species;
 - release of sediment-bound pollutants into watercourses potentially building up chronic levels of pollutant in watercourse sediments; and
 - release of soluble pollutants into watercourses causing acute pollution, including dissolved copper and dissolved zinc.
- 16.6.17 The 91 drainage outfalls proposed have been subject to the 3 Step HAWRAT assessment described in 16.4.7-16.4.11. The results of the assessments are provided in Appendix 16E. They demonstrate that, allowing for proposed mitigation in the form of sustainable drainage systems, typically wet/retention ponds, all outfalls pass the HAWRAT criteria. The results also demonstrate that all applicable outfalls pass the cumulative assessment, at locations where there is more than one discharge on the same reach of a watercourse. All outfalls also pass the assessment relating to Environmental Quality Standards (EQS).
- 16.6.18 The contribution of the road runoff sediments within the transitional waters (waters with tidal influence) of the River Foyle and Finn River has been assessed. The results of this assessment are provided within Appendix 16E and demonstrate that the contributions of routine runoff sediment from carriageway discharges to these channels are very small and accordingly have very small percentage contributions in comparison to baseline river sediment load conditions in these watercourse stretches.
- 16.6.19 The outcome of the discharge assessments for all proposed drainage outfalls demonstrates that during operations all outfalls would perform acceptably in relation to release and dilution of pollutants into surface watercourses and therefore would not adversely affect downstream surface water abstractions.
- 16.6.20 Given that all individual outfalls and all cumulative outfalls assessment pass all required standards, the magnitude of impact on the receiving surface watercourses with attribute importance ranging from very high to low is considered negligible and the significance of impact neutral.

In-stream sedimentation

- 16.6.21 The results of the in-stream sedimentation calculations undertaken to determine sediment concentrations downstream of proposed drainage outfalls, relative to the Loughs Agency target concentration of 25mg/l, are detailed in Table 16E.1 in Appendix 16E.
- 16.6.22 The data demonstrates that concentrations associated with all outfalls, with the proposed sustainable drainage systems installed, are within the target requirement across attribute importance levels, ranging from very high to low, and are considered negligible and the effect is neutral.

Accidental spillage during use

- 16.6.23 Potential impacts from accidental spillage once the Proposed Scheme is open to use relate to vehicle accidents causing fuel spillage or spillage of liquid cargo carried by delivery vehicles, draining from the carriageway via mainline outfalls, leading to pollution of the receiving watercourse.
- 16.6.24 The results of the calculations relating to accidental spillage during use demonstrate the highest risk for any of the proposed outfalls based on the annual probability of a serious pollution incident would be a 1 in 1100 year return period, with outcomes for individual drainage networks provided in Appendix 16E. This outcome is considerably less than the standard 1 in 100 year minimum target and the 1 in 200 year target (for discharge outfalls where there is a relationship to a designated site) identified in the DMRB as being indicative of a need for consideration to be given to further mitigation.
- 16.6.25 As good practice, pollution control valves would be installed immediately upstream of the discharge location in all drainage networks. These would facilitate isolation of the drainage network from the relevant receiving watercourse, following a spillage incident, and pending completion of appropriate clean-up procedures. Ponds and other sustainable drainage techniques in each drainage network would also provide containment and treatment following an accidental spillage.
- 16.6.26 It has accordingly been concluded that the magnitude of impact on the receiving surface watercourses, with attribute importance ranging from very high to low, would be negligible and the effect neutral.

Impacts associated with changes in surface water flow characteristics

- 16.6.27 The presence of the proposed bridges, culverts, watercourse diversions and drainage outfalls has the potential to affect water quality and the status of existing watercourses as a result of:
- changes in channel form and gradient;
 - changes in flow volumes and flow rates; and
 - erosion and sedimentation.
- 16.6.28 As a result there could be:
- a reduction in the availability of surface water resources and deterioration in water quality relied on by users downstream of these design components;
 - deterioration or loss of aquatic and marginal habitats;
 - harm to aquatic fauna; and
 - severance of passage for aquatic fauna.
- 16.6.29 Impacts related to aquatic habitats and fauna are discussed in Chapter 11.
- 16.6.30 It should be noted that neither Tully Bog SAC ASSI nor McKean's Moss ASSI raised bogs are considered connected hydrologically to surface water features influenced by the Proposed Scheme, due to these being primarily rainwater-fed features with surface water flowpaths radiating outwards from the raised bogs into nearby watercourses,

existing perimeter drainage ditches further limit the potential for surface water interaction with the Proposed Scheme.

- 16.6.31 The design proposals for bridges, culverts, watercourse diversions and drainage outfalls have accordingly been developed in light of the identified risks. Measures proposed specific to each component are described below and interactions with specific watercourse locations are detailed in Appendix 16D.

Bridges

- 16.6.32 The adoption of open clear span structures for the 10 bridges proposed over the larger watercourses would ensure the existing channel section and vertical profile would remain unaltered. The design also allows for the setting back of bridge supports from the river channel and bank to allow the continuation of the riparian corridor beneath the bridge.
- 16.6.33 The upstream faces of bridge piers would be streamlined to reduce the risk of large wood debris becoming trapped during flood flows, which can lead to turbulence and potentially increased erosion, sedimentation and flooding.
- 16.6.34 Information derived from the fluvial geomorphological assessment undertaken for proposed bridges, culverts and watercourse diversions has resulted in proposals for pier protection and / or river bank erosion at the bridge locations for 7 of the proposed bridges: Burn Dennet, Mourne River, Derg River, Coolaghy Burn, Fairy Water, Routing Burn and Ballygawley Water. Details of the proposals are provided in Table 16F.1 within Appendix 16F.

Drainage outfalls

- 16.6.35 Drainage outfalls have been located on sections of watercourses where active erosion and deposition are less likely and would discharge as close as possible to 45° in the direction of flow, to reduce the risk of turbulence and erosion.
- 16.6.36 Outfalls would have mitred headwalls for ease of maintenance and would be constructed such that no part of the structure would protrude beyond the line of the watercourse bank to avoid obstruction of waterborne debris.
- 16.6.37 Outfall pipes would be installed to minimise the height between the pipe and watercourse bed, thus minimising erosion, but high enough to ensure the pipe remains clear of any sediment build-up and that high water levels within the watercourse do not back up into the road drainage system. Where there is a risk of backflow up the outfall pipe during high river flows a non-return valve may be fitted. This would be selected and fitted for ease of maintenance and to minimise the risk of blockages or entrapment to otters and fish. Erosion protection in the form of stilling basins, erosion protection aprons, stone rip-rap or geotextiles would be provided where high velocity discharges may result in scour. Erosion protection on the opposite bank may also be used, if deemed necessary.

Culverts

- 16.6.38 Culverts have been sized to ensure hydraulic capacity and natural channel widths would be maintained through the structure.

- 16.6.39 The invert of each culvert would be buried below natural bed level and backfilled with appropriate bed material to allow the natural bed level to be maintained. A minimum depth of 150mm bed material would be maintained within the culverts where there is no salmonid interest. Where salmonid interest has been identified, the minimum depth would be 350mm. Allowance has been made for both bed depths relative to sizing and hydraulic capacity. The bed material will reflect that found within the existing watercourse and would include boulders in relevant locations to provide bed structure and rest places for fish migration.
- 16.6.40 Culverts have been designed to replicate existing watercourse gradients, other than where changes in length of a watercourse or engineering constraints preclude such an approach.
- 16.6.41 Scour protection would be provided at entry and exit points to protect the structure and avoid the development of a drop or cascade that fish cannot negotiate. Information derived from the fluvial geomorphological assessment undertaken for proposed bridges, culverts and watercourse diversions has resulted in proposals for erosion protection for 6 of the proposed culverts; Blackstone Burn, UD15, UD22, UD26, UD90 and Roughan Burn. Details of the proposals are provided in Table 16F.1 in Appendix 16F.

Watercourse diversions

- 16.6.42 All of the proposed watercourse diversions are located on tributary channels many of which are artificial, such as field drains, or have heavily modified stretches. New sections of channel would be designed in detail to reflect existing channels in cross section, gradient and channel bed characteristics, including features such as pools and riffles. This includes maintaining a dynamic bed slope so that it is not eroding or accreting. Similarly, bank habitats would have appropriate vegetation replacement. The cross section at bends would be typically deep on the outside of the bend and shallow on the inside with lateral and longitudinal variations incorporated in the design, where appropriate, to provide diversity of habitat. Low flow conditions would be considered within the design to ensure that an adequate depth of water is maintained for specific ecological, fisheries, recreation and amenity reasons, as appropriate. In some instances gradients would vary by virtue of the diversion being noticeably longer or shorter than the section which it would replace.
- 16.6.43 Information derived from the fluvial geomorphological assessment, provided in Appendix 16F, has resulted in additional data to inform the detailed design of the diversion and/or erosion protection for 5 of the proposed diversions on watercourses; UD33, UD44, UD69, UD89 and Lisadavil.
- 16.6.44 Taking into account the proposed design and mitigation measures, for geomorphological attributes ranging from high to low, it has been concluded the magnitude of impact associated with the substantial majority of the proposed watercourse diversions would be negligible, with a small number minor, such that the effect would be neutral or slight adverse.

Surface water abstractions

- 16.6.45 There are no surface water abstraction locations within the vesting area of the Proposed Scheme and therefore none that would require decommissioning due to the Proposed Scheme.
- 16.6.46 There are 2 public surface water abstraction locations downstream of the Proposed Scheme, on the main channels of the Mourne River and the Camowen River. These are located 2.5km and 4km downstream, respectively, of the nearest planned infrastructure. There are also 8 private surface water abstractions downstream, of which there are 2 within 1km, both approximately 100m downstream of the nearest proposed infrastructure. These are industrial supplies associated with Supermix Concrete Ltd, Newtown Stewart, and Dalradian Gold Ltd, Omagh. Further details on surface water abstractions are provided in Appendix 16C.
- 16.6.47 Construction activities could reduce local water quality, however, given the seasonal variations in water quality and large dilution potential (and good practice measures identified in 16.6.5), it would not be anticipated that there would be any measurable reduction in water quality at abstraction locations greater than 1km downstream.
- 16.6.48 Surface water flows would not be affected by construction activity on main channels, with smaller channel interactions being carefully managed to reduce flow alterations using temporary and permanent diversions.
- 16.6.49 The Northern Ireland Water shall be informed of the programme of anticipated construction activities and consulted to establish appropriate locations, parameters, frequency of monitoring and reporting of water quality data prior to construction commencing in the area upstream of the Mourne River and Camowen River abstraction locations.
- 16.6.50 The owners of the 2 private surface water abstractions located downstream and within 1km of the Proposed Scheme (Supermix Concrete Ltd and Dalradian Gold Ltd) shall be consulted at the detailed design stage to establish specific information on existing supply infrastructure, water resource requirements and, if applicable, an appropriate monitoring strategy commencing pre-construction, to ensure continuity of supply. Potential temporary and permanent substitution of supply options shall be identified as contingency measures, should monitoring confirm reduced resource availability.
- 16.6.51 Prior to construction, further surveys shall be undertaken for surface abstraction assets. Should additional locations be identified, these supplies would be treated on the same basis as the supplies discussed above.
- 16.6.52 Taking account of good practice design and mitigation measures (including monitoring and potential substitution of supplies, as applicable) this would be a negligible magnitude impact on very high (public abstractions) and high (private abstraction) importance attributes, of neutral significance.

Flood risk

- 16.6.53 Road embankments can cause obstruction within a floodplain and take up floodplain capacity which extends floodplain extent or depth elsewhere. Embankments can also act as a barrier to receding floodwaters.

- 16.6.54 Bridges, culverted channels and watercourse diversions can all exacerbate flood risk, with sediment accretion, obstruction with debris and under-sized cross sectional areas causing local and upstream flooding issues.
- 16.6.55 Flood modelling has been undertaken for all watercourses where there is known to be significant flooding issues, with 25 hydraulic models constructed to determine floodplains for various return periods. Flood Risk classification was completed for the 'design' events; 1% annual exceedance probability (1% AEP) for river floodplains and 0.5% AEP for tidal floodplains.
- 16.6.56 There are a number of good practice flood management guidance documents available, those of particular relevance for this scheme are as follows:
- Rivers Agency guidance and documents; Guidelines for Road Schemes, Guidance on Flood Risk Assessment and Guidance on Floodplain Storage Compensation;
 - Revised Planning Policy Statement 15: Planning and Flood Risk (2014);
 - CIRIA Report C679: SuDS Manual; and
 - CIRIA Report C624: Development and Flood Risk: Guidance for the Construction Industry.
- 16.6.57 Generally, flood impacts have been mitigated using measures which include some, or all of the following; appropriately sized culverts, clear span structures, appropriately designed watercourse diversions, connectivity structures to maintain floodplain conveyance where floodplains are bisected by the road alignment and compensatory storage where there is material volumetric floodplain encroachment..
- 16.6.58 All proposed culverts have been designed to accommodate a 1% annual exceedance period (AEP) flow. Small culverts (1500mm diameter or less) would include a minimum of 300mm freeboard allowance above the 1% AEP level within the culvert. Large culverts and bridges (> 1500mm diameter) would include a minimum of 600mm freeboard allowance above the 1% AEP within the watercourse/culvert.
- 16.6.59 Bridges have been designed as clear span structures and for 1% AEP with a minimum freeboard of 600mm.
- 16.6.60 Where diversions are proposed within existing floodplain, the channel capacity has been designed to be the same as the existing channel, and will therefore not exacerbate the existing flood risk. Where proposed diversions result in the new reach lying outside of existing floodplain the channel has been designed to take the 1% AEP flow. This ensures that flood risk is not introduced to new areas. The aim of the hydraulic design of each watercourse diversion has been to replicate the size, shape and hydraulics of the channel to be replaced as closely as possible. This includes consideration for the flow, cross sectional area and gradient. Diversion dimensions have been designed on a like-for-like basis, wherever possible.
- 16.6.61 Floodplain connectivity culverts have been designed and located to maintain floodplain conveyance where floodplains are bisected by the road alignment. These features enable flood flow to pass through road embankments at defined locations and drain from the floodplain to local watercourse channels.

- 16.6.62 There will be some loss of floodplain storage capacity where the Proposed Scheme crosses the various floodplains. Areas of lost capacity have been identified and compensatory storage provided by re-profiling adjacent land. At specific locations, for example the Foyle floodplain, it is envisaged that compensatory storage would not be appropriate as the flood risk is influenced by tidal movements/surges and the flooding mechanism is dominated by the floodplain's ability to convey flow; therefore the influence of storage is reduced and mitigation such as incorporating large connectivity structures into the Proposed Scheme has been agreed with Rivers Agency.
- 16.6.63 To create the required volume for flood compensatory storage, the Flood Compensatory Storage Areas would be excavated and re-contoured with a series of terraces or steps. The stepped nature of the contouring would also mean that during more frequent flood events, the steps would limit the extent of the flood waters by forming an effective barrier preventing the inundation extending over the whole of the storage area.
- 16.6.64 Where it has been assessed that there is the potential for increased flood risk from drainage discharge, flow attenuation would be included as mitigation prior to discharge. Attenuation ponds and basins will be designed to control the rate of discharge, thereby reducing peak flows in receiving watercourses.
- 16.6.65 Flood risk receptors have been identified as predominantly agricultural. However, within the Foyle River system, Omagh and Ballygawley River models, there are a small number of properties within existing floodplain and these remain at risk from flooding. No new or additional properties have been brought into floodplains as a result of the Proposed Scheme.
- 16.6.66 Taking account of good design and mitigation measures, there would be a slight adverse impact relating to flood risk as a result of the Proposed Scheme.

Groundwater

- 16.6.67 The Proposed Scheme requires substantial earthwork activities in order to achieve the designed vertical alignment. This includes a large number of road cuttings, which would remove topsoil, drift deposits and/or rock. Due to the increased impermeable area from the road carriageway and associated infrastructure, there would also be a potential loss of infiltration to underlying groundwater bodies. Table 16.6 summarises interactions in relation to the groundwater bodies crossed by the Proposed Scheme.

Table 16.6 Scheme interactions with groundwater

WFD Groundwater Body Name WFD ID	Scheme Interactions with Groundwater
Claudy UKGBNI4NW003	7 cuttings with potential for slight/moderate local impact 0.05% loss of permeable area due to road surface
Ballybofey UKGBNI4NW048	3 cuttings with potential for slight/moderate local impact 0.51% loss of permeable area due to road surface
Gortin UKGBNI4NW004	9 cuttings with potential for slight/moderate local impact 0.04% loss of permeable area due to road surface
Castledearg UKGBNI4NW005	7 cuttings with potential for slight/moderate local impact 0.05% loss of permeable area due to road surface
Omagh UKGBNI4NW006	27 cuttings with potential for slight/moderate local impact 0.10% loss of permeable area due to road surface
Aughnacloy UKGBNI4NB007	5 cuttings with potential for slight/moderate local impact 0.08% loss of permeable area due to road surface

Construction related pollution

- 16.6.68 Groundwater quality is generally higher than surface water quality in this region, with groundwater less susceptible to pollution, largely due to the barrier presented by overlying soil and drift deposits. However, should groundwater become contaminated, it is more difficult to remedy in comparison with surface waters.
- 16.6.69 The potential impacts upon groundwater during construction largely relate to the earthwork activities and particularly those involving removal of soil and drift deposits during creation of cuttings and other locations where earthworks occur close to or below the water table. These activities could create or shorten pathways for soluble pollutants to contaminate groundwater.
- 16.6.70 Potential sources of pollution include:
- fuel, oil and hydraulic fluid leaks from construction machinery, spillage during refuelling of vehicles and leakage from temporary fuel storage facilities; and
 - temporary drainage works and settlement lagoons.
- 16.6.71 Pollution prevention mitigation measures to be undertaken to protect the surface waters during construction (provided in 16.6.5) would also protect the underlying groundwater due to hydrological linkages between surface water and groundwater bodies.

- 16.6.72 As for surface water, it is important to establish dry working areas in order to minimise potential for contamination to be introduced to the groundwater. Where construction is required in areas of shallow groundwater, such as peatland and adjacent to some river corridors where there is increased opportunity for groundwater contamination, ground investigations would be undertaken pre-construction to establish water table depth and identify site-specific methods to enable construction to occur safely, with recognition that groundwater levels would naturally fluctuate depending on season and recent rainfall events. Working in such areas may involve additional techniques or procedural controls to reduce pollution risk or the provision of temporary dry working areas.
- 16.6.73 Good practice publications are listed in 16.6.4, many of which also apply to groundwater management, particularly NIEA PPG5 (Works in, near or liable to affect watercourses). In addition, CIRIA Report 515: Groundwater Control Design and Practice provides guidance specific to groundwater management.
- 16.6.74 From good practice publications there are a number of mitigation measures that would be applied to reduce pollution impacts on groundwater (alongside the mitigation measures itemised in 16.6.5):
- applying good source control on all potential contaminants with storage and refuelling undertaken at specific sites on hardstandings and appropriately trained and equipped personnel responsible for adherence to good practice to reduce both likelihood and severity of a pollution incident causing an effect on groundwater;
 - where contaminated land is identified and requires construction activity, NIEA advice would be sought on appropriate practices, applicable groundwater authorisations would be requested and conditions adhered to;
 - collection of waste fuels and other fluid contaminants in leak-proof containers, prior to removal to an approved recycling facility; and
 - ensuring surface water drainage systems are designed to avoid infiltration of soluble contaminants into groundwater.
- 16.6.75 The assessment of potential pollution impact from construction on groundwater, taking account of mitigation, is considered a minor magnitude impact on these high importance attributes and is of slight adverse effect.

Pollution associated with routine runoff and accidental spillage

- 16.6.76 The road drainage networks were assessed following DMRB Method C Assessment, with results in Appendix 16E demonstrating that all drainage networks registered an initial medium risk outcome, prior to the application of mitigation measures.
- 16.6.77 The water quality treatment components for the Proposed Scheme road drainage are designed to discharge to surface receiving watercourses, removing sediment and soluble pollutants via sediment settling and uptake in plant material. Pollution control valves would be fitted in all drainage networks to facilitate detaining contaminants. These treatment types are designed for surface water discharge, thereby further reducing the risk of impact to groundwater. Any infiltrating water would be anticipated to be of relatively low volume and adequately treated by the above methods prior to

any entry to groundwater. Further mitigation measures would involve detailed design using ground investigation data to target specific networks where interruption of infiltration pathways between the surface water drainage network and underlying groundwater systems would reduce this risk. Applicable methods could include impermeable lining systems for ponds and for non-pipework channels linking carriageway drainage to the discharge outfall.

- 16.6.78 Accidental spillages would be collected within the surface water system for treatment and detainment, with the likelihood of an incident to surface water assessed as very low (1 in 1100 years). It would be considered that the likelihood of an incident affecting groundwater would be considerably lower than to surface water due to the methods discussed above.
- 16.6.79 The potential pollution impact on groundwater once the road is in use, for both routine runoff and accidental spillage, when taking account of the surface water drainage system employed and mitigation therein, is of negligible magnitude on high importance attributes and hence of neutral significance.

Impacts on groundwater levels and flows

- 16.6.80 The introduction of increased impermeable area for road surfacing can reduce infiltration into groundwater and associated groundwater recharge. Dewatering activities during construction and excavation of cuttings or other areas where the water table is penetrated may also reduce local groundwater flows or levels. These can adversely affect local groundwater receptors, including surface waters and wetlands. Groundwater supply abstractions are discussed separately.
- 16.6.81 Mitigation measures which would apply comprise:
- groundwater seeping into cuttings would be contained, channelled and directed to the down gradient side of the cutting;
 - minimising dewatering activities during construction, prior to dewatering an assessment to be undertaken of potential impacts and, if sensitive receptor identified, appropriate site-specific mitigation measures employed;
 - new road embankments and foundations for road structures are not expected to create measurable impacts on groundwater flows, but local conditions, such as the presence of very shallow groundwater in thin permeable layers, may require additional investigation and assessments during the detailed design or construction stage to consider the provision of additional drainage measures (e.g. land drains) to avoid localised groundwater flooding; and
 - NIEA advice would be sought on dewatering practices, applicable groundwater abstraction licences would be requested and conditions adhered to.
- 16.6.82 Note that the designated raised bog sites of Tully Bog SAC ASSI and McKean's Moss ASSI are considered of limited hydrological connectivity to groundwater levels and flows that may be influenced by the Proposed Scheme, these being considered primarily rainwater-fed peatland features. The lowest elevation of Tully Bog SAC is approximately 62mAOD, with a natural clay ridge situated east of Tully Bog at approximately 64mAOD (i.e. above the lowest level of Tully Bog SAC), which does not

show evidence of groundwater seepage. The combination of the retention of this existing clay ridge, which is likely to act as a barrier for any groundwater movement, and the relative position of the Proposed Scheme, at a lower elevation further east, leads to a judgement that there would be very limited hydrological connectivity of any groundwater effects from the Proposed Scheme upon Tully Bog SAC. Existing perimeter drainage ditches further limit the potential for groundwater interaction with either McKean’s Moss or Tully Bog.

Appendix 16E provides details on the increased impermeable surface area and this increase as a proportion of the total surface area of each groundwater body, returning a maximum impermeable increase of 0.5% surface area (for the relatively small Ballybofey groundwater body), with the increase in other bodies recorded as no greater than 0.1%.

Road Cuttings

- 16.6.83 Cuttings below the groundwater table and associated drainage have the potential to cause localised effects by lowering groundwater levels in the aquifer adjacent to the cutting or alter groundwater flowpaths. This could also potentially affect nearby groundwater dependent receptors, such as wetlands, surface water bodies or groundwater abstraction locations. The results of the specific risk assessment undertaken for cuttings presented in Appendix 16E, demonstrate that groundwater is likely to be encountered in 75 of the proposed cuttings, with a further 44 cuttings also considered as having potential for groundwater interaction. A summary of potential significance for the 134 cuttings which have been assessed is provided in Table 16.7.

Table 16.7 Significance of Scheme Interactions for Individual Cuttings

Unknown - Unlikely	Unknown - Likely	Neutral	Slight	Moderate
37	9	30	46	12

- 16.6.84 There are 12 cuttings anticipated as having a potential moderate effect on nearby groundwater receptors, with a further 46 assessed as having a potential slight impact. These locations generally represent deeper cuttings which would intercept groundwater in moderate permeability local aquifers, typically superficial gravel deposits or sandstone bedrock. Each of the groundwater bodies in the Proposed Scheme corridor has at least one moderate impact cutting and thus these locations are widely distributed through the Proposed Scheme corridor.
- 16.6.85 As described in Appendix 16E, there are 5 non-aquifer features (surface water bodies) which are considered to be at moderate risk to be affected, with 3 operational quarries potentially moderately affected, and one disused quarry. The flooded Strabane quarry is considered to be at high risk of impact from the adjacent cutting, due to altered groundwater flowpaths leading into the flooded quarry. Only 4 locations were identified where there is potentially contaminated land in the region of the Proposed Scheme.
- 16.6.86 Further investigation and groundwater impact assessments for road cuttings which were identified as having a potential material impact on local groundwater (including

impacts on identified non-aquifer features like ponds, wetlands, quarries or contaminated land) shall also be undertaken to establish the requirement for appropriate location-specific mitigation measures as part of the detailed design. This may involve temporary or permanent measures to protect the affected features or groundwater control measures to reduce inflows into the cutting, such as cut off walls. The further investigations will also enable the road drainage design in these locations to accommodate groundwater inflows, i.e. to protect the road itself from potential groundwater flooding.

- 16.6.87 While there are not many active quarries along the Proposed Scheme, should any of those currently dewatering cease operation at some point in the future, this may result in a rise in local groundwater levels. This could potentially cause flooding of proposed road cuttings, if no adequate drainage measures are in place. This matter requires further consideration at the detailed design stage, in consultation with statutory stakeholders.
- 16.6.88 Taking account of the low increase in impermeable surface area for local groundwater bodies, the proposed mitigation and that a number of the groundwater resource effects would be highly localised, many of them temporary during the construction stage, the magnitude of effect would be minor on these high to medium importance attributes, of slight adverse significance.

Impacts on groundwater abstractions

- 16.6.89 Dewatering during construction and the excavation of cuttings may temporarily or permanently reduce the yield of nearby groundwater water abstractions. These impacts would need to be assessed (according to CIRIA Report 515) as part of the detailed design and monitoring activities included.
- 16.6.90 The majority of the groundwater bodies in the Proposed Scheme corridor have active groundwater abstraction supplies within the vesting area and all groundwater bodies have some abstractions close enough to the Proposed Scheme to be considered at risk due to cutting excavations. Details for each groundwater body are provided in Appendix 16E.
- 16.6.91 Subject to verification of status prior to construction, the 24 active well and spring groundwater supplies within the Proposed Scheme would be decommissioned. For such locations an alternative supply would be installed and commissioned prior to the commencement of local construction work, thereby ensuring continuity of supply. Care would be taken to ensure that the relocated supply would provide water of at least as good quality and quantity as the existing abstraction. This would apply to supplies providing drinking water to properties, water for livestock or water for other agricultural or industrial use.
- 16.6.92 Consultations would be held with the owners of the nearby 79 wells and spring supplies to establish current water requirements, proposed monitoring strategies and potential mitigation in advance of construction. These supplies would be monitored prior to and during the construction of local cuttings until construction is completed. Should monitoring establish that there is a consequent impact on a supply, mitigation would be

agreed with the landowner, appropriate to the severity of impact, which could involve provision of alternative temporary or permanent supply.

- 16.6.93 The Proposed Scheme may divide a property or farm from its water abstraction. Each location would be assessed individually to decide whether the most appropriate course of action would be to relocate the abstraction point or to protect the intake pipeline as it crosses the road corridor in such a way as to prevent any future damage or disruption to the supply. In some situations it may be decided that the best option would be to install a mains supply. This would only be undertaken with the full consent of the landowner and/or occupier, as appropriate. In all situations, the landowner and/or user of the water abstraction would be consulted and kept fully informed during the process.
- 16.6.94 Any additional supplies identified in future consultations with landowners or during pre-construction activities and considered at potential risk of impact, would be similarly provided for.
- 16.6.95 Taking account of mitigation and that a number of the effects would be temporary during the construction stage and with alternative water supplies provided for those within the Proposed Scheme (and other local groundwater supplies monitored), the magnitude of effect would be minor on these high to medium importance attributes and be of slight adverse significance.

Cumulative Impacts

- 16.6.96 As a catchment-based approach has been adopted for this assessment for both surface water and groundwater bodies, the process has considered and identified potential individual and cumulative impacts within each waterbody feature. This includes multiple temporary working areas during construction and the installation of Proposed Scheme components such as bridges, culverted channels, watercourse diversions, drainage outfalls and road cuttings, followed by the permanent presence of multiple components, relative to specific catchments and groundwater bodies.
- 16.6.97 Given the length of the Proposed Scheme, there are a very large number of Proposed Scheme components with interactions with surface waters and groundwater bodies, however, these interactions are generally well dispersed throughout the Proposed Scheme corridor. Additionally, the associated surface catchment areas and groundwater bodies are reasonably large and can be expected to absorb localised slight adverse impacts, following the application of good practice design and mitigation.
- 16.6.98 Thus, the magnitude of cumulative impacts upon surface water, flood risk or groundwater attributes are considered to be minor, of slight adverse significance.

Water Framework Directive Assessment

- 16.6.99 This is an assessment required by NIEA and has been undertaken following their published guidelines and with consultation throughout the process. As detailed in Appendix 16D, the Water Framework Directive Assessment considers local and catchment-wide influences and therefore cumulative effects within water bodies.
- 16.6.100 Following an initial screening exercise, 48 locations on the Proposed Scheme have been assessed and datasheets provided (plus 3 representative examples of screened-out watercourse locations), with the results demonstrating that with the application of

good practice (and at some locations site-specific mitigation) there is no adverse effect to current Water Framework Directive status, nor impediment to achieving target status in the future, for any water body. Thus, WFD objectives are met by the Proposed Scheme.

16.7 Conclusions and effects

- 16.7.1 Table 16.8 summarises the potential impacts upon various attributes of the features of the water environment from construction and operation of the Proposed Scheme, discussed in the sections above. This table is an adaptation of the format described in Table A4.2 taken from the DMRB Volume 11, Section 3, Part 10 Annex IV.

Table 16.8 Summary of Potential Impacts and Significance

Potential Impact	Feature	Attribute	Importance	Magnitude (Post-Mitigation)	Significance
Pollution due to increased sedimentation and increased risk of accidental spillage of pollutants such as oil, fuel, chemical and concrete during construction	River Foyle and Tributaries SAC, River Finn SAC	Surface Water Quality & Biodiversity	Very High	Negligible	Neutral
	Foyle and Faughan Estuaries Burn Dennet and Foyle LMA, Surface Water		Very High	Negligible	Neutral
	Burn Dennet Burn Dennet and Foyle LMA, Surface Water		High	Negligible	Neutral
	Glenmornan River Burn Dennet and Foyle LMA, Surface Water		High	Negligible	Neutral
	Finn River Derg and Mourne LMA, Surface Water		Very High	Negligible	Neutral
	Mourne River Derg and Mourne LMA, Surface Water		Very High	Negligible	Neutral
	Derg River (including Coolaghy Burn) Derg and Mourne LMA, Surface Water		Very High	Negligible	Neutral
	River Strule (across both WFD stretches) Strule LMA, Surface Water		Medium	Minor Adverse	Slight Adverse
	Fairy Water Strule LMA, Surface Water		High	Negligible	Neutral
	Drumragh River Strule LMA, Surface Water		High	Minor Adverse	Slight Adverse ¹
	Camowen River Strule LMA, Surface Water		High	Minor Adverse	Slight Adverse ¹
	Routing Burn Strule LMA, Surface Water		High	Minor Adverse	Slight Adverse ¹
	Eskragh Water (across both WFD stretches) Strule LMA, Surface Water		Medium	Minor Adverse	Slight Adverse
	Blackwater Tributary (Roughan Burn) Blackwater LMA, Surface Water		High	Minor Adverse	Slight Adverse ¹
	Ballygawley Water Blackwater LMA, Surface Water		High	Minor Adverse	Slight Adverse ¹
River Blackwater (5) Blackwater LMA, Surface Water	High	Minor Adverse	Slight Adverse ¹		
Blackwater Aughnacloy (Aughnacloy River) Blackwater LMA, Surface Water	Low	Minor Adverse	Neutral		

Potential Impact	Feature	Attribute	Importance	Magnitude (Post-Mitigation)	Significance
Pollution during operational period, due to routine runoff and accidental spillage	River Foyle and Tributaries SAC, River Finn SAC	Surface Water Quality & Biodiversity	Very High	Negligible	Neutral
	Foyle and Faughan Estuaries Burn Dennet and Foyle LMA, Surface Water		Very High	Negligible	Neutral
	Burn Dennet Burn Dennet and Foyle LMA, Surface Water		High	Negligible	Neutral
	Glenmornan River Burn Dennet and Foyle LMA, Surface Water		High	Negligible	Neutral
	Finn River Derg and Mourne LMA, Surface Water		Very High	Negligible	Neutral
	Mourne River Derg and Mourne LMA, Surface Water		Very High	Negligible	Neutral
	Derg River (including Coolaghy Burn) Derg and Mourne LMA, Surface Water		Very High	Negligible	Neutral
	River Strule (across both WFD stretches) Strule LMA, Surface Water		Medium	Negligible	Neutral
	Fairy Water Strule LMA, Surface Water		High	Negligible	Neutral
	Drumragh River Strule LMA, Surface Water		High	Negligible	Neutral
	Camowen River Strule LMA, Surface Water		High	Negligible	Neutral
	Routing Burn Strule LMA, Surface Water		High	Negligible	Neutral
	Eskragh Water (across both WFD stretches) Strule LMA, Surface Water		Medium	Negligible	Neutral
	Blackwater Tributary (Roughan Burn) Blackwater LMA, Surface Water		High	Negligible	Neutral
	Ballygawley Water Blackwater LMA, Surface Water		High	Negligible	Neutral
River Blackwater (5) Blackwater LMA, Surface Water	High	Negligible	Neutral		
Blackwater Aughnacloy (Aughnacloy River) Blackwater LMA, Surface Water	Low	Negligible	Neutral		

Potential Impact	Feature	Attribute	Importance	Magnitude (Post-Mitigation)	Significance
Alteration to availability of local surface water abstractions, during construction and operation	Foyle and Faughan Estuaries Burn Dennet and Foyle LMA, Surface Water	Surface Water Resources	Medium	Negligible	Neutral
	Burn Dennet Burn Dennet and Foyle LMA, Surface Water		High	Negligible	Neutral
	Glenmornan River Burn Dennet and Foyle LMA, Surface Water		Medium	Negligible	Neutral
	Finn River Derg and Mourne LMA, Surface Water		High	Negligible	Neutral
	Mourne River Derg and Mourne LMA, Surface Water		Very High	Negligible	Neutral
	Derg River (including Coolaghy Burn) Derg and Mourne LMA, Surface Water		Very High	Negligible	Neutral
	River Strule (across both WFD stretches) Strule LMA, Surface Water		High	Negligible	Neutral
	Fairy Water Strule LMA, Surface Water		High	Negligible	Neutral
	Drumragh River Strule LMA, Surface Water		Low	Negligible	Neutral
	Camowen River Strule LMA, Surface Water		Very High	Negligible	Neutral
	Routing Burn Strule LMA, Surface Water		Low	Negligible	Neutral
	Eskeagh Water (across both WFD stretches) Strule LMA, Surface Water		Medium	Negligible	Neutral
	Blackwater Tributary (Roughan Burn) Blackwater LMA, Surface Water		Low	Negligible	Neutral
	Ballygawley Water Blackwater LMA, Surface Water		Medium	Negligible	Neutral
	River Blackwater (5) Blackwater LMA, Surface Water		High	Negligible	Neutral
Blackwater Aughnacloy (Aughnacloy River) Blackwater LMA, Surface Water	Low	Negligible	Neutral		

Potential Impact	Feature	Attribute	Importance	Magnitude (Post-Mitigation)	Significance
Alteration to surface water flow characteristics that may affect channel geomorphology, erosive or deposition processes	Foyle and Faughan Estuaries Burn Dennet and Foyle LMA, Surface Water	Fluvial Geomorphol.	Low	Minor Adverse	Neutral
	Burn Dennet Burn Dennet and Foyle LMA, Surface Water		High	Negligible	Neutral
	Glenmornan River Burn Dennet and Foyle LMA, Surface Water		High	Negligible	Neutral
	Finn River Derg and Mourne LMA, Surface Water		Low	Negligible	Neutral
	Mourne River Derg and Mourne LMA, Surface Water		Medium	Minor Adverse	Slight Adverse
	Derg River (including Coolaghy Burn) Derg and Mourne LMA, Surface Water		High	Negligible	Neutral
	River Strule (across both WFD stretches) Strule LMA, Surface Water		Low	Minor Adverse	Neutral
	Fairy Water Strule LMA, Surface Water		Medium	Negligible	Neutral
	Drumragh River Strule LMA, Surface Water		Low	Minor Adverse	Neutral
	Camowen River Strule LMA, Surface Water		Low	Minor Adverse	Neutral
	Routing Burn Strule LMA, Surface Water		Medium	Minor Adverse	Slight Adverse
	Eskragh Water (across both WFD stretches) Strule LMA, Surface Water		Low	Minor Adverse	Neutral
	Blackwater Tributary (Roughan Burn) Blackwater LMA, Surface Water		Medium	Minor Adverse	Slight Adverse
	Ballygawley Water Blackwater LMA, Surface Water		High	Minor Adverse	Slight Adverse ¹
	River Blackwater (5) Blackwater LMA, Surface Water		Medium	Minor Adverse	Slight Adverse
Blackwater Aughnacloy (Aughnacloy River) Blackwater LMA, Surface Water	Medium	Minor Adverse	Slight Adverse		

Potential Impact	Feature	Attribute	Importance	Magnitude (Post-Mitigation)	Significance
Potential for impact due to increased flood risk during construction and operation	Foyle and Faughan Estuaries Burn Dennet and Foyle LMA, Surface Water	Flood Risk	High	Major Adverse	Slight Adverse ²
	Burn Dennet Burn Dennet and Foyle LMA, Surface Water		High	Moderate Adverse	Slight Adverse ²
	Glenmornan River Burn Dennet and Foyle LMA, Surface Water		High	Moderate Adverse	Slight Adverse ²
	Finn River Derg and Mourne LMA, Surface Water		High	Moderate Adverse	Slight Adverse ²
	Mourne River Derg and Mourne LMA, Surface Water		High	Major Adverse	Slight Adverse ²
	Derg River (including Coolaghy Burn) Derg and Mourne LMA, Surface Water		Low	Major Adverse	Slight Adverse ²
	River Strule (across both WFD stretches) Strule LMA, Surface Water		High	Minor Adverse	Slight Adverse ²
	Fairy Water Strule LMA, Surface Water		High	Minor Adverse	Slight Adverse ²
	Drumragh River Strule LMA, Surface Water		Low	Moderate Adverse	Slight Adverse ²
	Camowen River Strule LMA, Surface Water		Low	Minor Adverse	Slight Adverse ²
	Routing Burn Strule LMA, Surface Water		Low	Major Adverse	Slight Adverse ²
	Eskragh Water (across both WFD stretches) Strule LMA, Surface Water		Medium	Major Adverse	Slight Adverse ²
	Blackwater Tributary (Roughan Burn) Blackwater LMA, Surface Water		High	Moderate Adverse	Slight Adverse ²
	Ballygawley Water Blackwater LMA, Surface Water		High	Major Adverse	Moderate Adverse ²
	River Blackwater (5) Blackwater LMA, Surface Water		Low	Negligible	Neutral
Blackwater Aughnacloy (Aughnacloy River) Blackwater LMA, Surface Water	Low	Moderate Adverse	Slight Adverse ²		

Potential Impact	Feature	Attribute	Importance	Magnitude (Post-Mitigation)	Significance
Pollution due to increased risk of accidental spillage of pollutants such as oil, fuel, chemical and concrete during construction	Claudy Groundwater	Groundwater Quality	High	Minor Adverse	Slight Adverse ³
	Ballybofey Groundwater		High	Minor Adverse	Slight Adverse ³
	Gortin Groundwater		High	Minor Adverse	Slight Adverse ³
	Castledearg Groundwater		High	Minor Adverse	Slight Adverse ³
	Omagh Groundwater		High	Minor Adverse	Slight Adverse ³
	Aughnacloy Groundwater		High	Minor Adverse	Slight Adverse ³
Pollution during operational period, due to routine runoff and accidental spillage	Claudy Groundwater	Groundwater Quality	High	Negligible	Neutral
	Ballybofey Groundwater		High	Negligible	Neutral
	Gortin Groundwater		High	Negligible	Neutral
	Castledearg Groundwater		High	Negligible	Neutral
	Omagh Groundwater		High	Negligible	Neutral
	Aughnacloy Groundwater		High	Negligible	Neutral
Impact upon local groundwater levels and flows, during construction and operation	Claudy Groundwater	Groundwater Resources	High	Minor Adverse	Slight Adverse ⁴
	Ballybofey Groundwater		Medium	Minor Adverse	Slight Adverse
	Gortin Groundwater		High	Minor Adverse	Slight Adverse ⁴
	Castledearg Groundwater		Medium	Minor Adverse	Slight Adverse
	Omagh Groundwater		High	Minor Adverse	Slight Adverse ⁴
	Aughnacloy Groundwater		High	Minor Adverse	Slight Adverse ⁴

Potential Impact	Feature	Attribute	Importance	Magnitude (Post-Mitigation)	Significance
Alteration to availability of local groundwater abstractions, during construction and operation	Claudy Groundwater	Groundwater Resources	High	Minor Adverse	Slight Adverse ⁴
	Ballybofey Groundwater		Medium	Minor Adverse	Slight Adverse
	Gortin Groundwater		High	Minor Adverse	Slight Adverse ⁴
	Castledearg Groundwater		Medium	Minor Adverse	Slight Adverse
	Omagh Groundwater		High	Minor Adverse	Slight Adverse ⁴
	Aughnacloy Groundwater		High	Minor Adverse	Slight Adverse ⁴

¹ Following guidance provided as Note 2 on Table A4.5 in DMRB Volume 11, Section 3, Part 10 Annex IV to avoid listing significance outcome as two alternatives, given that these potential impacts are predominantly upon minor tributary channels which are likely to have lower attribute importance characteristics than that established for the associated main channel downstream (e.g. due to ecology), these have been evaluated as having a significance of Slight Adverse, rather than Slight / Moderate Adverse.

² Following guidance provided as Note 2 on Table A4.5 in DMRB Volume 11, Section 3, Part 10 Annex IV to avoid listing significance outcome as two alternatives, a number of locations have been assigned a single description of significance based upon professional judgement with reference to the qualifying criteria provided on Table A4.6 in DMRB Volume 11, Section 3, Part 10 Annex IV. In addition, at a number of watercourse/floodplain locations the importance and magnitude values quoted reflect a conservative evaluation procedure but these conservative values may not be coincident, therefore significance values reflect overall impact as per the qualifying criteria set out in DMRB Table A4.6. The impact significance values quoted are relevant to specific floodplain locations where the Proposed Scheme has the potential to influence flood risk and therefore do not represent flood risk conditions across the entire WFD Surface Water Body.

³ Following guidance provided as Note 2 on Table A4.5 in DMRB Volume 11, Section 3, Part 10 Annex IV to avoid listing significance outcome as two alternatives, given that these potential groundwater impacts are conservatively considered minor (but more likely to be negligible), these have therefore been evaluated as having a significance of Slight Adverse, rather than Slight / Moderate Adverse.

⁴ Following guidance provided as Note 2 on Table A4.5 in DMRB Volume 11, Section 3, Part 10 Annex IV to avoid listing significance outcome as two alternatives, given that these potential groundwater resource and abstraction impacts are considered very localised and many of which will be temporary, these have therefore been evaluated as having a significance of Slight Adverse, rather than Slight / Moderate Adverse.

Conclusions

Surface Water

Pollution from construction

16.7.2 Surface water interactions involve construction within 50m of watercourses for scheme components such as bridges, culverted channels, watercourse diversions and discharge outfalls. Construction activities necessitate the use of fuels, oils and chemicals plus substantial earthworks; all of which introduce potential contamination. Mitigation would incorporate good site environmental management practices with clear procedures and the installation of specific measures to protect the surface water environment.

16.7.3 This impact is assessed as not significant.

Pollution to surface waters from routine runoff

16.7.4 Once the road is open to use, routine runoff has the potential to introduce sediment and soluble contaminants, including copper and zinc, to the receiving watercourse. Ponds have been designed as the typical water quality treatment method, with ponds located adjacent to the discharge outfall. Prior to discharge, the 91 individual drainage networks have been designed to treat road runoff to pass all required discharge standards; HAWRAT, EQS and 'in river' 25mg/l sediment standard downstream of the outfall. Also sediment input into transitional waters, those with tidal influence, have been evaluated as discharging very low sediment loads relative to the natural sediment load of the River Foyle and Finn River. Cumulative outfall assessments were undertaken at the 21 locations where multiple outfalls discharge to the same stretches of watercourse, each of these also passed all standards.

16.7.5 Given that all individual and cumulative discharges pass all criteria, this impact is assessed as not significant.

Pollution to surface waters from accidental spillage

16.7.6 Once the road is open to use, there is the potential for an accidental spillage to occur and cause pollution to the downstream receiving watercourse. This has been assessed for all 91 drainage networks in terms of likelihood of an incident combined with that incident causing harm to a watercourse. The most likely network recorded a 1 in 1100 year return period, this is comfortably greater than both the standard 1 in 100 year and also the 1 in 200 year return period for sensitive watercourses close to designated waters. Additionally, pollution control devices would be installed in all drainage networks to contain and enable treatment of contaminants.

16.7.7 Given that all networks pass the required standard, this impact is assessed as not significant.

Alteration to surface water flow characteristics that may affect channel, erosive or deposition processes

16.7.8 The Proposed Scheme interactions on surface water flow characteristics are primarily the installation of watercourse diversions and culvert structures, these predominantly

occur on minor channels, which are often already modified or artificial. Such minor watercourses are often planned to be diverted to minimise culvert length below carriageway, embankments and new side road requirements. Mitigation measures include appropriate design and location of structures taking account of local flow and erosion / deposition characteristics. Where the Proposed Scheme interacts with larger surface waterbodies, there are no diversions or culverts planned, with clear span bridge structures used to cross the watercourse with an associated reduction in potential impact on these channels in terms of water quality, water resources and fluvial geomorphology.

- 16.7.9 There are a number of watercourse networks with large numbers of modifications to minor tributary channels. This impact is accordingly assessed as not significant.

Alteration to availability of surface water abstractions

- 16.7.10 Surface supplies could be effected by reduction in water quality or reduction in flows, thereby reducing the availability of the water resource, this would primarily be an impact at the construction stage as the discharges have been confirmed to meet required standards once the road is in use. There are 2 public and 8 private supplies located downstream of the Proposed Scheme, with 2 of these private supplies within 100m and the remainder over 1km distant. Mitigation measures include consultation with the owners of the public and nearest private water supplies to establish details of their resource requirements, infrastructure details and establish appropriate measures to monitor supplies, with further measures such as temporary substitution of supply, should monitoring indicate a reduction in resource availability related to water quality or flows.

- 16.7.11 Given the mitigation measures discussed, this impact is assessed as not significant.

Flood risk

- 16.7.12 Through the Flood Risk Assessment, the scheme and the associated mitigation has been assessed. For further details on the models, results and flood risk assessments please refer to the 2015 Flood Risk Assessment Report.

- 16.7.13 In summary, out of the 16 Water Framework Directive surface waterbodies evaluated, 1 has a moderate adverse impact (Ballygawley Water, due to interactions with existing flood defences), 14 have slight adverse impact and 1 neutral impact. Therefore, the overall impact on a scheme-wide basis is assessed as slight adverse and not significant.

Groundwater

Pollution from construction

- 16.7.14 Groundwater can be polluted by construction activities, groundwater pollution is less likely than surface water pollution due to the barrier presented by soil or drift deposits. Contamination to groundwater is more likely where construction activities remove soil or drift and occur close to or penetrate into the water table, such as during the creation of cuttings. Construction activities would incorporate good site environmental

management practices with clear procedures and mitigation measures to protect the groundwater environment.

16.7.15 This impact is assessed as not significant.

Pollution to groundwater from routine runoff and accidental spillage

16.7.16 Pollution could occur to groundwater once the road is in use, due to infiltration of soluble contaminants from routine runoff and accidental spillage events. All drainage networks have been designed to contain and treat contaminants as a surface water system.

16.7.17 These have been assessed for routine runoff as there may be inadvertent infiltration to groundwater. The assessment outcome was that all networks were medium risk, pre-mitigation. Mitigation measures include treatment of runoff and ensuring impermeable barriers are introduced for ponds where local conditions indicate that interaction between surface water and groundwater systems are most likely.

16.7.18 The accidental spillage outcomes for the surface water drainage networks are very low (1 in 1100 years at the most likely network), consequently the likelihood of damage to the groundwater would be lower still.

16.7.19 The impact for both routine runoff and accidental spillage impact on groundwater is assessed as not significant

Impacts on groundwater levels and flows

16.7.20 Groundwater levels and flows can be affected by increases in impermeable area reducing groundwater recharge and by alterations to groundwater levels and flows, predominantly due to dewatering and the excavation of road cuttings with depths extending below the water table. The increase in impermeable area from the Proposed Scheme for all groundwater bodies has been calculated and is very small in comparison with each groundwater body's surface area. Cuttings have been assessed for potential effect on nearby receptors and detailed ground investigation at cuttings identified as being of most concern would be undertaken pre-construction, with dewatering activities carefully controlled and the application of cut off walls, if required.

16.7.21 This impact is assessed as not significant.

Alteration to availability of groundwater abstractions

16.7.22 Local groundwater abstractions may be affected by construction activities or alterations in flows when the road is in use. Groundwater abstraction locations within the Proposed Scheme and those nearby have been identified. Surveys and monitoring activities undertaken since 2010 indicate that 24 supplies lie within the area of the Proposed Scheme and a further 79 are nearby and potentially affected by the scheme. Mitigation would involve consultation with all 103 supply owners and establishing resource use and a substitution supply for those within the area of the Proposed Scheme. The nearby supplies would be monitored and contingency measures agreed for replacement temporary or permanent supplies should monitoring indicate that the Proposed Scheme has led to a reduction in resource availability related to groundwater quality or yield.

16.7.23 This impact is assessed as a slight adverse effect, not significant.

Cumulative impacts on surface water, flood risk and groundwater

16.7.24 Cumulative impacts are assessed as not significant.

Overall impact assessment outcome on surface water, flood risk and groundwater

16.7.25 This assessment concludes that the significance of Proposed Scheme (cumulative) impacts on surface water, flooding and groundwater would be no greater than a slight adverse effect. The overall effect of the Proposed Scheme on surface water, flood risk and groundwater is therefore evaluated as not significant.

17 INTERACTIONS AND CUMULATIVE EFFECTS

17.1 Executive summary

17.1.1 Six projects were identified that would have the potential to result in cumulative effects with the Proposed Scheme. The third party developments noted were:

- Three Rivers Development;
- N14/N15 to A5 Link Road;
- Hazardous Substances Consent A/2011/0686/HSC;
- Bunderg Road Powerline Spur;
- Bunderg Road Wind Turbine; and
- Strabane Footbridge J/2008/0612/F.

17.1.2 The assessment has concluded that only the Three Rivers Development and N14/15 to A5 link road would have the potential to result in cumulative impacts. Both schemes would likely result in some cumulative impact on landscape character and nature conservation.

17.2 Scope of the assessment

17.2.1 This assessment focuses on the main likely significant cumulative effects rather than reporting every interaction.

17.3 Cumulative effects

17.3.1 There are 6 large schemes identified within proximity to the Proposed Scheme that could result in cumulative impacts with the A5WTC, the Three Rivers Development, Hazardous Substances Consent A/2011/0686/HSC, Bunderg powerline spur, Bunderg Road Wind Turbine, Strabane Footbridge and the N14/N15 to A5 Link Road.

The Three Rivers Development

17.3.2 The site is located along Lifford Road between Strabane and Lifford at the confluence of the rivers Finn, Mourne and Foyle. The development is a mixed used development involving retail, leisure and employment opportunities.

17.3.3 The construction phase for the Three Rivers developments is planned for 2016, whilst the construction of the A5WTC at this location is part of Phase 2 in 2021-2023. There is

therefore no overlap in construction activity which could have led to cumulative impacts on local receptors.

- 17.3.4 The Three Rivers development would result in moderate impacts on landscape character and visual impacts as a result of urbanising the area to the west of Strabane. Cumulative impacts may arise with the construction of the A5WTC with the introduction of additional infrastructure and lighting. In the short term, the impact would be substantial adverse. Mitigation screening planting is proposed for both schemes and as this planting matures, the landscape/visual impacts would reduce.
- 17.3.5 There would be cumulative impacts on fauna as a result of the works including bats, otters, badgers, birds and aquatic fauna. Both schemes would have some short term detrimental impact on these species, including some cumulative interactions. Both schemes propose mitigation and habitat creation measures that would reduce the impact on species in the medium term.
- 17.3.6 The Three River Development is expected to overall reduce flood risk in Strabane and Lifford as a result of the alterations to the river bank profile. In addition, drainage discharge rates and water quality as a result of the proposed mitigation, would be maintained at pre-development levels. As such no cumulative impacts on the water environment are anticipated.
- 17.3.7 Overall, there would be no significant traffic noise level increases on the existing road network as a result of the Three Rivers development. Some minor cumulative increases in noise may occur as a result of the impacts of the combined schemes.
- 17.3.8 The Three Rivers development would result in negligible changes to local air quality and as such no cumulative impacts are anticipated.
- 17.3.9 No additional mitigation is recommended as a result of cumulative impacts as each scheme has proposed mitigation were appropriate to minimise any adverse impacts.

The N14/N15 to A5 Link Road

- 17.3.10 The scheme involves a new link road from the A5WTC at Junction 7 to the existing N15 in County Donegal. This would include the construction of a new multi-span structure across the Finn River and associated floodplain.
- 17.3.11 Cumulative impacts relating to landscape character are likely as a result of the two new roads as it would bring new infrastructure, lighting and traffic into the landscape. The Three Rivers scheme is in close proximity so all schemes would change the local character on completion, affecting the feel of the River Finn corridor and urban edge. All schemes would include planting which aims to integrate the projects into the environment. Cumulative impacts would reduce as the mitigation planting establishes.
- 17.3.12 Cumulative impacts relating to ecology may also occur as a result of additional development of the river corridor. Species such as otter and bats would be disturbed

during construction with some residual effects on completion of the works from operational disturbance from lighting and traffic.

- 17.3.13 No additional mitigation is recommended as a result of cumulative impacts as each scheme has proposed mitigation where appropriate to minimise any adverse impacts.

Hazardous Substances Consent A/2011/0686/HSC

- 17.3.14 The approved planning application is located in the Carrakeel Industrial Park 11km to the north of the A5WTC. The scheme involves developing the site to store hazardous materials. Both projects are in close proximity to the River Foyle, however with the proposed designs and mitigation no cumulative impacts are anticipated on this watercourse. Given the distance between the two schemes, no other cumulative impacts are anticipated.

Bunderg Road powerline spur

- 17.3.15 The project involves an 11kw powerline spur adjacent to 41 Bunderg Road, Newtownstewart crossing the River Strule. The project is located approximately 1km to the north east of the A5WTC at the nearest point. No cumulative impacts have been identified.

Bunderg Road Wind Turbine

- 17.3.16 The project involves a 250kw wind turbine to the north of Bunderg Road (J/2011/0269/F) to serve a farm. No cumulative impacts have been identified between this development and the A5WTC.

Strabane Footbridge J/2008/0612/F

- 17.3.17 The project involves a new footbridge linking Meeting House Street with recreation grounds at Melvin, Strabane. The proposed footbridge is located some 1050m east of the Proposed Scheme and is separated from the Proposed Scheme by the urban area of Strabane. Given the distance from the Proposed Scheme, the intervening urban environment and likely impacts of the proposed bridge no cumulative impacts have been identified.

18 SCHEDULE OF ENVIRONMENTAL COMMITMENTS

18.1 Introduction

18.1.1 The findings related to impacts and effects reported in this ES take into account design and mitigation measures which would form an integral part of the Proposed Scheme should it progress to implementation. The schedule below details the measures upon which the findings have been based and which would be a mandatory requirement under the contract(s) for the construction and future management and maintenance of the A5WTC.

Table 18.1 Schedule of Environmental Commitments

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
Air Quality			
AQ1	<p>Contractors (and their sub-contractors) would put in place an approved dust minimisation plan, as part of the contract Construction Environmental Management Plan (CEMP) prior to the commencement of any works. Other mitigation requirements would include:</p> <ul style="list-style-type: none"> • The identification of a nominated Environmental Site Manager; • Notification procedures where potentially significant dust generating activities are required; • Method statements for the control of dust in such locations and complaint receipt; • Management procedures to ensure issues are addressed should they be raised by the public. • Roads and accesses would be kept clean; • Grout or cement-based materials would be mixed using a process suitable for the prevention of dust emissions; • Fine material would not be stockpiled to an excessive height in order to prevent exposure to wind and/or dust nuisance; 	Pre and during construction	Contractor Environmental Manager

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	<ul style="list-style-type: none"> • Dust generating activities (e.g. cutting, grinding and sawing) would be minimised and weather conditions considered prior to conducting potentially dust emitting activities; • If possible, plant would be located away from site boundaries close to residential areas; • Water would be used as a dust suppressant where applicable; • Drop heights from excavators to crushing plant would be kept to a minimum. • Distances from crushing plant to stockpiles would be kept to the minimum practicable to control dust generation associated with the fall of materials; • Skips would be securely covered; • Soiling, seeding, planting or sealing of completed earthworks would be completed as soon as reasonably practicable following completion of earthworks; • Dust suppression and the maintenance of the surface of access routes would be appropriate to avoid dust as far as practicable, taking into account the intended level of trafficking; • Wheel wash facilities at major site exits. • Material would not be burnt on site; • Engines would be switched off when not in operation. 		
Cultural Heritage			
CH1	<p>Unknown Archaeology</p> <p>The areas of the Proposed Scheme which have not already been subject to archaeological evaluation/excavation would be subject to the new evaluation methodology recommended by NIEA, which comprises randomly placed trenches measuring 20-30m spaced no more than 20m apart. Archaeological remains found within these areas would have a 10m buffer excavated around them to look for further associated remains. Any further remains found would themselves be subject to the excavation of a 10m buffer. All areas of proposed groundworks (including areas for compounds, storage areas, access roads and car parks) need to be evaluated in this way.</p>	Pre-construction	<p>Works would be undertaken under the supervision of a suitably qualified and licensed archaeologist</p> <p>Agreement between TransportNI and the Northern Ireland Environment Agency (NIEA) - Built Heritage</p>

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
			Directorate prior to any archaeological or construction works commencing.
CH2	<p>Impacts to Setting</p> <p>Where the impacts on known sites and features relate solely to the setting of the asset, mitigation has been proposed in the form of screen planting within the landtake for the Proposed Scheme for the following archaeological assets:</p> <ul style="list-style-type: none"> • Site 4 Plantation Village • Site 49 Strabane Canal • Site 102 Standing Stone • Site 122 Standing Stone • Site 150 Wedge Tomb • Site 151 Court Tomb • Site 182 Platform Rath • Site 184 Court Tomb • Site 212 Rath • Site 217 Large Enclosure • Site 222 Tycanny Hillfort • Site 232 Platform Rath • Site 233 Rath • Site 252 Rath • Site 254 Hilltop Enclosure 	During and post Construction	Agreement between TransportNI and the NIEA - Built Heritage Directorate prior to any archaeological or construction works commencing.

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	<ul style="list-style-type: none"> • Site 255 Platform Rath (schedule) – Requires excavation and Scheduled Monument Consent. • Site 260 Rath • Site 262 Hilltop Enclosure <p>and for the following built heritage assets:</p> <ul style="list-style-type: none"> • Site 20 Listed Church • Site 53 Listed Cottage • Site 89 Red House (listed) • Site 90 Gate Lodge (listed) • Site 101 Gallany House (listed) • Site 108 Ballyfatten House • Site 256 Palymira Lodge (listed) • Site 266 Manse (listed) • Site 267 House (listed) 		
CH3	<p>Historic Building Recording</p> <p>Where a historic building/structure would be subject to direct impacts by the Proposed Scheme (total or partial demolition) a programme of historic building recording would be undertaken.</p> <p>Archaeological assets:</p> <ul style="list-style-type: none"> • Site 23 Demolished buildings <p>Built heritage assets:</p> <ul style="list-style-type: none"> • Site 12 Corn Mill Site • Site 23 Vernacular Buildings • Site 85 Castletown House (listed) Listed Building consent required for total demolition, building 	Pre-construction	Agreement between TransportNI and the NIEA - Built Heritage Directorate prior to any archaeological or construction works commencing.

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	<p>recording would be required prior to demolition.</p> <ul style="list-style-type: none"> • Site 106 Vernacular dwelling • Site 112 Vernacular dwelling • Site 145 Vernacular dwelling • Site 169 Bridge • Site 170 Bridge • Site 173 Bridge • Site 176 Bridge • Site 200 Vernacular building 		
Landscape			
L1	<p>The planting strategy for the Proposed Scheme includes a mix of planting and habitat creation proposals with the combined objectives of landscape and ecological mitigation. In the context of landscape objectives, the proposals provide for integration of the Proposed Scheme into the local landscape and screening of the road and associated traffic where sensitive receptors would be potentially subject to significant visual impacts. As the detail design is developed, it would be the requirement that the planting proposals accord with the objectives, functions and extents described, specifically in relation to areas identified for screening purposes. It is not the intention that mature trees would be planted to provide “instant screening” (this may take 5-10 years) but that the planting affords an appropriate level of visual and character mitigation from the year of opening.</p> <p>Existing hedges on the Proposed Scheme boundary and some areas of mature vegetation within the vesting extents are identified for retention wherever possible.</p> <p>Planting measures would be implemented in accordance with the strategy as described in Chapter 6 and illustrated in Figs 6.18 to 6.45</p>	During and post Construction	As part of TransportNI standard maintenance regime.
L2	<p>Environmental Barriers would be constructed at specific locations for visual or combined visual & acoustic mitigation. The barriers would be timber fencing (to acoustic design specification where necessary) at a height of 2m at the following locations:</p>	During Construction	As part of TransportNI standard maintenance regime.

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	<p>Ch. 7160 – 7410 Bready (west of mainline) (acoustic, with visual screen benefit)</p> <p>Ch. 10910 – 11200 Clogher (east of mainline) (visual & acoustic)</p> <p>Ch. 14350 – 14560 55a Park Road (north of J3) (visual screen with acoustic benefit)</p> <p>Ch. 15880 – 16310 North of Strabane (south of J3) (acoustic, with visual screen benefit)</p> <p>Ch. 16800 – 17000 Strabane (west of mainline) (visual screen with acoustic benefit)</p> <p>Ch. 18630 – 19260 Urney Road / Glenfinn Park (visual & acoustic)</p> <p>Ch. 63870 – 64070 Tattykeel / Doogary (visual & acoustic)</p> <p>Ch. 65480 – 65940 Tullyrush Road (acoustic, with visual screen benefit)</p> <p>Ch. 71620 – 71750 Routingburn (acoustic, with visual screen benefit)</p> <p>Ch. 86160 – 86420 Lisgenny Road (visual screen with acoustic benefit)</p>		
L3	<p>Landscape earthworks would be introduced to screen views of the road and its traffic. Where screen mounding is proposed it would be used in conjunction with proposed planting. Mounding would be typically no less than 2m in height, with 1:2.5 side slopes and 2m width across the crown of the mound, graded out to cutting slopes or embankment profiles and with smooth, flowing transitions.</p> <p>This combination of screen mounding and planting is proposed in the following locations:</p> <p>Ch. 3000 – 3400 Magheramason (east side of mainline)</p> <p>Ch. 8200 – 8300 A5 Victoria Road (west of mainline, between pond area and property boundary)</p> <p>Ch. 8450 – 8850 A5 Victoria Road / Willow Road (west of mainline)</p> <p>Ch. 9350 – 9800 Ash Avenue (east of mainline)</p> <p>Ch. 22770 – 22800 Sion Mills (east of mainline)</p> <p>Ch. 27000 – 27150 Sion Mills (east of mainline)</p> <p>Ch. 37000 – 37300 J10 Drumlegagh Road North, Baronscourt Road (east of mainline)</p>	During Construction	As part of TransportNI standard maintenance regime.

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	<p>Ch.39000 – 39300 Honeyford Road / Glen Road (east of mainline)</p> <p>Ch. 40700 – 41100 West Road (west of mainline)</p> <p>Ch. 47300 – 47850 Lisnagirr Road (east of mainline)</p> <p>Ch. 62600 – 62900 A5 / Tattykeel (east of mainline)</p> <p>Ch. 66950 – 67100 Rarone Road (east of mainline, in conjunction with deposition area S3-DEP-004)</p> <p>Ch. 68380 – 68600 North of Moylagh Road (west of mainline)</p> <p>Ch. 71780 – 72100 Routingburn Road (west of mainline)</p> <p>Ch. 73570 – 73770 Newtownsaville (east of mainline)</p> <p>Ch. 80000 – 80200 Errigal (south of mainline)</p> <p>Ch. 84020 – 84320 Lisdoart (south of mainline)</p> <p>Ch. 92030 – 92300 south of Caledon Road (west of mainline)</p>		
L4	<p>Profiling of cutting slopes to mitigate severity of impact is proposed in the following locations:</p> <p>Ch. 6500 – 7250 Bready</p> <p>Gortmonly Hill is a prominent feature of the Foyle Valley landscape; the proposed cutting at Bready would be widely exposed to views in particular along the line of the river valley. Sensitive profiling would remove the necessity for berms and to allow for a varied cutting slope profile that integrates with the natural form of the hill. As much of the existing woodland to the southern exit of the cutting should be retained where at all possible.</p> <p>Ch. 38400 – 38700 Harry Avery’s Castle (east of mainline)</p> <p>Localised slope steepening within the cutting where the Proposed Scheme passes close to Harry Avery’s Castle, west of Newtownstewart. This would enable the width of cutting to be reduced so as to avoid a potential break in the skyline profile when viewed from Newtownstewart.</p> <p>Ch. 54000 – 54300 Clanabogan Road (east of mainline)</p> <p>Outer edge of cutting slope to the south-east of Clanabogan Road would be profiled to integrate with</p>	During Construction	As part of TransportNI standard maintenance regime.

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements								
	<p>drumlin landform.</p> <p>Ch. 56000 – 56300 (east of mainline):</p> <p>The northern edge of the cutting slope would be profiled to reflect adjacent landform and integrate the cutting slope.</p> <p>Ch. 68870 – 68950 Moylagh (east of mainline):</p> <p>Additional land-take at Moylagh to ensure integration of transition into cutting with graded landform, in combination with additional planting provision.</p>										
L5	<p>Where deposition areas are proposed and subject to verification of need specific to each location, grading and integration strategies have been adopted based on the following principles:</p> <ul style="list-style-type: none"> • Areas would be graded to complement the forms and slopes of existing landform; • Grading would be merged into the dual carriageway verge wherever possible to establish a continuity of profile from road to the newly profiled landform; and • Field patterns would be agreed with potential landowners to ensure that there is no significant impact on local landscape pattern (any proposed field patterns indicated in the Specimen Design are based on an assumed re-instatement of existing field boundaries, subject to consultation and agreement). <p>Any proposed change to a deposition area in terms of material volumes deposited or geographical extents of fill must ensure that the grading and integration strategy conforms to the above principles. Deposition areas that combine to provide a visual screen function to sensitive receptors would not be modified to the extent that this function is compromised.</p> <p>Proposed deposition areas are located at the following locations:</p> <table border="0"> <tr> <td>S1-DEP-001 Ch. 6000 – 6300 (east of mainline)</td> <td>S3-DEP-003 Ch. 64600 – 64950 (west of mainline)</td> </tr> <tr> <td>S1-DEP-002 Ch. 7350 – 7800 (east of mainline)</td> <td>S3-DEP-004 Ch. 66910 – 67100 (east of mainline)</td> </tr> <tr> <td>S1-DEP-003 Ch. 7300 – 7750 (west of mainline)</td> <td>S3-DEP-008 Ch. 70000 – 70400 (east of mainline)</td> </tr> <tr> <td>S1-DEP-004 Ch. 9150 – 9400 (east of mainline)</td> <td></td> </tr> </table>	S1-DEP-001 Ch. 6000 – 6300 (east of mainline)	S3-DEP-003 Ch. 64600 – 64950 (west of mainline)	S1-DEP-002 Ch. 7350 – 7800 (east of mainline)	S3-DEP-004 Ch. 66910 – 67100 (east of mainline)	S1-DEP-003 Ch. 7300 – 7750 (west of mainline)	S3-DEP-008 Ch. 70000 – 70400 (east of mainline)	S1-DEP-004 Ch. 9150 – 9400 (east of mainline)		During Construction	As part of TransportNI standard maintenance regime.
S1-DEP-001 Ch. 6000 – 6300 (east of mainline)	S3-DEP-003 Ch. 64600 – 64950 (west of mainline)										
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S1-DEP-004 Ch. 9150 – 9400 (east of mainline)											

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	<p>S2-DEP-001 Ch. 45700 – 46000 (east of mainline)</p> <p>S2-DEP-004 Ch. 45750 – 46050 (west of mainline)</p> <p>S2-DEP-005 Ch. 46700 – 46950 (east of mainline)</p> <p>S2-DEP-009 Ch. 48050 – 48150 (east of mainline)</p> <p>S2-DEP-010 Ch. 51600 – 51950 (west of mainline)</p> <p>S2-DEP-011 Ch. 52500 – 52700 (west of mainline)</p> <p>S2-DEP-012A Ch. 55200 – 55450 (east of mainline)</p> <p>S2-DEP-013 Ch. 54900 – 55400 (east of mainline)</p> <p>S2-DEP-014 Ch. 54950- 55400 (west of mainline)</p> <p>S3-DEP-001 Ch. 62400 – 62900 (west of mainline)</p> <p>S3-DEP-002 Ch. 64300 – 64650 (east of mainline)</p> <p>S3-DEP-009 Ch. 70600 – 70850 (east of mainline)</p> <p>S3-DEP-010 Ch. 71700 – 72000 (east of mainline)</p> <p>S3-DEP-012 Ch. 74400 – 74800 (east of mainline)</p> <p>S3-DEP-014 Ch. 76500 – 76800 (west of mainline)</p> <p>S3-DEP-022 Ch. 80650 – 81000 (north of mainline)</p> <p>S3-DEP-023 Ch. 81550 – 81650 (south of mainline)</p> <p>S3-DEP-024 Ch. 81750 – 81850 (south of mainline)</p> <p>S3-DEP-025 Ch. 81700 – 81900 (north of mainline)</p> <p>S3-DEP-026 Ch. 82300 – 83200 (north of mainline)</p> <p>S3-DEP-034 Ch. 89600 – 90000 (west of mainline)</p> <p>S3-DEP-038 Ch. 91900 – 92200 (east of mainline)</p>		
L6	<p>Planting types would include woodland and woodland edge (LE 2.1, 2.2), linear belts of trees and shrubs (LE 2.4), shrubs with intermittent trees (LE 2.5) and areas of scrub (LE 2.8).</p> <p>Woodland and scrub planting would comprise mixes of native species including ash, oak and wet</p>	During Construction	As part of TransportNI standard maintenance regime.

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	<p>woodland types as described in Appendix 11E.</p> <p>Amenity tree and shrub planting (LE 3.1) would be restricted to primary road junctions and settings near urban centres.</p>		
L7	<p>Land has been taken in the following locations for the specific purpose of providing screen planting:</p> <p>Ch. 9800 – 10050 Maghereagh (east of mainline)</p> <p>Ch. 20900 – 21100 Knockroe Road (west of mainline)</p> <p>Ch. 41100 – 41250 West Road (attenuation pond area)</p> <p>Ch. 63670 – 64140 Doogary (east of mainline)</p> <p>Ch. 65500 – 65880 Tullyrush Road (east of mainline)</p> <p>Ch. 70680 – 70940 Killadroy (east of mainline)</p> <p>Ch. 73730 – 73760 Newtownsaville (east of mainline)</p> <p>Ch. 76080 – 76400 north of Tycanny Road (east of mainline)</p>	During Construction	As part of TransportNI standard maintenance regime.
L8	<p>Larger nursery stock and/or increased planting densities would be provided as an element of the planting to serve as a partial screen measure in the following locations:</p> <p>Ch. 14300 - 14550 north of J3 (west of mainline)</p> <p>Ch. 16100 – 16500 A5 (east of mainline)</p> <p>Ch. 18670 – 19250 Urney Road / Glenfinn Park (east of mainline)</p> <p>Ch. 49250 – 49650 J11 Drumlegagh Road South (west of mainline)</p> <p>Ch. 51600 Mullaghmena Road (east of mainline)</p> <p>Ch. 63900 – 64050 Doogary (east / west of mainline)</p> <p>Ch. 80020 - 80200 Errigal Keerogue. (south of mainline)</p> <p>Ch. 86200 - 86400 Lisginny Road (south of mainline)</p>	During Construction	As part of TransportNI standard maintenance regime.

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
L9	<p>The proposals provide for the introduction of hedgerows and hedges along the majority of the Proposed Scheme subject to consultation with landowners. Where possible, existing hedges would be retained on boundaries.</p> <p>Hedges would comprise native species hedges (LE 4.2), native species hedgerows (LE 4.3) and native hedgerows with trees (LE 4.4). Typical mixes are hedge species mixes are described in Appendix 11E.</p>	During Construction	As part of TransportNI standard maintenance regime.
L10	<p>Areas of species rich grassland are proposed at 73 locations (see Figures 6.18-6.45) throughout the Proposed Scheme. Typical species mixes are described in Volume 1, Chapter 6, Table 6.10</p>	During Construction	As part of TransportNI standard maintenance regime.
L11	<p>Specific Retention of planting.</p> <p>Measures to ensure the specific retention of as much mature woodland and tree planting as possible at the following locations:</p> <p>Ch. 7200 - 7360 Bready (east of mainline): the retention of woodland at the southern exit of the proposed cutting.</p> <p>Ch. 33200 (east of mainline): Localised slope retention in order to retain existing mature woodland as possible.</p> <p>Ch. 63880 – 64080 Doogary (east of mainline): the retention of mature trees fronting local properties at Tattykeel.</p>	During Construction	As part of TransportNI standard maintenance regime.
Ecology and Nature Conservation			
EC1	<p>Mitigation measures during construction would be formalised in the Contractors CEMP and would address the following issues (the contractor would be required to ensure strict compliance with statutory authority requirements):</p> <ul style="list-style-type: none"> • Restrictions on working areas in close proximity to sensitive ecological receptors; • Imposition of a minimum 50m exclusion zone for the location of site compounds in relation to salmonid watercourses; • Suitable secure storage of hazardous, potentially polluting substances; 	During construction	<p>Appropriate ecological supervision.</p> <p>Consultation required pre and during construction with relevant organisations.</p>

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	<ul style="list-style-type: none"> • Programming of construction operations to avoid loss of bird nests during site clearance; • Programming of construction works to minimise the impacts to watercourses. • Development of method statements specific to construction activities involving potential ecological impacts, detailing of required measures to safeguard the interests and agreement of the method statement prior to commencement of works; • Development and agreement of a species protection plan and imposition of dust control measures as detailed under Air Quality; • Felling of mature trees would be undertaken following approval from the Environmental Manager; • Construction compounds would be reinstated as quickly as possible following the completion of construction; • Agreement and implementation of a site access traffic plan and traffic control measures with Transport NI prior to commencement of the works; and • The inclusion of a pollution response plan. <p>Works affecting potential bird nesting habitat, e.g. trees, scrub, hedgerows, riverine habitat and grassland, would be undertaken outside the main bird nesting season of March - August. Should this not be possible, works affecting potential bird nesting habitat would be checked by a suitably experienced ecologist. If active bird nests are found, work would be postponed until the young birds have fledged.</p>		
<p>Designated Sites <i>River SAC</i></p>			
EC2	<p>Habitat removal within the River SAC would be limited to the removal of bankside vegetation to enable protection to be introduced at the base of the abutment walls required to support clear-span bridges and to facilitate the implementation of drainage outfalls.</p>	During construction	<p>Appropriate ecological supervision.</p> <p>Consultation required pre and during construction with</p>

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
			relevant organisations.
EC3	Sediment runoff would be attenuated at the alignment north west of Maghermason by the construction of a wet retention pond and two drainage outlets onto a small tributary of the River Foyle approximately 50m from the northernmost boundary of the SAC.	During construction	Appropriate ecological supervision. Consultation required pre and during construction with relevant organisations.
EC4	<p>During construction watercourses with identified salmonid spawning and nursery habitat would not receive an increase of higher than 10mg/l of total suspended solids.</p> <p>All other watercourses would not receive an increase in total suspended solids of greater than 25mg/l. The achievement of these thresholds and the method for doing so are discussed in paragraph 16.5.5 in Chapter 16 of the ES. To achieve both thresholds during construction the contractor would transpose contract specific silt management plans into a CEMP.</p> <p>Within the contractors' CEMP a pollution response plan would be written and agreed with LA and NIEA prior to any construction work commencing on site. These documents would include as a minimum management roles and responsibilities, protocols, method statements and mitigation measures.</p>	During construction	Appropriate ecological supervision. Consultation required pre and during construction with relevant organisations.
EC5	<p>During construction of the drainage networks potential sediment release into receiving watercourses would be controlled by the advanced construction of permanent retention ponds with penstocks at the outfall from the ponds or the introduction of temporary settlement ponds pending completion of the permanent works.</p> <p>Contractors would ensure imported rock does not contain invasive species of plant</p>	During construction	Appropriate ecological supervision. Consultation required pre and during construction with relevant organisations.
EC6	Sediment release during operation at the 44 outfalls into the SACs (at locations indicated in table 16E.1 in Appendix 16E) would pass the HAWRAT and would be below the 25mg/l threshold recommended in the Water Framework Directive.	During construction	Appropriate ecological supervision. Consultation required pre and during construction with relevant organisations.

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
EC7	All drainage outfalls, including the 44 which would discharge within the SACs or tributaries and headwaters which eventually feed into watercourses within the designated sites would include a valve / penstock prior to discharge to facilitate routine or emergency maintenance of the drainage network.	During construction	Appropriate ecological supervision. Consultation required pre and during construction with relevant organisations.
EC8	The temporary bridges over the Burn Dennet, Glenmornan, River Derg and Fairy Water would be clear span temporary bridge structures that would be installed at a level which allows for flood water to pass underneath, and would not block movement of animals along the watercourse corridor.	During construction	Appropriate ecological supervision. Consultation required pre and during construction with relevant organisations.
EC9	Culverts on diverted sections of watercourses would be completed prior to abandonment of the relevant section of existing channel, and temporary sections of diverted watercourse would be provided along watercourses where culverts are to be constructed on-line.	During construction	Appropriate ecological supervision. Consultation required pre and during construction with relevant organisations.
EC10	Excavated soils would be temporarily set aside a minimum of 3m from the top of the bankside and any not required for reinstatement of the bankside would be removed from site once reinstatement is completed. In locations of relatively low flow, the works would be programmed for implementation at times of lowest flow between May and September.	During construction	Appropriate ecological supervision. Consultation required pre and during construction with relevant organisations.
EC11	<u>Noise and vibration impacts to Atlantic Salmon</u> Works would be undertaken between May to September at the Derg crossing. Continuous Flight Auger (CFA) piles would be used at the River Mourne crossing. In the case of the	During construction	Appropriate ecological supervision. Consultation required pre and during

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	<p>foundations for the abutment walls at other bridges, either CFA or drilled piles would be used.</p> <p>Construction procedures would include a soft-start methodology which would involve a gradual increase in force and intensity of drilling, and hence, noise and vibration, over a 30 minute.</p> <p>The soft-start methodology would be required each time the machinery is started following a 30 minute rest period. This process would be repeated at the start of each period of piling activity.</p>		<p>construction with relevant organisations.</p>
EC12	<p>Night working in the vicinity of watercourses identified as being of salmonid interest would not generally be allowed. However, circumstances may arise which require emergency works outside of daylight hours, in these cases lighting would be positioned/cowled to minimise light spill onto the watercourse and the duration would be kept to a minimum.</p>	<p>During construction</p>	<p>Appropriate ecological supervision.</p> <p>Consultation required pre and during construction with relevant organisations.</p>
EC13	<p>To ensure that instream vegetation loss is minimised on watercourses which constitute tributaries or headwaters of the SACs, pre-planted coir rolls of suitable native emergent and marginal vegetation would be inserted into the rip-rap during construction. Where possible, suitable bankside planting would be provided.</p> <p>Loss of instream habitat would be mitigated by embedding culvert bases, introducing gravels and boulders, the provision for natural sedimentation and boulders upstream and downstream of the structures (see specific WFD Data Sheets in Annex 16D.1).</p> <p>Replication of bed and channel characteristics of the watercourses and planting of marginal and bankside habitat which would reinstate the ecological characteristics of the original watercourse along the diversions on which they are located. It would also be a specific requirement of the contracts that construction of the new sections must be completed prior to the closure and abandonment of the diverted section.</p> <p>The de-watering of the abandoned sections would be carried out under supervision of an ecological clerk of works to ensure fish would be safely removed.</p>	<p>During construction</p>	<p>Appropriate ecological supervision.</p> <p>Consultation required pre and during construction with relevant organisations.</p>
EC14	<p>The following design principles would be adhered to in all salmonid watercourse channels and margins:</p> <ul style="list-style-type: none"> • Oversized box culverts would be installed on watercourses identified as being of importance to 	<p>During construction</p>	<p>Appropriate ecological supervision.</p>

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	<p>salmonids.</p> <ul style="list-style-type: none"> The diversion of watercourses to facilitate the introduction of a shorter culvert, with lower flow velocity downstream and better light penetration, at or close to right angles to the Proposed Scheme carriageway where the angle of crossing would otherwise be overly long or steep. The avoidance of steps in the vertical profile through culverts and along associated diverted watercourses; The avoidance of bends in culverts which could initiate the deposition of debris and obstruct passage. The adoption of vertical profiles through the culverts relative to length. 		<p>Consultation required pre and during construction with relevant organisations.</p>
EC15	<p>Night time working would not be permitted adjacent to watercourses where the presence of otter is confirmed through pre-construction surveys.</p>	<p>During construction</p>	<p>Appropriate ecological supervision. Consultation required pre and during construction with relevant organisations.</p>
EC16	<p>The following principles would be adhered to, to avoid impacts to otter:</p> <ul style="list-style-type: none"> location of compounds and storage of materials a minimum of 25m away from watercourses; fencing off of riparian habitat to be retained within working areas (see Figure 6.18-6.45); installation of suitable fencing to exclude otters from works areas near watercourses where use by the species has been established (see Figure 11.36); fencing or covering of excavations in excess of 2m depth over-night in the vicinity of watercourses where use by the species has been established (see Figure 11.36); provision of a suitable ramp within all uncovered excavations during non-working hours; and inclusion of a contractual requirement for contractors to provide details for temporary means of continued passage along watercourses during construction in location specific method statements pending the incorporation of permanent means of passage in the completed works. 	<p>During construction</p>	<p>Appropriate ecological supervision. Consultation required pre and during construction with relevant organisations.</p>

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	<ul style="list-style-type: none"> construction of artificial holts near the River Derg and Routing Burn crossings; <p>The artificial holts would be located in the vicinity of the proposed crossing of the Derg River and Routing Burn to replace the existing holts located on the line of the Proposed Scheme. Mammal fencing would be installed along the road boundary at this location. The artificial holt would be located at the edge of the construction site and would be fenced off from the works with close-board fencing.</p>		
EC17	Forty four tunnels or ledges (as described in paragraphs 11.5.63 and 11.5.64) for otter passage would be constructed adjacent to culverts across the Foyle catchment (see Figures 6.18-45 for locations). In addition, major watercourses within the Foyle catchment would have clear-span structures.	During construction	Appropriate ecological supervision. Consultation required pre and during construction with relevant organisations.
<i>SPA</i>			
EC18	Blasting activities would not be undertaken between October and March when Whooper Swans and Greylag Geese are present.	During construction	Appropriate ecological supervision.
EC19	<p>If breaking out of rock at Bready and piling at the Burn Denmet is necessary between October and March then trial breaking out and piling would be undertaken and monitoring undertaken by an appropriately qualified ecologist.</p> <p>The trials would involve short periods of breaking out and piling at prescribed intervals to establish if the activity results in disturbance which could prove detrimental; should the trials indicate this would be likely to the case, the activities would be suspended until the swans and / or geese have left the area.</p>	During construction	Appropriate ecological supervision. Consultation required pre and during construction with relevant organisations.
<i>Designated Bogs</i>			
EC20	Dust deposition impacts would be avoided through the use of appropriate dust suppression measures to prevent the dispersal onto the bogs as indicated in AQ1 above. In addition, progress of the works would be monitored to determine if further control of dust creation would be required should extended dry periods of weather coincide with winds from a non-prevalent easterly, north-easterly or south-easterly direction.	During construction	Appropriate ecological supervision.
<i>Strabane Nature Reserve</i>			

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
EC21	0.7ha of wet woodland would be created adjacent to the site and the northbound carriageway of the Proposed Scheme.	During and post construction	Appropriate ecological supervision.
Aquatic Habitats and Species			
<i>River Habitats and Flora</i>			
EC22	<p>Working practices at all crossing points would be formalised in the contracts. The contractors' would be required to prepare a CEMP and define the principle method of controlling works via site specific method statements as well as any other requirements dictated by local conditions.</p> <p>These documents would include as a minimum management roles and responsibilities, protocols, and method statements.</p> <p>Working practices at all crossing points would adhere to relevant Pollution Prevention Guidelines (PPGs) produced by NIEA.</p> <p>A specific emergency procedure and suitable equipment would be in place to reduce the extent of any accidental spillage.</p> <p>Culverts would be constructed off line, where practicable, with the original channel diverted once the new crossing is completed.</p>	During construction	Appropriate ecological supervision.
<i>Fish</i>			
EC23	<p>A minimum depth of 150mm bed material would be maintained within the culverts where there is no salmonid interest. Where salmonid interest has been identified, the minimum depth would be 350mm. Allowance has been made for both bed depths relative to sizing and hydraulic capacity. The bed material would reflect that found within the existing watercourse and would include boulders in relevant locations to provide bed structure and rest places for fish migration (Refer to Annex 16D.1 WFD Assessment).</p> <p>Culverts on non-salmonid watercourses would be concrete pipes with roughened internal surfaces to create lower flow velocities adjacent to the pipe walls.</p> <p>The culverts would allow a 150mm additional depth for natural substrate to either be deposited during construction or to fill naturally from stream bed movement.</p>	Pre and during construction	Appropriate ecological supervision.

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	Re-aligned sections of water courses would also be constructed, lined with suitable substrate and planted with suitable vegetation prior to diversion of the original channel.		
EC24	Where night working is required lighting would be cowled and directed to minimise light spill into the watercourse, and the duration of night working would be kept to a minimum.	During construction	Appropriate ecological supervision.
EC25	The dewatering process of existing channels would be supervised by ecologists. Lamprey ammocoetes translocation would be required on the Burn Dennet, Routing Burn and Roughan River and would need to be undertaken in the months of June to September.	During and post construction	Appropriate ecological supervision.
EC26	Avoidance of Disturbance: A working window of May to September would be adhered to for the Derg River crossing. Continuous Flight Auger (CFA) piles would be used at the Mourne River crossing. In the case of the foundations for the abutment walls at other bridges, either CFA or drilled piles would be used; both of these forms of piling do not produce significant vibration. A soft-start method would be adopted for all locations where piling would be undertaken in the immediate vicinity of salmonid watercourses. Night working in the vicinity of watercourses identified as being of salmonid interest would not generally be allowed. However, circumstances may arise which require emergency works outside of daylight hours, in these cases lighting would be positioned / cowled to minimise light spill onto the watercourse and the duration would be kept to a minimum.	During construction	Appropriate ecological supervision. Consultation required pre and during construction with relevant organisations.
EC27	The new channel alignments would fulfil the habitat requirements of local aquatic fauna including measures such as the use of natural substrate and boulders to create pools. In-stream works and bankside landscaping would be undertaken using localised/excavated/natural material wherever possible.	Pre and during construction	Appropriate ecological supervision.
Non-Designated Terrestrials Habitats and Fauna			
<i>Schedule 8 Plants</i>			
EC28	Works at the Mourne crossing (Ch. 18000) would require the removal of trees and boulders upon which River/Spruce's bristle moss, a bryophyte listed under Schedule 8 of the Wildlife Order, has established	Pre and During	Appropriate ecological

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	(see Figure 11.17 and Appendix 11D). Update surveys for plants listed under Schedule 8 of the Wildlife Order would be undertaken along those sections of the River Finn and River Mourne within 500m of the Proposed Scheme vesting line. Toolbox talks would be undertaken to make construction staff aware of the presence and type of controlled species to avoid accidental damage or the spread of the controlled species. Translocation of material which may support these plants would be considered in consultation with NIEA.	construction.	supervision. Consultation required pre and during construction with relevant organisations.
<i>Ancient and Long Established Woodland</i>			
EC29	Broadleaved woodland would be planted in road verges and land specifically vested at: Mulvin Parks Ch. 32600 – 33600 (1.3ha), Routing Burn Ch. 71700 – 72200 (1.81ha) Wood Hills Ch. 91200 – 92700 (1.12ha)	During construction and post-construction implementation.	Appropriate ecological supervision.
<i>BAP Priority Habitats</i>			
EC30	The areas used for compounds or earthworks storage would be strictly delineated to avoid impacting adjacent habitats. Species mixes of woodland, scrub and grassland and landscape planting would mirror those found locally in flora and habitat surveys. Woodland planting within the landscaping of the road would create approximately 122ha of habitats similar to young stands of mixed oak and ash woodland, although they would not have associated ground flora. 191km of species rich hedges, 33ha of species rich grassland and approximately 700ha of general grassland would be created. Two ponds would be created during construction of the scheme as mitigation for lost aquatic habitat.	During and Post-construction	Appropriate ecological supervision.
<i>Otters</i>			
EC31	Otter are discussed in paragraphs 11.5.48 to 11.5.64 and above in relation to the SAC designated sites. Due to the large territory size of otter, it has been assumed that otter associated with the SAC are	Pre post and during construction	Appropriate ecological supervision.

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements																		
	<p>potentially present throughout the scheme corridor. The measures indicated above would be implemented throughout the Proposed Scheme and at locations identified in Figures 6.18 – 6.45.</p> <p>The breeding site at Strabane Nature Reserve would be subject to a strict significant pre-construction survey period at this location to identify when construction would be carried out at this location.</p>		EPS licence required from NIEA																		
<i>Bats</i>																					
EC32	<p>Artificial roosts would be installed prior to the destruction of the original ones (locations identified in Figures 6.18 – 6.45). The closure of any roosts would be carried out under an EPS licence and may involve restrictions on the timing of works.</p> <p>Flight lines near major roosts and commuting routes would be maintained wherever practicable.</p>	Pre post and during construction	<p>Appropriate ecological supervision.</p> <p>EPS licence required from NIEA</p>																		
EC33	<p>Bat boxes would be placed in woodland fragments and around settlement ponds throughout the Proposed Scheme as shown in Figures 6.18 – 6.45 at the following locations:</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">Ch. 500</td> <td style="width: 50%;">Ch. 44300</td> </tr> <tr> <td>Ch. 12200</td> <td>Ch. 46200</td> </tr> <tr> <td>Ch. 16600</td> <td>Ch. 52900</td> </tr> <tr> <td>Ch. 17400</td> <td>Ch. 71700</td> </tr> <tr> <td>Ch. 29900</td> <td>Ch. 77900</td> </tr> <tr> <td>Ch. 30500</td> <td>Ch.79500</td> </tr> <tr> <td>Ch. 30900</td> <td>Ch.83800</td> </tr> <tr> <td>Ch. 33200</td> <td>Ch. 88200</td> </tr> <tr> <td>Ch. 41800</td> <td></td> </tr> </table> <p>Any further roosts identified during construction would be destroyed under licence and bat boxes installed in nearby woodland fragments or surrounding habitat.</p>	Ch. 500	Ch. 44300	Ch. 12200	Ch. 46200	Ch. 16600	Ch. 52900	Ch. 17400	Ch. 71700	Ch. 29900	Ch. 77900	Ch. 30500	Ch.79500	Ch. 30900	Ch.83800	Ch. 33200	Ch. 88200	Ch. 41800		Pre-construction	EPS licence required from NIEA
Ch. 500	Ch. 44300																				
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Ch. 33200	Ch. 88200																				
Ch. 41800																					
EC34	Road lighting would only be introduced near and at junctions with UV filters attached or lighting with a low UV component. Additional cowling would reduce the light spill onto potential or actual roosts to 1 lux	During construction / implementation																			

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	10m from the road.		
EC35	Planting would guide bats to 'bat crossing points which include culverts, under passes and minor over bridges at over 65 locations (locations identified in Figures 6.18 – 6.45) including: Ch. 3050 Ch. 34400 Ch. 64000 Ch. 3375 Ch. 36300 Ch. 65890 Ch. 3950 Ch. 38600 Ch. 66050 Ch. 5800 Ch. 39250 Ch. 67630 Ch. 7900 Ch. 39950 Ch. 68750 Ch. 8240 Ch. 41100 Ch. 71100 Ch. 9100 Ch. 42600 Ch. 71350 Ch. 10980 Ch. 43780 Ch. 71650 Ch. 11650 Ch. 43950 Ch. 73750 Ch. 13000 Ch. 44990 Ch. 78400 Ch. 15200 Ch. 46950 Ch. 80420 Ch. 16650 Ch. 49600 Ch. 81700 Ch. 19500 Ch. 50450 Ch. 82000 Ch. 21990 Ch. 51290 Ch. 83880 Ch. 27250 Ch. 52000 Ch. 84300 Ch. 29100 Ch. 53200 Ch. 86450 Ch. 29900 Ch. 54320 Ch. 87800 Ch. 30150 Ch. 55900 Ch. 88220 Ch. 30400 Ch. 56450 Ch. 90300	During construction / implementation	n/a

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements	
	Ch. 30800 Ch. 30950 Ch. 31500	Ch. 57000 Ch. 61850 Ch. 62550	Ch. 90850 Ch. 91300 Ch. 900 Ballygawley Spur	
<i>Red Squirrel and Pine Marten</i>				
EC36	Pre-construction surveys would be undertaken for all suitable habitat which would be removed as part of the Proposed Scheme.			
EC37	Suitable planting would be placed leading to the entrances of the structures to encourage its use by red squirrels and pine marten acting as a multi-species crossing points, with the provision of a dry-tunnel or mammal ledge at these locations (see Figures 6.18 – 6.45): Ch. 34500 Ch. 36450 Ch. 37500 Ch. 40600 Ch. 41850 Ch. 48950 Ch. 50000 Ch. 53980 Ch. 68750 Ch. 71650 In addition the hedge planting between Ch.36300 – 37500 would contain the 'conifer species mix'.	Ch. 72375 Ch. 75900 Ch. 77000 Ch. 77900 Ch. 80420 Ch. 87800 Ch. 88200 Ch. 91300	During and post construction Appropriate ecological supervision.	
<i>Badger</i>				
	Pre-construction surveys would be carried out to maintain the validity of species data.			

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
EC38	Any setts located within the area of works would require closure in accordance with an NIEA licence. Closure would only take place between July 1st and November 30th. This is likely to require replacement of main setts with an artificial structure.	Pre-construction	Supervision during sett closure / removal only Licence would be required from NIEA
EC39	Underpasses and multi-species crossing points under the route and badger resistant fencing to prevent access to the road and guide badgers to suitable crossing points would be installed (See Figures 6.18-6.45 and Red Squirrel / Pin martin above).	During and post-construction	n/a
<i>Breeding Birds</i>			
EC40	Pre-construction surveys would be undertaken for barn owl breeding sites, kingfisher breeding sites within watercourses and of the heronry at McKean's Moss ASSI. The heronry at McKean's Moss ASSI would be subject to monitoring during construction. If any grey heron attempt to nest at this location, and appear to be experiencing disturbance effects, discussion of appropriate mitigation would be undertaken with NIEA and RSPB. This may involve ceasing work in the disturbance area agreed with NIEA until the nesting season is finished.	Pre-construction	Appropriate ecological supervision.
EC43	Any works directly affecting potential bird nesting habitat would be carried out outside the main breeding season (March to August inclusive) planting providing a food source for many species.	During construction	Appropriate ecological supervision.
<i>Wintering Birds</i>			
EC44	The planting scheme would include species mixes in planting schemes which favour farmland birds in Northern Ireland and are based on publications from the UWT Guides and DARD. Replacement grassland, hedges and scrub would be created within the Proposed Scheme vesting line and would include grass and rush species likely to form tussocks (see Figure 6.18-6.45).	During construction	Appropriate ecological supervision.
<i>Smooth Newts</i>			
EC45	Pre-construction surveys would be undertaken to determine presence and use by newt. The objective would be to ensure that statutory obligations relating to the conservation and protection of the species are fully accorded with. Any changes in patterns of use or presence to those described in this ES and identified during the pre-construction surveys would be taken into account in order that method	Pre-construction	Appropriate ecological supervision.

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	statements for construction activities in specific locations and design measures relating to the provision of new ponds, newt fencing, refugia and supporting habitat can be appropriately finalised and ensure statutory obligations are met.		
EC46	The two ponds at Ch.19500 (P77) and 67300 (P65) would be subject to a programme of capture and exclusion using suitable exclusion fencing and pit fall/refugia traps prior to pond destruction. This would be carried before construction begins, but during the active season for smooth newts (February-October). Once clear of animals, areas would be cleared under supervision. The two would be replaced with suitable ponds at the boundary of the vested land at least 1 year before filling in P77 and P65.	During and post-construction	Fencing and topsoil stripping to be supervised during construction NIEA licence
EC47	Where existing ponds would be located within 200m of the required working areas, newt fencing would be provided to exclude access by the species as the works proceed. Trapping and translocation would then be undertaken within the working area prior to commencement of the works. Permanent newt fencing would also be introduced along the road boundary once construction is complete.	Pre-construction	Supervision during translocation
EC48	Where the Proposed Scheme severs the existing relationship between the pond cluster north of the River Derg (P30-34, P37-39 and P12-104) access across the road corridor would be available via a proposed 300mm diameter tunnel. Newt fencing would be introduced to direct movement to the tunnel.	During construction	
Geology and Soils			
GS1	Investigations and sampling of 26 potentially contaminated brownfield sites would be undertaken by the contractor in advance of construction commencing to inform method statements, risk assessments and prepare detailed handling, removal and disposal measures to be formalised in a contractor CEMP. Where possible, contaminated ground would be retained within the scheme to minimise disposal to landfill.	Pre and during construction	Appropriate supervision. Liaison with NIEA required
Noise and Vibration			
NV1	The following measures would form part of the contractors' CEMP: <ul style="list-style-type: none"> • use of temporary acoustic barriers where appropriate; • location of static noisy plant as far away from noise sensitive receptors as is feasible for the particular activity; 	During construction	Monitoring to be undertaken pre and during at specific locations /construction hotspots

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	<ul style="list-style-type: none"> • ensuring that plant and equipment covers and hatches are properly secured and there are no loose fixings causing rattling; • ensuring that equipment and plant is properly maintained; • use of silenced equipment where possible; in particular silenced power generators if night time power generation is required for site security or lighting; • ensuring that vehicles and mobile plant are well maintained such that loose body fittings or exhausts do not rattle or vibrate; • ensuring that plant and machinery is turned off when not in use; • closure of engine compartments for all equipment; • use of suitable dampening materials to reduce the resonance of body panels and cover plates; • siting and orientation of semi-static equipment as far as is reasonably practicable away from noise sensitive receptors; • super-silencing and / or screening of generators and water pumps required for 24-hour operation; • lubrication of crane spindles, pulley wheels, telescopic sections and moving parts of working platforms to prevent undue screeching and squealing; and • use of mains electricity rather than generators where possible. • imposition of vehicle speed limits for heavy goods vehicle traffic travelling on access roads close to receptors and ensuring that vehicles do not park or queue for long periods outside residential properties with engines running unnecessarily; • ensuring, where practicable, that site access routes are in good condition with no pot-holes or other significant surface irregularities; and • prior notification of intended use of the routes to households in the vicinity of the routes where they currently experience low levels of vehicular and HGV use. <p>The contractors' Environmental Site Manager would ensure that Method Statements for construction</p>		

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	activities incorporate the above measures. The contractors' CEMPs would make provision for prior notification to potentially affected receptors in the vicinity of working areas. Information provided would include; the nature of the activity and associated noise, measures which would be adopted to reduce noise; duration and any working time limitations and channels of communication via the contractors' Site Liaison Manager for the registering and resolution of concerns or complaints.		
NV2	The contractors' CEMP would make provision for prior notification of affected receptors in the vicinity of working areas where there would be a risk that vibration may cause concern or superficial damage. Information provided would include; the nature of the activity and associated vibration, measures which would be adopted to reduce vibration, duration and any working time limitations and channels of communication via the contractors' Public Liaison Manager for the registering and resolution of concerns or complaints.	During construction	Monitoring to be undertaken pre and during at specific locations /construction hotspots
NV3	<p>Environmental Barriers are provided at specific locations. A number of the barriers would primarily serve as visual screens with some additional acoustic attenuation benefit, as indicated below. The barriers would be timber fencing to appropriate acoustic performance specifications at a height of 2m at the following locations:</p> <ul style="list-style-type: none"> Ch. 7160 – 7410 Bready (west of mainline) Ch. 10910 – 11200 Clogher (east of mainline) Ch. 14350 – 14560 55a Park Road (north of J3) (primarily as a visual screen with acoustic benefit) Ch. 15880 – 16310 North of Strabane (south of J3) Ch. 16800 – 17000 Strabane (west of mainline) (primarily as a visual screen with acoustic benefit) Ch. 18630 – 19260 Urney Road / Glenfinn Park Ch. 63870 – 64070 Tattykeel / Doogary Ch. 65480 – 65940 Tullyrush Road Ch. 71620 – 71750 Routingburn Ch. 86160 – 86420 Lisginny Road (primarily as a visual screen with acoustic benefit) 	During Construction	As part of TransportNI standard maintenance regime.
NV4	Low noise surfacing would be implemented on the mainline of the Proposed Scheme.	During construction	n/a

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
Effects on All Travellers			
ET1	The contractors' would provide continued access or localised temporary diversions along all local roads pending completion of the works.	During construction	n/a
Community and Private Assets			
CPA1	Accommodation works would be provided to maintain access (where economically viable), services and a secure boundary. These works would be agreed with the individual landowners prior to the construction phase. Similarly, the contractors would ensure that access to severed land is maintained during the construction phase.	Pre / During Construction and Operation	Liaison with affected landowners
CPA2	Where the Proposed Scheme would involve landtake on the boundary of private properties, boundaries would be reinstated as part of the accommodation works for the Proposed Scheme. Where existing access to properties or land would be severed, the proposals would allow for new access.	Post construction	Liaison with affected landowners
Road Drainage and the Water Environment			
Construction Impacts			
Surface Water Quality			
RD1	The Contractors CEMP would include: <ul style="list-style-type: none"> method statements to be agreed prior to commencement of works with NIEA and Loughs Agency / DCAL for all locations where working is required within 50m of existing watercourses, in accordance with Pollution Prevention Guideline (PPG) 5 – Works and Maintenance in or Near Water; environmental incident response plans to be prepared and submitted for approval prior to construction works commencing; identification of defined working zones and areas which are to be excluded from access for construction purposes within method statements; 	Pre, during and post construction	Environmental Manager supervision

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	<ul style="list-style-type: none"> • 50m minimum exclusion zone for the site compounds and any stockpiling of soils, rock and granular materials in relation to environmentally sensitive watercourses • abstraction locations would be a minimum of 10m from all watercourses; • secure storage of fuels and potentially hazardous construction materials in bunded storage areas with external cut off drainage. Fuel would be stored in double skinned tanks with 110% capacity. Storage locations shall be at least 10m from any watercourse and 50m from sensitive watercourses or abstraction locations; • refuelling and lubrication of construction vehicles and plant at dedicated hard standing areas, where reasonably practicable, located at least 50m from watercourses with spill kits and appropriate cut-off drainage • named and appropriately trained personnel shall be responsible for refuelling activities; • safe refuelling methodologies for large plant, where relocation to refuelling areas is not reasonably practicable; • details of regular monitoring of construction plant to check for oil or fuel leaks and specific checks prior to commencement and throughout extended periods of construction activity near to watercourses; • a plan to collect wash down from aggregate stockpiles via cut off drains, using settlement to remove solids, monitoring pH levels prior to discharge to the receiving watercourse; • a plan to collect and treat wash down water from delivery wagons and concrete lorries, monitoring pH levels prior to discharge to the receiving watercourse; • a plan to collect waste fuels and other fluid contaminants in leak-proof containers, prior to removal to an approved recycling facility; • details of the installation of construction-phase drainage as a priority before substantial earthworks commence, surface runoff shall be intercepted before entering construction site and separately transferred to local surface waters to avoid site contamination; • retention of strips of existing vegetation, wherever possible, along the immediate margins of existing watercourses, vegetation only to be stripped immediately before required, rather than 		

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	<p>long periods in advance of engineering requirement;</p> <ul style="list-style-type: none"> • rapid re-vegetation of profiled and soiled areas to minimise the area of potential soil loss, resulting in sediment-bearing run-off; • treatment of sediment-laden runoff prior to discharge, typical measures, subject to location and volumes, may include use of silt fences, silt traps, filter bunds, settlement ponds and/or proprietary silt treatment units; • use of coffer dams or temporary water diversions where in-channel works are required to provide for dry working conditions. The method of isolation used would be dependent on the scale and timing of the works and the size and sensitivity of the watercourse; • pumping of water from contained in-stream working areas onto a land site with peripheral cut off drainage to settle out solids or the use of 'silt buster' type equipment to settle out suspended solids, prior to discharge of the water to an existing watercourse; • where possible, culverts and diversions are constructed offline and diversion to the new channel would be timed to allow for the establishment of vegetation within the channel. • construction would proceed from the low end of the newly constructed watercourse channels, to minimise sedimentation, with 'breakthrough' of upper end of the channel and release of flow only when new channel is suitably prepared; • use of pre-cast concrete structural materials, where feasible, to minimise application of wet concrete during near-channel or in-channels works. Should concrete spraying be necessary, measures would be installed to prevent rebounded or 'wind-blown' concrete reaching local watercourses; • Minimising dewatering activities in vicinity of sensitive groundwater receptors, including abstractions, surface waters and quarries; and • groundwater seepages into cuttings would be contained, channelled and directed to the down gradient side of the cutting. 		
RD2	<p><u>Construction Alongside Water Courses</u> In addition to the measures outlined in RD1 and between Ch. 18750 – 19500 (The River Finn) a lined</p>	Pre and during construction	Environmental Manager supervision,

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	barrier would be installed to prevent the migration of soil/sediment into the river and control pollution associated with accidental spillages..		including specialist land quality support NIEA conditions
RD3	<p><u>Bridges</u></p> <p>In addition to the measures described in RD1 and at the 10 bridges proposed to cross the Burn Dennet, Glenmornan River, Mourne River, Derg River, Coolaghy Burn (also known as channel UD_20), Fairy Water, Drumragh River, Routing Burn and Ballygawley Water (2 crossings), coffer dams would be installed along the margins of the watercourses.</p>	Pre and during construction	Environmental Manager supervision NIEA conditions
RD4	<p><u>Surface Water Abstractions</u></p> <p>The Northern Ireland Water would be informed, by the contractor, of the programme of anticipated construction activities and consulted to establish appropriate locations, parameters, frequency of monitoring and reporting of water quality data prior to construction commencing in the area upstream of the Mourne River and Camowen River abstraction locations.</p> <p>The owners of 2 private surface water abstractions (Supermix Concrete Ltd and Dalradian Gold Ltd) would be consulted, during detailed design, to ensure continuity of supply.</p> <p>Prior to construction, further surveys would be undertaken for surface water abstraction assets and if identified would receive the same treatment as the supplies identified above.</p>	Pre and during construction	Environmental Manager supervision The Northern Ireland Water
Operational Impacts (routine run-off, accidental spillage and changes in flow characteristics)			

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
RD6	<p><u>Drainage</u></p> <p>All drainage outfalls would meet HAWRAT, EQS and in river sediment standards.</p> <p>Drainage outfalls would be located on straight sections of watercourses.</p> <p>Outfall pipes would be installed to minimise the height between the pipe and watercourse bed but high enough to ensure the pipe remains clear of any sediment build-up and that high water levels within the watercourse do not back up into the road drainage system. Drainage Outfalls would discharge in the direction of flow for the watercourse and be flush with the watercourse bank.</p> <p>Outfalls would have mitred headwalls for ease of maintenance and would be constructed such that no part of the structure would protrude beyond the line of the watercourse bank to avoid obstruction of waterborne debris.</p> <p>Erosion protection in the form of stilling basins, erosion protection aprons, stone rip-rap or geotextiles would be provided where high velocity discharges may result in scour.</p> <p>Each drainage network would include pollution control valves to enable isolation and treatment of contamination from accidental spillage incidents.</p>	Pre and during construction	Environmental Manager supervision, including specialist ecology and geomorphology support
RD7	<p><u>Bridges</u></p> <p>The upstream faces of the bridge piers would be streamlined to stop large wood debris becoming trapped.</p> <p>Pier protection and / or bank erosion protection would be installed at the new bridges over the Burn Dennet, Mourne River, Derg River, Coolaghy Burn, Fairy Water, Routing Burn and Ballygawley Water, details of these proposals are provided in Appendix 16D (specific watercourse information in the WFD Assessment), Appendix 16F and Table 16F.1</p>	Pre and during construction	
RD8	<p><u>Culverts</u></p> <p>Culvert inverts would be buried and backfilled with appropriate bed material to retain natural bed and flow levels. A minimum depth of 150mm bed material would be maintained within the culverts where there is no salmonid interest. Where salmonid interest has been identified, the minimum depth would be 350mm. Allowance has been made for both bed depths relative to sizing and hydraulic capacity. The bed material would reflect that found within the existing watercourse and would include boulders in</p>	Pre and during construction	

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
	<p>relevant locations to provide bed structure and rest places for fish migration.</p> <p>Scour protection would be provided at entry and exit points at 6 of the proposed culverts; Blackstone Burn, UD15, UD22, UD26, UD90 and Roughan Burn. Details of the proposals are provided in Appendix 16D (specific watercourse information in the WFD Assessment) Appendix 16F and Table 16F.1.</p>		
RD9	<p><u>Watercourse Diversions</u></p> <p>New sections of channel would reflect existing channels in cross section, gradient and channel bed characteristics, including features such as pools and riffles. This would include maintaining a dynamic bed slope</p> <p>Vegetation removed from all banks would be reinstated or replaced appropriately.</p> <p>The cross section at bends would be typically deep on the outside of the bend and shallow on the inside with lateral and longitudinal variations incorporated in the design</p> <p>Low flow conditions would be considered within the design to ensure that an adequate depth of water is maintained for specific ecological, fisheries, recreation and amenity reasons.</p> <p>Erosion protection would be installed for 5 of the proposed diversions on watercourses; UD33, UD44, UD69, UD89 and Lisadavil.</p>	Pre and during construction	
<i>Flood Risk Impacts</i>			
RD10	All proposed culverts would accommodate a 1% annual exceedance period (AEP) flow. Small culverts (1500mm diameter or less) would include a minimum of 300mm freeboard allowance above the 1% AEP level within the culvert. Large culverts and bridges (> 1500mm diameter) would include a minimum of 600mm freeboard allowance above the 1% AEP within the watercourse/culvert.	Pre and during construction	As part of TransportNI standard maintenance regime.
RD11	All Bridges would be large clear span structures and to accommodate a 1% AEP with a minimum freeboard of 600mm.	Pre and during construction	
RD12	All upstream faces of piers would be streamlined to reduce the risk of large wood debris becoming trapped during flood flows.	Pre and during construction	
RD13	Floodplain connectivity culverts are would be located to maintain floodplain conveyance where floodplains are bisected by the road alignment.	Pre and during construction	

Ref Number	Mitigation Measure	Point of Implementing Mitigation Measure	Monitoring Requirements
RD14	<p>Where diversions are proposed within existing floodplain, the channel capacity would be the same as the existing channel.</p> <p>Where proposed diversions result in the new reach lying outside of existing floodplain the channel would take the 1% AEP flow. Each watercourse diversion has been to replicate the size, shape and hydraulics of the channel to be replaced.</p>	Pre and during construction	
RD15	<p>Mitigation storage would be provided by re-profiling adjacent land at appropriate locations.</p> <p>The Flood Compensatory Storage Areas would provide controlled displacement of water to avoid displacement that would put properties and other assets at risk from flooding. (Appendix 6C and Figures 6.1-6.17).</p>	Pre and during construction	
<i>Groundwater Impacts</i>			
RD16	<p>24 active well and spring groundwater supplies within the Proposed Scheme would be subject to verification of status prior to construction. Where these supplies are decommissioned an alternative supply would be installed prior to the commencement of local construction to ensure a continued supply.</p>	Pre and during construction	<p>Environmental Manager supervision, including specialist land quality support</p> <p>NIEA conditions</p>
RD17	<p>Consultations would be held with the owners of 79 wells and spring supplies to establish current water requirements, proposed monitoring strategies and potential mitigation in advance of construction. These supplies would be monitored prior to and during the construction of local cuttings until construction is completed. Should monitoring establish that there is a consequent impact on a supply, mitigation would be agreed with the landowner, appropriate to the severity of impact. If landowners property is divided from its water abstraction each location would be assessed (with the landowners consent) individually to decide whether the most appropriate course of action.</p> <p>Any additional supplies identified in future consultations with landowners or during pre-construction activities and considered at potential risk of impact, would be similarly provided for.</p>	Pre and during construction	<p>Environmental Manager supervision, including specialist land quality support</p> <p>NIEA conditions</p>

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